Sustainable Tourism in Protected Areas?:

An Ecological Economics Case Study of the

Wet Tropics World Heritage Area

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Statement of originality

Except where otherwise noted, this thesis is entirely the result of my research.

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Abstract

This thesis is concerned broadly with operationalising the concept of sustainable development. A particular natural resource use, tourism in protected areas, is selected for investigation in this context. A working definition for 'sustainable tourism in protected' areas is developed, based on reviews of the literature on sustainable development and tourism in protected areas.

The thesis takes an ecological economics approach to the question of operationalsising the concept of sustainable tourism in protected areas. The reasons for selecting an ecological economics approach are discussed. An ecological economics model is developed in order to try to measure whether the criteria and conditions proposed for sustainable tourism in protected areas are being met.

The model is then applied to a case study of the Wet Tropics World Heritage Area in North Queensland, Australia. This area of tropical rainforest houses numerous rare and endangered species. It also has experienced rapid growth in tourism in recent years, and tourist numbers are expected to double between the years 1992 and 2001. The budget for management has recently been reduced significantly.

The case study shows that the criteria and conditions for sustainable tourism in the Wet tropics World Heritage Area are currently not being met. This is mainly because the budget dedicated to management is less than that considered adequate to avoid exceeding limits of acceptable ecological change. The net economic benefits, conditional upon adequate funding being provided for management, are positive and large. The effects of introducing an entry fee to raise funds for management are modelled. Conclusions are drawn on the application of the model to the Wet Tropics World Heritage Area and the broader application of the approach developed.

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Glossary of Acronyms

ANPWS	Australian National Parks and Wildlife Service
BCA	Benefit Cost Analysis
CS	Consumers' Surplus
CVM	Contingent Valuation Method
DASET	Department of the Environment, Sport and Territories (C'wealth)
DEH	Department of Environment and Heritage (Qld)
DEST	Department of the Environment, Sport and Territories (C'wealth)
DNR	Department of Natural Resources (Qld), formerly QDPI-FS
DoE	Department of the Environment (Qld), formerly QDEH
DPIE	Department of Primary Industries and Energy (C'wealth)
HPF	Household Production Functions
NPV	Net Present Value
NQ	North Queensland
PS	Producers' Surplus
QDEH	Queensland Department of Environment and Heritage
QDPI-FS	Queensland Department of Primary Industries, Forest Service
RUM	Random Utility Models
TCM	Travel Cost Method
Wet Tropics WHA	Wet Tropics World Heritage Area
WHA	World Heritage Area
WTMA	Wet Tropics Management Authority
1993 WTVUS	*1993 Visitor Use Survey, Wet Tropics WHA* (Manidis Roberts et al 1994)

CHAPTER 1
INTRODUCTION

The research for this thesis grew out of a concern for developing the means to implement measures to move society towards sustainable development. The concept of sustainable development was popularised following release of the Brundtland Report in 1987 (WCED 1987). This concept was developed as a response to the increasingly obvious problems of local and global natural resource depletion which accompany population and economic growth, and the poverty in which many of the world's people live. In Australia, the Ecologically Sustainable Development (ESD) process engaged public debate over a period from 1990 to 1992, culminating in the National Strategy for ESD (COA 1992b). While both these processes provided broad directions for managing and using resources, details for operationalisation of the concepts were less clear. The claims that economic development and environmental protection can coexist are beguiling, however, they can only be proved or disproved by operationalising the broad directions proposed and considering the results.

Tourism in protected areas was selected as an issue for detailed investigation of operationalisation of the concept of sustainable development. The search for a harmonious coexistence between tourism and conservation of protected areas embodies many of the issues relevant to the sustainable development debate. Protected areas are those areas specifically identified as being such important natural environments that they should be managed to retain their natural environment characteristics into perpetuity. These areas are usually considered as important in themselves for conservation of biodiversity, watershed protection and other life support functions. In the Australian National Strategy for ESD, it is recommended that a representative system of protected areas be developed throughout terrestrial and marine areas to provide an ongoing broader function of biodiversity conservation and life support functions. Because of the importance placed on protected areas to provide a core of environmental services, any human activity that poses a potential threat to the integrity of protected areas deserves special scrutiny.

Tourism is such an activity. Evidence presented in this study shows that, globally, tourism is growing at a significant rate and that nature based tourism is perhaps increasing at a greater rate than tourism as a whole. Natural environments are becoming an important resource for economic development via tourism. The question now is whether tourism in natural environments and protected areas can be consistent with sustainable development. Tourism is potentially a threat to protected areas but it is also seen by many as potentially a saviour for protected areas. This latter role is effected if tourism brings an economic justification for the conservation of natural environments and brings funds for management. The key to sustainable development through tourism in protected areas lies in finding a balance between levels of tourism and conservation of both the natural environment and the attractiveness of the area to tourists.

The major disciplinary tools applied in this research were those of economics. Economics provides an analytical framework for the consideration of trade-offs between use and conservation of resources. The emergence of the concept of sustainable development has added to what is a relatively recent movement within the economics discipline towards better ways of incorporating the values of natural environment resources in analysis and decision making. The potential roles of standard neoclassical economics and ecological economics in operationalising concepts of sustainable tourism and providing policy guidance were explored and questioned.

The research in this study also drew upon work from a number of other disciplines. The pursuit of sustainable development requires a multi-disciplinary approach to problem solving. It is hoped that this work goes some way towards providing a framework for a multi-disciplinary approach, but there were limitations to the extent to which research in other disciplines (for example, detailed ecological research) could be undertaken and incorporated in this piece of work.

Reviews of the literature on tourism in natural environments and protected areas revealed that there were few studies that addressed the issue of sustainable development through tourism in protected areas in the empirical detail that the author considered was necessary for operationalisation of the concept[1]. It was identified therefore that research in this area could provide an original contribution.

The investigation of tourism in protected areas was undertaken with particular reference to a case study of the Wet Tropics World Heritage Area (WHA), in North Queensland, Australia. This internationally significant area of tropical rainforest supports a very diverse biota and many rare and threatened species. Tourism and recreation in the area has been growing at a significant rate in recent years and is forecast to continue to increase. The case study displays characteristics common to the challenges of achieving sustainable tourism in protected areas, at least in developed countries. Use of a case study has two benefits: it allows testing of a model with actual data; and it provides results of use in managing the area in question.

[1] A recent literature review for the World Bank (Wells 1996, unpublished), confirms that view.

Approach to the research

The many questions which arose when considering the topic of tourism in protected areas in the context of operationalising concepts of sustainable development were distilled to three main questions. The thesis therefore addresses three questions about realising sustainable development in relation to tourism in protected areas. It is particularly concerned about the role economics has in:

- operationalising the concept of sustainable tourism;
- the design of policy instruments for the attainment of such an objective; and
- providing managers with detailed empirical guidelines.

In terms of these concerns, the thesis is that:

1. it is ecological economics that can best inform operationalising the concept of sustainable tourism;
2. economics can contribute at the level of principle to the design of policy instruments for the attainment of sustainable tourism; and
3. the potential of economics to providing managers with detailed empirical guidelines is fairly limited beyond indicating broad orders of magnitude.

In order to test the first of the three questions posed, it was necessary to develop a working definition for sustainable tourism and an economic model to operationalise the definition. A working definition of sustainable tourism in protected areas was developed based on a review of the literature on tourism and on sustainable development.

An economic model was developed which incorporated the elements identified as important to sustainable tourism in protected areas. The model was tested by application to the Wet Tropics WHA.

The initial aim for the economic model was to apply a standard Benefit Cost Analysis (BCA) type framework. This would, in theory, allow estimates to be made of the benefits of tourism and to subtract from these the costs of tourism, to estimate net benefits or costs of tourism to the Wet Tropics WHA. The model could then be used to investigate scenarios for future tourism in the area, under predicted tourism growth rates, crowding effects, restrictions or increases in site supply, entry fees, etc. This would provide useful information to allow managers to investigate under what future scenarios net benefits could be maximised.

There are however, two main problems with this standard BCA type approach . One is that the standard neoclassical economics approach to arriving at an economically efficient solution will not necessarily guarantee sustainability (the reasons for this are discussed in Chapter 3). It could be consistent with efficiency for the natural environment to be degraded, as long as the projected pattern of tourism resulted in a positive net present benefit (NPV) measure. The other problem is the difficulty of measuring all the costs of tourism, including any environmental impacts, in dollar values.

The solution tried was to turn to an approach suggested by ecological economics of 'constrained optimisation'. Using this approach, there are constraints placed on the extent to which tourism can occur, so that impacts are kept within safe minimum standards. The search is then for the pattern of tourism that maximises benefits within those constraints. While environmental costs are kept within acceptable levels, there is no need to measure loss of environmental quality in dollar terms. It is relevant to measure the costs of avoiding environmental losses and to factor these into the model. It is recognised that the capacity of environments to support tourism is able to be manipulated via investment in management (eg. site hardening, research and monitoring, rehabilitation etc), so that the constrained optimisation exercise needs to incorporate different trade-offs between different levels of investment in management and different levels of tourism benefits accruing.

The economic model is presented in Chapter 9. From the runs of the model, it was possible to judge whether tourism in the Wet Tropics WHA is currently sustainable according to the working definition, and whether alternative future patterns might be moving towards, or away from, sustainability. This however required judgements to be made outside the model as to whether environmental impacts of tourism remain within acceptable limits which maintain the integrity of the Wet Tropics WHA, on a local and regional scale. The potential use of the economic instrument of entry fees in promoting sustainable tourism in the Wet Tropics WHA was modelled.

Organisation of this study

The information in this study is arranged as described here. Chapters 2 and 3 are based on a literature review and provide background theory and discussion of the issues of tourism in protected areas, sustainable development, and economic approaches to analysis and management. Chapter 2 sets the scene for appreciating the complementarities and conflicts between tourism and protected natural environments. In Chapter 3, concepts and approaches for analysis of the issues are outlined.

Essential background information on the Wet Tropics WHA is contained in Chapter 4. The information presented in this chapter is from published sources, supplemented by some observations made by the author. The results of more formal data gathering for the case study are presented in subsequent chapters.

The economic concepts and techniques to be applied in the empirical case study are described in Chapter 5. In this chapter, a definition of sustainable tourism in protected areas is proposed. The model to be applied in Chapter 9 is developed.

Chapters 6,7 and 8 are concerned with collection and analysis of data for the Wet Tropics WHA case study. The topic of Chapter 6 is environmental impacts of tourism and funding for their management. The chapter includes the results of a survey of scientists and managers to provide qualitative information on visitor impacts. Past levels of funding of management of visitor use of the Wet Tropics WHA were extracted from the accounts of the Wet Tropics Management Authority and are detailed in Chapter 6. Also in this chapter is an assessment of future levels of funding that may be required to provide 'adequate management' for the achievement of sustainable tourism in the Wet Tropics WHA.

A survey was conducted of visitors to the Wet Tropics WHA in order to collect data for economic analysis. The survey also provided other interesting information on visitors, some of which is relevant to developing scenarios for future demand for visits the Wet Tropics WHA. Relevant results of this survey are described in Chapter 7.

The Travel Cost Method (TCM) was applied to data collected on visitors to the Wet Tropics WHA in order to estimate levels of benefits enjoyed by people visiting for tourism and recreation. The analysis and results are reported in Chapter 8. In addition, in Chapter 8, the estimate of the price elasticity of demand in the face of entry fees is reported. This elasticity measure is used in Chapter 9 in modelling the potential impacts of entry fees.

In Chapter 9, the operation of the economic model and its results are reported and discussed. Conclusions that relate to the thesis posed, the approach adopted in this study and the findings for the Wet Tropics WHA, are presented in Chapter 10.

Several Appendices accompany this study in order to provide more detailed information on some topics and record additional data generated.

The terms 'tourism', 'recreation' and 'visitor use' and their variants are used interchangeably throughout this study. Technically a tourist is a person who is travelling away from home, while a recreationist may be making a day trip from home to the Wet Tropics WHA. All people who enter for leisure purposes are visitors. Names of government departments have changed over the course of the period relevant to this study. The names at the time of the events discussed are used.

The majority of material in this study is directed towards testing the three propositions posed. This is achieved in the following chapters by: reviewing the literature, developing a working definition of sustainable tourism in protected areas; developing the economic model; generating data on tourism in the Wet Tropics WHA for use in the model; and running the model and interpreting results.

CHAPTER 2
TOURISM IN NATURAL ENVIRONMENTS AND PROTECTED AREAS

The aim in this chapter is to identify sources of conflict over tourism in protected areas and present information about impacts and management of tourism in protected areas.

Protected areas are areas of the natural environment that have been specifically identified and given legal status, with the intention to manage them principally for nature conservation. One of the few classes of human activity commonly deemed consistent with protected areas is tourism and recreation. In Section 2.1 of this chapter, the trends for increasing demands on natural environment areas for tourism and recreation are illustrated. This sets up a potential conflict with the conservation objectives for the areas because human presence inevitably brings potential for negative biophysical, social and cultural impacts. In Section 2.2, the aims and uses of protected areas, including concepts of 'appropriate' tourism are explored.

The advantages and disadvantages of tourism in protected areas are discussed in more detail in Sections 2.3 and 2.4. The advantages to individuals and societies are driving forces for the growth and encouragement of tourism including nature-based tourism. One advantage claimed for tourism in protected areas is providing economic justification for protection and a potential source of revenue for management. The primary source of conflict over tourism in protected areas is that tourism causes environmental impacts, in the very areas that are specially reserved for environmental protection. Also significant in some protected areas is conflict between tourism and traditional owners. The issue of crowding and reductions in amenity *due to* tourism being a negative impact *on* tourism is critical for the management of the resource base for sustainable tourism. It is a complex issue that combines elements of psychology and ecology.

To a certain extent the advantages and disadvantages experienced due to tourism in any protected area will be dependent on the effort put into management and the approaches adopted. The history of unregulated tourism in natural environments has seen environmental damage and negative social and cultural impacts. A key to sustainable tourism is to understand the negative impacts and put in place management strategies to contain these. A review of current management approaches is included in Section 2.5. In Section 2.6, conclusions on this chapter are presented.

2.1 Trends in Tourism

While humans have always travelled, the mass tourism of the late 20th century is beyond our previous experience. Growth in population, in individual wealth and the technology of fast mass transport has fuelled a growth in numbers of people travelling within their own countries and internationally. The majority of these people are travelling for leisure.

Globally, tourism is an important economic activity. The World Tourism and Travel Council promotes tourism as the world's largest 'industry' accounting for 10.9% of GDP (WTTC 1995). The following data are from the World Tourism Organisation (1994) and refer to tourism, excluding business travel. Worldwide, there were over 500 million arrivals of tourists from abroad in 1993. Annual international tourism travel has increased around 2000% since 1950. During the decade 1980 to 1990, the average annual increase in tourist arrivals was 4.8%. This is actually a lower rate than the previous three decades but represents a larger number of movements in absolute terms each year. Around 60% of international air travel is by tourists (WTO 1994).

In global terms, Australia's tourist industry is modest. Australia is the world's 36th most popular destination, with 0.54% of arrivals world wide, earning 1.34% of world wide receipts (WTO 1994).

The contribution of the tourism industry in Australia to the economy is significant. It is estimated that for the year 1993-94, tourism contributed 6.6% to Australia's GDP. Around 535 600 people were employed in tourism, making up 6.9% of the workforce (Commonwealth Department of Industry, Science and Tourism (DIST)1996). The contribution to GDP is estimated based on tourist expenditure which occurs across a number of sectors of the economy. The majority of expenditure is concentrated in the accommodation, hospitality and transport sectors, with significant expenditure also in the retail and entertainment sectors (Lee 1995).

It is estimated that expenditure derived from tourism in 1993-94 was $43.6 billion. The largest contribution was $19.0 billion from domestic overnight tourism, with a further $13.5 billion from domestic day trips. Overseas tourists spent $10.4 billion and the domestic component of expenditure by Australians travelling overseas was $0.7 billion (DIST 1996).

Export earnings from international tourism to Australia was $14.1 billion in 1995-96, and this was 12.8% of Australia's total export earnings (DIST 1996).

Trends in inbound tourism have been for a steady increase. In 1988, the number of international visitors topped 2 million for the first time, and this number has climbed to 3.7 million in 1995 (DIST 1996). The majority of arrivals in 1994, 81%, were for holidays or visiting friends and relatives (Commonwealth Department of Tourism 1995b). Domestic tourism including overnight trips has varied between 46 million and 49 million trips during the years 1988 to 1993. Larger numbers of trips are reported for 1994 and 1995, but this may be a function of a change in the survey method. The reported number of trips in 1995 was 59.6 million (DIST 1996). The proportion of domestic trips made for holidays or visiting friends or relatives was 63% in 1993-94. The predicted growth rates are 10% per annum for international arrivals to the year 2000, and 1.6% per annum for domestic tourism to 1998-99 (Bureau of Tourism Research 1995).

2.1.2 Tourism in natural environments and protected areas

It is difficult to describe global trends in nature-based tourism because data are not currently collected to allow accurate monitoring of international or domestic tourism to natural environments (Filion, Foley & Jacquemot 1994). There are numerous reports that tourism which focuses on visiting and appreciating natural environments is an important component of global tourism and that the absolute number of visits are increasing annually (Boo 1990, Lindberg 1991), perhaps at a faster rate than tourism as a whole. Such reports are based on observations made in various sites and regions around the world. The potential for growth in the number of people wishing to experience natural environment attractions is considered to be significant (Commonwealth Department of Tourism 1994).

Estimates of the numbers of people participating in tourism based on natural environment attractions, and estimates of the economic benefits generated from such, are complicated by a need to somehow define the proportion of all tourists who should be included in the estimates. Tourists' experience with the natural environment range from incidental visits to parks and beaches as part of a trip focussing on multiple attractions, to travel dedicated nature study. Arguments arise as to whether it is tourists' motivation or actual, possibly unplanned, participation that is the appropriate basis for classification (Eagles 1992).

For reasons of definition for study and to provide a basis for development of policy, various definitions of 'nature-based tourism' and 'ecotourism' have been developed. Some of these definitions have taken on normative roles, that is they have become descriptions of what people think tourism should be like. 'Nature-based' tourism is often used broadly to describe tourism that has visits to, and appreciation of, natural sites as a focus (Lindberg, 1991, Valentine 1992). All tourism to protected areas is nature-based tourism, and nature-based tourism can be experienced in natural areas that are not legally protected. There is no limit on the size groups, or infrastructure employed (so long as the area visited is predominantly natural) for nature-based tourism, nor is there any condition that nature-based tourism be sustainable.

By contrast, definitions of ecotourism have become increasingly tight, so that ecotourism is a subset of nature-based tourism. 'Ecotourism' as usually currently defined is considered to exhibit more than one of the following characteristics: focused specifically on enjoying and learning about nature, ecologically sustainable, socially and culturally appropriate, small scale, and providing a positive economic benefit to local regions (Boo 1990, Buckley 1994, Blamey 1995).

An Australian definition of ecotourism, as developed via a public consultation process, and which now anchors the National Ecotourism Strategy, is:

> 'Ecotourism is nature-based tourism that involves education and interpretation of the natural environment and is managed to be ecologically sustainable' (Commonwealth Department of Tourism 1994, p. 3).

This is an example of a definition that takes on a normative role in that the National Ecotourism Strategy is directed at developing a tourism sector that fulfils the conditions for ecotourism[1].

In their study of the relationship between biodiversity conservation and tourism in Australia, Preece, van Oosterzee & James (1995) chose to use the term 'nature-based and ecotourism' (NBE) to describe the full range of tourism activity that is dependant on Australia's natural environment, as they considered definitions of 'ecotourism' too narrow to allow consideration of all the relevant interactions between tourism and biological diversity.

The definitions of nature-based or ecotourism are not particularly a problem when considering sustainable tourism. Firstly, the aim of sustainable development is to make all tourism, whether nature-based or not, sustainable. Thus concerns range wider than natural sites and take in transport and other off-site impacts. Secondly, with regard to tourism to natural sites, sustainable tourism is not necessarily small scale or tourism that

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[1] No activity can be conclusively said to be 'ecotourism' as defined unless the contribution to learning and ecological sustainability is evaluated, or at least conditions to deliver these are established. Currently that type of evaluation is not generally undertaken, and so it is difficult to justify applying the term 'ecotourism', to many activities in Australia.

delivers a specific educational content, so it is not necessarily the case that all tourism has to become 'ecotourism' to be considered potentially sustainable.

In trying to investigate the volume and trends of tourism to natural environments on a global scale, Filion, Foley & Jacquemot (1994) have made estimates of international travel 'to enjoy and appreciate nature'. They examined studies of tourist motivation and participation from North America, Latin America, Africa Oceania and Europe. From these, they estimated that:

- travel to enjoy and appreciate nature accounted for 40 to 60% of all international tourism; and
- wildlife-related travel accounts of 20 to 40% of al international travel.

If these proportions are constant, the absolute numbers of international tourists who travel to enjoy and appreciate nature will be growing annually.

Filion, Foley & Jacquemot (1994) found there was insufficient data to estimate how much domestic tourism worldwide was oriented to nature appreciation. They did note that there is evidence of much more domestic tourism than international tourism, as the ratio of expenditure is around 9 to 1.

The statistical information on ecotourism and nature-based tourism in Australia was recently reviewed by Blamey (1995). The approach taken was to investigate the importance to domestic and international visitors of natural environment destinations, and to look for data and trends on visits to particular natural environment destinations.

The Australian national survey of domestic tourism, the Domestic Tourism Monitor, was found not to provide sufficient information to allow identification of nature-based tourism. Some evidence of the popularity of natural environments for domestic tourists was provided by a 1994 Newspoll national survey, which found that 53.2% of respondents intended to visit a National Park or natural attraction, on a trip of at least one night away from home, in the next 12 months (Blamey 1995). A recent national survey conducted by Blamey and Braithwaite (1995) found that 66% of people would like to spend some of their holidays in the next 12 months 'increasing their understanding and appreciation of nature'.

Information from the International Visitor Survey (IVS) of visitors to Australia proved more amenable to analysis of nature-based tourism. In 1993, international visitors were asked if they had visited 'National/State Parks/reserves/caves' and fifty precent replied 'yes' (Blamey 1995). The IVS includes a list of sites in each state that are significant visitor destinations. Thirty-four of these were selected as featuring natural environment attractions. Blamey (1995) analysed visitor numbers to these sites from 1989 to 1993 and found that while visitor numbers had declined at 30% of these sites, visitor numbers had grown for the remaining 70%, with significant growth (15% or more) at 24% of the sites.

The information available on the number of visitors to individual protected areas varies with State government approaches to collecting visitor statistics in National Parks and reserves and with the ease of collecting visitor numbers at sites. Where sites are remote or have multiple entry points, data collection is logistically difficult and expensive, with the result that no information is collected for many such sites. Blamey (1995) reports that the data available for the states of Victoria and Western Australia indicate increases in visits to National Parks in recent years.

World Heritage sites

Information on visitor numbers to some of Australia's World Heritage Areas was complied by Driml (1994). Over the period from 1984-85 to 1992-93, visitor numbers on commercial boat tours to the Great Barrier Reef WHA is estimated to have doubled, to 2.2 million per annum. The number of tour operators also doubled from 275 to 542. No trend data is available for the Wet Tropics WHA but the first comprehensive survey for the area, conducted in 1993, estimated 4.7 million visits to individual sites in the WHA in that year (Manidis Roberts et al 1994). Visitor numbers to Kakadu National Park grew from 45 800 in 1982 to a peak of 238 000 in 1990 (Driml 1994). The annual numbers have since declined to 154 000 in 1992, while numbers of visitors have risen in National Parks nearer Darwin (Blamey 1995), where facilities and access have been upgraded in recent years. Visitor numbers continue to grow at Uluru-Kata Tjuta National Park. From a rate of 87 871 visits in 1982, visitor numbers grew to 218 160 in 1992 (Driml 1994). In the Tasmanian Wilderness WHA, visitor numbers were estimated at 600 000 visits in 1990-91 (Buckman & O'Loughlin 1991).

2.2 Protected areas, sustainable development and tourism

2.2.1 The role of protected areas in sustainable development

The history of specific declaration and legal protection of areas from uses destructive of natural and cultural features is often dated from the declaration of the world's first 'National Park' at Yellowstone in the USA in 1872 (Dixon & Sherman 1990). This specific action follows a long history of special protection of areas of the natural environment, including by prohibitions placed on uses by indigenous peoples and the maintenance of hunting reserves by the European monarchs and landed gentry

(Primack 1993). In Australia, post European occupation, the approach of legally protecting areas of the natural environment was adopted with the declaration of the first National Park, Royal National Park, in New South Wales in 1879 (Common & Norton 1992).

In describing the history of reservation of protected areas in Australia, Hall (1992) has identified three distinct phases where the main reasons for reservation, and hence the reserves created, have differed. From the 1870s to WWI, emphasis was on using the natural environment for physical and mental restoration. Areas were preserved for scenic values, capturing the spirit of 'the bush', and the study of flora and fauna. Between the world wars and to the late 1950s, a significant movement grew up amongst Sydney bushwalkers to conserve large areas of 'wilderness' for active recreation and to preserve spiritual values. Rational management of protected areas commenced with the first State Government National Parks Services formed in Victoria and Western Australia. From the 1960s onwards, there has been more emphasis on reserving areas for ecological values, as well as aesthetic and spiritual values. Political action preceded decisions on reservation in a number of well known cases. The emphasis has moved from the local to the national and international significance of areas of Australia's natural environment, with the declaration of several World Heritage Areas. The Commonwealth and all State Governments have now established management agencies for protected areas. It might be relevant to add a further phase to Hall's schema, starting in the 1990s with a more scientifically based approach aimed at making the reserve estate representative and emphasising conservation of biodiversity and the current and potential economic values of protected areas.

The reasons underlying declaration of protected areas in Australia have been identified by Common and Norton (1992) as including: preservation of areas of scenic beauty; provision of recreation areas; protection of timber resources; protection of particular habitats or species; and simply because there was no other use proposed for the land. Bridgewater (1993, p. 38) calls the pattern of acquisition until recently 'opportunistic and expedient'. The result is a valuable collection of protected areas, but the collection is not representative of the range of different Australian ecosystems.

Only in recent years has the role of protected areas to conserve the diversity of species and ecosystems been emphasised world wide and in Australia. Biological diversity[2] and its conservation has been accepted to be important as we have come to appreciate the dependence of humans on biological systems. Reasons put forward for supporting the conservation of biological diversity include:

[2] Biological diversity is considered at three levels: genetic diversity, species diversity and ecosystem diversity (COA 1996).

- we don't know enough about the functioning of ecosystems to know what species or systems we can do without (a precautionary reason);
- it is wise to support currently cultivated food and drug resources with genetic information from wild strains of the species;
- there is potential for further discoveries of genetic information useful to humans (utilitarian reasons);
- we have a responsibility to pass the earth's natural capital on to future generations (equity reasons); and
- other species have rights to existence (ethical reasons).

The expression of international support for the conservation of biological diversity is via the International Convention on Biodiversity. Australia became a signatory to this convention in 1992, assuming obligations to protect biodiversity on this continent (HORSCERA 1993)[3]. The International Convention on Biodiversity places the establishment of a system of protected areas, where special measures are taken to conserve biodiversity, at the top of the list of strategies for in-situ conservation. Ecologists consider in-situ conservation to be the superior approach to conservation of biodiversity (Whitmore 1990, Primack 1993).

Australia has approximately 3225 terrestrial protected areas covering 40 781 000 hectares, which is 5.3 per cent of the land area. Only 0.07 per cent of Australia's marine jurisdiction is protected (Common & Norton 1992). The Australian protected areas come under 50 different classifications (HORSCERA 1993) and are protected under a range of Commonwealth, State/Territory and local government legislation.

The current system of protected areas does not contain representative areas of all of Australia's ecosystems (Bridgewater 1993). Furthermore, the current system may not include sufficient amounts of all the ecosystems currently represented, in appropriately large enough reserves (Common & Norton 1992), to give biodiversity conservation a high chance of success.

The goal of achieving a national system of protected areas representative of Australia's biodiversity is now included within several national strategies including; the National Strategy for Ecologically Sustainable Development (COA 1992b), the National Forest Policy Statement (COA 1992a), and the National Strategy for the Conservation of Australia's Biological Diversity (COA 1996). These strategies do not have legislative power but are intended to guide government policy.

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[3] The Commonwealth Government has established arrangements with the State and Territory Governments, through the Intergovernmental Agreement on the Environment to implement the International Convention on Biodiversity (DASET 1992, p3).

The (former) Prime Minister's Statement on the Environment of December 1992, includes the statement that the Commonwealth Government 'is committed to the development of a national comprehensive system of parks and reserves' (Keating 1992, p. 21). The statement goes on to say that, in cooperation with the States and Territories, the reserves will be established progressively, with the system complete by the year 2000. The process for establishment includes the use of a bioregional framework for scientific assessment of needs and suitability of areas as well as reservation.

A 1993 review of biodiversity conservation in Australia by the House of Representatives Standing Committee on the Environment, Recreation and the Arts (HORSCERA) supported the role of protected areas and made a specific recommendation for the expenditure of $150 million over 6 years by the Commonwealth and the States and Territories for the acquisition of identified areas necessary to achieve 'a nationwide system of ecologically representative core protected areas' (HORSCERA 1993, p. xv). This recommendation is based on the view of the committee that acquisition of privately held lands as well as reservation of public lands will be needed to achieve a comprehensive system.

Progress is being made towards a comprehensive, adequate and representative system of forest reserves in Australia via a series of Regional Forest Agreements (RFAs) which will delineate the areas of forest to be reserved and those available for wood production. The RFAs are being developed via comprehensive regional assessments which incorporate ecological and economic assessments (COA 1995).

The advice and commitments reported here clearly establish that support for conservation of Australia's biological diversity, and acknowledgment of the role of protected areas as an important strategy for conservation has entered the mainstream of Australian political and community consciousness. The achievements of those commitments will not be guaranteed however unless the necessary financial commitments are made by the Commonwealth and State/Territory Governments.

2.2.2 Appropriate Uses of Protected Areas

Internationally and in Australia there exist a range of different legal and operational conditions governing areas that may be included in the category of 'protected areas'. There is no common set of guidelines used in practice for managing protected areas.

It is generally understood that conservation of the natural environment and any heritage features is the major use of protected areas. This is generally stated in legislation and in management plans where they exist. An example, relevant to the later case study of the Wet Tropics WHA is the new Queensland *Nature Conservation Act* where preservation of natural and cultural values is the 'cardinal principle' for National Parks, (see Box 2.1). Most protected areas, however, also allow other uses deemed consistent with conservation. This is termed 'multiple-use'. In some cases, particular uses are prohibited via legislation or regulation. Examples from Australia are the Great Barrier Reef Marine Park where mining and drilling for oil are prohibited and the Wet Tropics WHA where logging is banned under regulations of the Commonwealth Government.

Box 2.1: Queensland *Nature Conservation Act 1992*, management principles.

The Queensland *Nature Conservation Act 1992* specifies management principles for National Parks and for World Heritage Management Areas.

S17 (1) A National Park is to be managed to-
(a) provide, to the greatest possible extent, for the permanent preservation of the area's natural condition and the protection of the area's cultural resources and values; and
(b) present the area's cultural and natural resources and their values; and
(c) ensure that the only use of the area is nature-based and ecologically sustainable.
(2) The management principle mentioned in subsection (1)(a) is the cardinal principle for National Parks.

S25. A World Heritage Management Area is to be managed to-
(a) meet international obligations in relation to the area; and
(b) protect the area's internationally outstanding cultural and natural resources and its biological diversity; and
(c) transmit the area's world heritage values to future generations.

(NB the Wet Tropics WHA is not a WHMA under this Act, it has a separate management act).
Section 35 allows the Chief Executive of QDEH to grant a lease, licence or permit for use of a National Park if the cardinal principle for management is observed, the use will be in the public interest, the use is ecologically sustainable and there is no reasonably practical alternative to the use.

The range of uses occurring in Australian protected areas includes; tourism and recreation, commercial and recreational fishing, grazing, mining, water channelling for hydro electricity production, water catchment reserves, road and rail transport, telecommunications towers and lines, powerlines, research, education, and residential occupation (Driml 1994). In some cases uses existing before designation of protected area status are being phased out, but in other cases, notably tourism and recreation, use is growing and is encouraged.

Where management plans for protected areas exist, these are vehicles for developing policy on appropriate use. Fisher and Stanton (1991, p. 165) say 'Government policies may dictate broad goals, but these are rarely at the level required for individual parks, at least until a regional management plan formalises priorities in the public/political arena.' Examination of management plans for a number of Australian protected areas revealed that conservation of the natural and cultural environment was usually seen to be afforded high priority by being listed first amongst the objectives of the protected area (Driml 1994).

Accompanying the moves for the development of a national representative system of protected areas are recommendations that Australia's reserve classification system be rationalised. Such an argument was put forward by the HORSCERA Inquiry into biodiversity conservation in Australia (HORSCERA 1993). The schema given most support by participants in that Inquiry and favoured in the Inquiry's recommendations is the IUCN Protected Areas Management Categories. This scheme categorises areas into six categories and describes management goals, (see Box 2.2). Only 'strict nature reserves' are single use areas, all the rest permit multiple-use. Areas are classified according to the lowest level of protection given but that does not preclude zoning of higher levels of protection within the area.

Box 2.2: IUCN Categories for Protected Area Management

Category	Purpose
Category I	Strict Nature Reserve/Wilderness Area: protected area managed mainly for science or wilderness protection
Category Ia	Strict Nature Reserve: protected area managed mainly for science
Category Ib	Wilderness Area: protected area managed mainly for wilderness protection
Category II	National Park: protected area managed mainly for ecosystem protection and recreation
Category III	Natural Monument: protected area managed mainly for conservation of specific natural features
Category IV	Habitat/Species Management Area: protected area managed mainly for conservation through management intervention.
Category V	Protected Landscape/Seascape: protected area managed mainly for landscape/seascape conservation and recreation
Category VI	Managed Resource Protected Area: protected area managed mainly for sustainable use of natural ecosystems

Source: IUCN 1994

One model that has been developed to promote conservation whilst dealing with realities of demands for multiple-use of protected areas for subsistence, recreation and commercial uses is the International Biosphere Reserve. This combines core areas managed as strict nature reserves with concentric zones which allow increasing intensities of use. The concentric zones provide a buffer zone for the core area and can incorporate conservation management programs relevant to the zone. This concept particularly addresses the needs of local residents in developing countries who may depend upon the natural resources of the area for their livelihood (Primack 1993).

The charter for World Heritage Areas is also for multiple-use. Managers of World Heritage Areas are required to provide for 'the protection, conservation, presentation, rehabilitation and transmission to future generations' of the areas (Hall 1992). 'Presentation' implies allowing people to visit the areas. Tourism and recreation are allowed uses in all of Australia's WHAs. While sustainable harvesting can be consistent with 'conservation', extractive uses are not generally allowed in Australia's WHAs with the exception of traditional hunting by Aboriginal people and commercial and/or recreational fishing.

2.2.3 Tourism in Protected Areas

This section presents discussion on what is appropriate tourism in protected areas. The following quote from the ESD Working Group on Tourism summarises the debate over tourism in protected areas:

> Tourist development in protected areas will continue to be a contentious issue for governments, park administrators, and conservationists. For many people in the community, developments in protected areas severely jeopardise the conservation values that have led to their creation, while others see these areas primarily as a recreational resource (ESD Working Groups 1991, p. 18).

There is general agreement in the literature on two principles that should govern tourism in Australian protected areas. These are:

- some areas may need to be off limits to tourism due to environmental or cultural sensitivity; and
- tourism in protected areas should be designed and managed to minimise impact.

The first point has the support of numerous recent commentators including the ESD Working Group on Tourism (1991), the Senate Standing Committee on Environment, Recreation and the Arts (1992) and the Commonwealth Department of Tourism, through the National Ecotourism Strategy (COA 1992b).

Most commentators go on to say that in other parts of protected areas, managed tourism is an appropriate use. The degree of endorsement given to tourism development varies. Figgis (1994) points out potentially beneficial aspects of tourism in protected areas, however she identifies a tendency for planning and management to become 'tourism-centred' rather than 'nature-centred', with respect to both small scale tourism and the larger scale of resort tourism. While nature-centred planning could be relied on to require tourism to be managed within constraints set for conservation, tourism-centred planning promotes compromises which may have a cumulative negative impact on the environment.

No commentators publicly express support for tourism in protected areas that is *not* subject to guidelines and management aimed at minimising impact. The tourist industry view as expressed by the Australian Tourist Industry Association (now the Tourism Council of Australia) is that action should be taken to minimise impact. The industry would prefer that the majority of this action be taken as self-regulation (ATIA 1990). This still leaves questions of which areas should be off-limits and what does 'minimise environmental impacts' mean in practice. Both can be controversial issues.

The range of tourism and recreation activities and facilities to be found in protected areas in Australia includes:

- access roads, lookouts;
- private vehicles;
- wilderness bushwalking and camping (no made tracks or facilities);
- walking on made tracks and boardwalks;
- day use facilities (parking, toilets, picnic tables, swimming platforms, barbeques);
- camping grounds (parking, toilets, picnic tables, barbeques);
- commercial transport facilities (train lines, boats, buses, 4WDs);
- viewing and recreation infrastructure (ski lifts, cable cars, pontoons, visitor centres); and
- permanent accommodation facilities (cabins, resorts).

It is reasonable to make a distinction between what may be seen as traditional National Park facilities including walking tracks, camping areas and day use facilities and the development of resorts and highly visible facilities such as ski lifts and cable cars. The traditional facilities convey a certain character, are small in size with respect to the landscape, and can be fairly easily removed and the areas rehabilitated if desired. Proposals to introduce these in sensitive parts of protected areas or to expand existing installations may however attract opposition. As noted above, there is agreement that even these facilities will not be appropriate in strict nature reserves and some parts of protected areas otherwise classified. It would be fair to say however that the most vocal opposition to development of facilities arises in response to proposals for tourist resorts and the larger, permanent recreation facilities.

There is no doubt that construction of a tourist resort would bring considerable change to the recreational setting of part of a protected area. Proposals for such also raise concerns that they are the 'thin end of the wedge' for greater changes to follow. Given that tourists need to be accommodated somewhere, what are the arguments for and against this being inside protected areas?

The ESD Working Group on Tourism notes that there are two views on this subject, the first being that developments constructed inside protected areas would be under the control of the management agency and therefore be subject to greater scrutiny and standards than those outside protected areas. This argument is strongest if developments would otherwise be adjacent to the protected areas and have an influence on the protected area.
The counter view is that large scale developments are 'at odds with the primary conservation purpose of protected areas and therefore should be located outside' (ESD Working Groups 1991, p. 49). One principle often adopted for protected areas is that the only uses that should be supported in protected areas are those for which there is no substitute available. For example, there is no substitute for going into Uluru National Park to view 'the rock', but there are substitutes available to the provision of accommodation inside the park (and in fact this was exercised with the movement of accommodation from inside the park to Yulara).

The Australian Conservation Foundation has a policy of opposing the siting of permanent tourism developments inside protected areas (ACF 1994). Figgis (1994), points out that resorts may have to be large to afford the technology to minimise impacts of operation. However, Figgis argues, that the construction of large and often isolated resorts causes not only the impacts of construction but attracts more visitors and has in cases led to the impacts of construction of new roads and additional tracks.

Also potentially controversial are facilities for viewing or experiencing the environment. The Skyrail cable car recently opened in the Wet Tropics WHA was approved on the basis that it should afford a unique opportunity to view rainforest canopy. This proposal has encountered very strong opposition from sections of the community as being inappropriate for within a World Heritage Area (Figgis 1994).

On the issue of facilities in protected areas, the National Ecotourism Strategy lists beneficial consequences of site hardening to minimise impacts but then goes on to say that:

> infrastructure may not always be perceived as appropriate for the ecotourism experience. For example, for visitors seeking a 'true' wilderness experience, permanent installations can be viewed as intrusive and potentially in conflict with the objectives of ecotourism. This view is often expressed of accommodation within National Parks (Commonwealth Department of Tourism 1994, p. 32).

There is nothing to suggest that, in the absence of strong guidelines against tourism developments in protected areas, interest in infrastructure development will wane. The Australian Tourism Industry Association has noted that:

> Current trends in tourism in Australia suggest that in the future the emphasis will be on: tourism to and tourist developments in national parks; greater domestic and international tourist interest in the Australian natural environment; and large prestige development projects, often in remote and sensitive areas (ATIA 1990, p. 2).

It seems that there is agreement that tourism is an appropriate use of protected areas but there is not a consensus on what is appropriate tourism. There are two potential approaches to this issue, the development of more specific guidelines, or taking a case-by-case approach. The ESD Working Group on Tourism (1991) suggested that there is a case for a national set of guidelines for appropriate tourism and recreation in different types of protected area. The Working Group was of the view that the guidelines would only make sense in conjunction with a rationalisation of protected area classifications. To be of any use, guidelines would need to have clear rules for each class of protected area on what percentage of an area may be developed, with walking tracks and visitor infrastructure, and whether or not tourist accommodation development is allowed. Such guidelines would be necessarily less flexible than a case-by-case approach.

A case-by-case approach would involve development proposals in individual protected areas being assessed on their individual merits. Ideally, assessment of the appropriateness of the particular proposal for a particular place would be undertaken in the context of a management plan for the whole of the protected area, and possibly also a regional environmental or tourism plan (Valentine 1994). Such plans, usually developed with public consultation, set guidelines for development, usually via zoning. It is at this level that debate about the general acceptability of different intensities of use, and setting of opportunity spectrums, should be conducted. Case-by-case assessment of proposals appropriate to a zone could incorporate the principles for minimising impact including; requiring the use of EIA and adopting the precautionary principle.

The development of any tourism infrastructure in protected areas involves a sacrifice of some of the natural environment for human made capital inputs. These inputs may allow more visitors to enjoy the attractions of the natural environment. Most individuals and organisations would support infrastructure such as tracks and boardwalks in areas where rare or endangered features are not placed under further pressure. Opinion is more widely divided when trade-offs proposed are between larger scale infrastructure including accommodation and potentially larger sacrifices of natural environments. This issue is taken up in the proposed model for sustainable tourism in protected areas which incorporates investment in management, including the provision of infrastructure.

2.3 ADVANTAGES OF TOURISM IN PROTECTED AREAS

A full recognition of the impacts of any activity includes physical, biological, social, cultural and economic impacts. This section and the following section focus on positive and negative impacts of tourism in natural environments, and in particular, in protected areas.
Some general characteristics of the nature of impacts need to be introduced. Impacts are changes that are effected upon a system by the introduction of external influences. Existing systems, whether biophysical, social or both, are usually undergoing some form of change due to internal or other external forces. Therefore examination of the predicted or actual impacts of any one activity is of changes being made to a system that is not itself static. The usual approach in impact assessment is to try to establish a baseline level of change in the system, without the activity in question, and to identify actual or predicted changes above that baseline if the activity is introduced. The inherent variability within natural environment systems complicates the search for baselines. The practical difficulties of separating impacts due to tourism from observed social and ecological changes, and collecting data on these impacts, are emphasised by Briassoulis (1992).

Impacts may be cumulative rather than one-off and easily noticeable. Systems or elements of systems may not exhibit detectable change until 'thresholds' are reached. Impacts may be reversible with the application of management measures or simply by ceasing the activity which is causing the impact. Other impacts will be irreversible where the capacity to reconstruct original conditions is lost (eg through species extinction). Often reversibility is interpreted as constrained by the cost of reversal that is technically feasible, but expensive.

Interpretation of the significance of impacts is a vexing issue. Even where the knowledge exists to understand the biophysical processes by which an activity changes a system and to predict the likely results of imposing an external influence, these results need to be further interpreted in terms of significance. Interpretation of significance usually has two phases. The first is to interpret significance in terms of the system being examined, ie., 'What is the ecological significance of an impact?' (Duinker & Beanlands 1986). Ecologists are developing concepts such as 'keystone species' (Primack 1993) to attempt to understand ecological significance. The second phase addresses a broader social, cultural and economic dimension, ie., 'How important to society is the predicted impact?'. Techniques such as Benefit Cost Analysis can be used to address this broader question by making the trade-offs involved explicit (James 1994).

Much of the literature drawn on here to illustrate the impacts of tourism in protected areas places emphasis on identifying the range of types of impacts that have been recorded as occurring, in different types of ecosystems, due to different types of tourism activity. This generic approach is a useful starting point. Assessment of significance must however be done with reference to particular examples.

A wide range of activities is associated with tourism, focused mainly on transport and accommodation of people, and their participation in recreational activities. The activities associated with tourism occur in a wide range of locations and environments, exacerbated by the very nature of tourism acting to disperse people to all corners of the planet. The presence of people and associated activities and infrastructure has the potential to cause a wide range of physical, biological, social, cultural and economic impacts (Mathieson & Wall 1982).

This present section looks at impacts that may be considered beneficial to tourists, regional economies and conservation interests. The next section looks at negative biophysical, social and cultural, and crowding and amenity impacts of tourism in natural environments and protected areas.

2.3.1 Benefits to tourists

There has been much research conducted into the psychological dimensions of tourism and recreation in natural environments (Pearce 1982, Craik 1991). Such studies aim to understand the motivations and satisfactions of visitors to natural areas. Visitors are often classified according to their reasons for visiting natural areas and the types of needs they seek to meet. The information is generated to increase understanding for its own sake, or to be used in marketing or management.

Economists are less interested in motive and more interested in demonstrated action. They would interpret the statistics on the growth of tourism as demonstration that more individuals think that they will benefit from tourism to the extent that they chose to devote a proportion of their disposable income to this activity. An economic interpretation of the welfare obtained by society by the opportunity to visit protected areas is indicated by the combined willingness to pay for visits. Where there is no established market for access to protected areas, either because there are no entry fees or fees charged are nominal, this willingness to pay is unknown, unless economic studies are undertaken to reveal this. There have been numerous studies undertaken to estimate the willingness to pay for visits to natural environments and protected areas.

A fuller discussion of economic measures of benefits to visitors to protected areas is included in Chapter 3. An estimate of economic benefits to visitors to the Wet Tropics WHA is made in the case study.

2.3.2 Benefits to regional economies

The term 'regional economies' is used here to refer to the economy of relevance for analysis, whether this be a nation or a sub-region in which the protected area is located. Tourists who visit protected areas in a region spend money inside and outside the protected area, including on; accommodation, transport, specialist tours, equipment, food and drink, souvenirs and entertainment. The amount they spend depends on how long they stay, how affluent they are, and what goods and services are available for sale.

This expenditure by tourists generates opportunities for business and employment in the local economy and confers often a substantial financial input to the economy. For example, tourism is the major source of foreign exchange (the major 'export' industry) for many developing countries (Boo 1990). Data presented at the beginning of this chapter illustrated the importance of tourism to the Australian economy. Expenditure by tourists has a 'multiplier effect' in economies as it generates activity and employment in sectors which support, or are supported by, the tourist services industries, and as people employed in tourism in turn spend their earnings in the region.

A distinction must be made between these financial impacts and the true measures of economic welfare which incorporate all the benefits and costs of tourism. The latter are discussed in Chapter 3.

The perceived financial benefits of tourism may be overestimated however by only considering gross expenditure in a region by tourists. There are several factors that need to be taken into a calculation of the net financial impacts of tourism. Firstly, there is usually an amount of 'leakage' of funds out of a region. This occurs through paying for imports to be used in producing tourist services, basic foodstuffs, luxury goods and capital for investment. Profits may be repatriated back to investors from outside the region (Boo 1990). In addition, skilled staff may be brought in from outside the region, reducing the employment and skill acquisition opportunities for local residents.

If regional infrastructure costs are higher with tourism than they would be without tourism, local residents may be subsiding tourism, unless efforts are made to recover costs from the tourist industry. Another factor that should be taken into account when calculating net financial impacts of tourism is the extent to which tourism that is not properly supported by infrastructure or management is causing environmental damage that will impose tangible costs on residents in the future or loss of expected earnings if tourism declines due to deterioration in conditions.

Most often the only information that is easily collected is the gross expenditure by tourists in a region (Driml & Common 1995). This author has calculated and reported this for a number of protected areas in Australia, (see Table 2.1). The net financial impacts have not been calculated in that exercise, however the shortcomings of the exercise were described (Driml 1994).

Table 2.1: Gross expenditure associated with visits to five Australian World Heritage Areas, 1991-92

World Heritage Area	Annual Expenditure by Tourists $ million
Great Barrier Reef WHA	776
Wet Tropics WHA	377
Kakadu National Park	122
Uluru National Park	38
Tasmanian Wilderness WHA	59
Total for five areas	1372

Source: Driml and Common 1995, p. 27.

Much of the literature reporting the results of studies of the 'economic benefits' of tourism in protected areas around the world also only includes financial measures, and most often only gross expenditure (and sometimes revenue from fees).

This discussion has focussed on financial impacts of tourism. These at least should be taken into consideration when evaluating the regional net benefits of tourism to protected areas. The discussion has not included the non-market benefits or costs of environmental or social and cultural impact. A model for calculating net economic benefits is developed in Chapter 5 and applied to the Wet Tropics WHA in the case study.

2.3.3 Benefits to conservation

Whether tourism benefits conservation is one of great questions in relation to tourism in protected areas. Strict protectionists would point out that the best strategy for preservation is to have no direct use of protected areas, including no tourism. Pragmatic conservationists would argue that tourism can provide a *raison d'etre* for conservation and be a source of funds for management (Thorsell & McNeely 1988, Figgis 1994).

Tourism does provide evidence that protected areas have a tangible economic value, as some examples given above have shown. Establishing that protected areas have economic value is particularly relevant to promoting conservation in poor countries, where short term demands for food and work compete against concerns for future resource quality (Dixon & Sherman 1990).

In many developed countries, the tangible economic values of alternative land uses are well established, and these are recognised as the opportunity costs of protection. In Australia, there are some examples where economic analyses have been undertaken in conjunction with declaration of protected areas. Information on potential tourism and non-market economic values of areas if protected have supported decisions to establish protected areas, made mainly on ecological or cultural grounds. In recent years, such analyses have been carried out for the Wet Tropics WHA (Driml 1991), Fraser Island (Hundloe et al 1990) and Kakadu Conservation Zone (Resource Assessment Commission). In these cases, the opportunity costs were the value of the areas for logging (Wet Tropics WHA and Fraser Island) and mining (Kakadu).

In addition, tourism may provide a source of revenue for management of the protected area. This is especially important in countries where there is no prospect of sufficient management funding being provided by governments. Examples of the use of entry fees in countries that feature tourism in natural environments and protected areas, and for protected areas in Australia follow.

The general situation in Asia and Latin America has been observed by Lindberg and Enriquez (1994) to be no fees or low fees being charged, with what revenue is earned going to central government rather than remaining to be spent in the protected areas. In a review of ecotourism in five Latin American countries, Boo (1990) found low fees charged in all but the Galapagos National Park in Ecuador. In 1994, Costa Rica raised fees to foreign tourists from US$1.25 to US$15.00 (Chase 1995).

Charging entrance fees is an established practice in many protected areas in eastern and southern Africa where rates range from around $10 to $20 per day (Lindberg and Enriquez 1994). In Kenya, revenue raised from tourism is used to fund the broader management requirements of the parks system.

In the United States, the percentage of costs of park management raised by fees ranges from less than 10% for the US Parks Service to over 100% in New Hampshire state parks (LaPage 1994).

In Nepal, fees set at around US$10 for entry to National Parks and US$5 per week for trekking have not deterred increasing numbers of visitors. Only in the Annapurna conservation area are fees earmarked to be spent in the park (Wells 1994). The Kingdom of Lo in the north of Nepal was first opened to tourism in 1992. Limits on visitor numbers were set at 200 visitors per year with relatively high fees of US$700 for 10 days. Despite the high fees, demand for visits was such that the 200 permits were taken up in two months (Hum Gurung pers. comm. 1994). Brown et al (1995) report that visitor limits have subsequently been expanded to 600 and then to 1000 permits, at the cost of possibly significant cultural impacts on the community of the area.

The Galapagos Islands off the coast of Ecuador are a popular tourist destination due to unique fauna and its associations with the development of Darwin's theory of evolution. The practice of charging entry fees has long been established and the inelastic demand by foreign tourists has been exploited to charge relatively high fees for this class of visitors. Fees have recently been raised from US$40 to US$80 for foreign tourists while they remain at the equivalent of US$6 for Ecuadoreans. The revenue raised is divided up with 11 per cent being retained for management of the Galapagos, some of the remainder being used to fund protected area management on the mainland and the remainder accruing to central treasury (Lindberg and Enriquez 1994).

In recent years, before the current political upheaval in Rwanda, around US$1 million was raised annually from entry fees to the Parc National des Volcans, paid by foreign tourists for the privilege of viewing mountain gorillas (Lindberg 1991).

In Australia, entry fee policies vary within and between States and the Commonwealth Government. Entry fees charged in some Australian National Parks and protected areas are summarised in Table 2.2.

In Australia, the degree to which user fees raise sufficient revenue to fund management is mixed. For example, in the previously mentioned study of the economics of tourism in five Australian World Heritage Areas, it was found that revenue raised from tourism (entry fees and other user fees) covered only a small proportion of management budgets for four of the areas, (see Table 2.3) (Driml & Common 1995). By contrast, the revenue raised for Uluru National Park covered 64% of the management budget. Uluru is a relatively small National Park and entry fees were high by Australian standards at $10 per person in 1991-92.

Table 2.2: Fees in some Australian National Parks and World Heritage Areas

World Heritage Area or National Park	Fee
Great Barrier Reef Marine Park, Qld.	Paid by operators: $1 per person per day EMC on standard operations PAAFs, bonds
Wet Tropics, Qld	Paid by operators: $1.15 or $2.30 per day
Fraser Island, Qld	Vehicle permits, various for commercial operators, camping fees
Kakadu, NT	$10 per person entry
Uluru, NT	$10 per person entry
Lord Howe Island, NSW	$10 per person entry
Tasmanian WHA	$5 per day adults, $8 per weekend, $20m per month, $40 yearly pass (children under 18 free, pensioners discount)
Shark Bay WHA, WA	nil
Monkey Mia Reserve, WA	$4 per day adult, $10 per day family, $01 long visit adult
Francis Peron	$3 per vehicle, $20 seven nights camping
Jervis Bay, ACT	$5 per car per week, $25 per car per year
Willandra Lakes WHA, NSW	nil
NSW Rainforests CERA WHA	nil
Most Victorian National Parks	charges generally on campsites and vehicles

Source: Stanley 1994, Driml 1994

Table 2.3: Management budgets and revenue from tourism, five Australian World Heritage Areas, 1991-92

World Heritage Area	Management Budget $ million	User Fees Collected $ million	User Fees as Percentage of Budget
Great Barrier Reef WHA	18.1	0.79	4.0%
Wet Tropics WHA	12.1	0.30	2.5%
Kakadu National Park	10.8	1.02	9.4%
Uluru National Park	2.9	1.85	63.8%
Tasmanian Wilderness WHA	4.8	0.20	4.2%
Total for five areas	48.7	4.16	8.5%

Source: Driml and Common 1995, p. 27.

Internationally there are several notable examples where revenue raised in protected areas is spread further than management of tourism in the area in which it is raised. In Ecuador, entry fees to the Galapagos Islands are US$80.00 for foreign tourists. Eleven per cent of the revenue is used to fund management on the Islands, and the remainder is split between funding management of mainland parks in Ecuador and a contribution to central treasury (Lindberg & Enriquez 1994). The Kenyan Government plans to cover the cost of system-wide management of its protected area estate with revenue raised from tourism (Lindberg & Enriquez 1994).

In Australia and in other countries, the potential to fund management with revenue raised from visitors is not met in the many protected areas which have no entry fees or low fees. In many cases, not enough revenue is raised to meet the costs which arise specifically from the need to manage tourism. In such cases, there are no extra funds remaining to fund other management requirements. Another constraint to adequate funding of management is where revenue raised from tourism is directed to central treasury and not made available for management of the area in which it was raised. Consequently, the case that tourism can benefit conservation via providing revenue for management is not proven, but the potential exists.

2.4 DISADVANTAGES OF TOURISM IN PROTECTED AREAS

2.4.1 Environmental impacts of tourism

The evidence to date is that biophysical impacts on natural environments have occurred in many areas as a result of tourism activities. Examples of negative environmental impacts from around the world are documented in many individual case studies and review articles (for example, OECD 1980, Mathieson & Wall 1982, Hunter & Green 1995). These documented cases of tourism impact cover all continents and all types of environment. In Australia, it has been observed that 'adverse ecological impacts of tourism in Australia can be cited for most of the locations into which it has intruded' (IAC 1989). A number of review articles have recorded types and examples of impacts of tourism on natural environments in Australia (for example, IAC 1989, Hundloe 1990). The documented cases of impact range from many general observations, to results of specific environmental impact assessments, to scientific experiments where 'treatments' of the types of impacts caused by tourists are applied and monitored (for example, trampling effects on coral (Kay & Liddle 1984)).

The ESD Working Group on Tourism (1991) notes four characteristics of tourism which serve to exaggerate impacts. these are:

- the rapid rate of growth;
- seasonal demand for infrastructure with the result that waste disposal systems etc., may not cope for some times of the year;
- location, especially where the most sought after locations are also the most environmentally sensitive; and
- requirements for infrastructure.

Types of impacts that may be experienced with tourism in natural environments are summarised in Table 2.4, which is taken from Hunter and Green (1995). Actual impacts in any area depend upon the vulnerability of the ecosystem and management practices adopted.

Table 2.4: Some major potential impacts of tourism on the natural environment

Impact aspect	Potential consequences
Floral and faunal species composition	• disruption of breeding habits; • killing of animals through hunting; • killing of animals in order to supply goods for the souvenir trade; • inward or outward migration of animals; • trampling and damage of vegetation by feet and vehicles; • destruction of vegetation through the gathering of wood or plants; • change in extent and/or nature of vegetation cover through clearance or planting to accommodate tourist facilities; and • creation of a wildlife reserve/sanctuary or habitat restoration
Pollution	• water pollution through discharges of sewage, spillages of oil/petrol; • air pollution from vehicle emissions, combustion of fuels for heating and lighting; and • noise pollution from tourist transportation and activities.
Erosion	• compaction of soils causing increased surface run-off and erosion; • change in risk of occurrence of landslips/slides; • change in risk of avalanche occurrence; • damage to geological features (eg. tors, caves); and • damage to river banks.
Natural resources	• depletion of ground and surface water supplies; • depletion of fossil fuels to generate energy for tourist activity; • change in risk of occurrence of fire; • depletion of mineral resources for building materials; • overexploitation of biological resources (eg overfishing); • change in hydrological patterns; and • change in land used for primary production.
Visual impact	• facilities (eg. buildings, chairlift, car park); • litter; and • sewage, algal blooms;

Source: Hunter & Green 1995, p.14.

The ecological 'footprint' of tourism generally extends more broadly than the areas visited. If there is pollution, modification of environments or disruption to mobile fauna, impacts may flow on to other areas. The economic activity and employment generated by tourism may mean an expansion of urban settlement, with all its related environmental impacts, in areas adjacent to the tourism centres. Provision of services for tourism draws on resources, from the local region or further afield. The global dimension of tourism's footprint includes the contribution of air transport to the greenhouse effect. It is reported by Hunter and Green (1995) that aviation accounts for 2% of carbon dioxide emissions from fossil fuels.

In well managed protected areas, many of the more impacting activities or ways of operating are not permitted, and those activities allowed are managed closely to minimise impacts. Nevertheless, there are impacts associated even with the construction and use of walking tracks. A review article by Buckley and Pannell (1990) provides a description of numerous types of potential impacts of recreation and tourism in National Parks and conservation reserves. These authors provide a generic description of the performance of a range of recreational activities and infrastructure against their list of potential impacts of tourism in protected areas, namely:

- vegetation clearance or damage;
- soil erosion or compaction;
- wildlife disturbance, shooting or habitat destruction;
- solid waste generation;
- water pollution;
- air pollution;
- noise pollution;
- increased fire risk; and
- risk of introducing weeds and fungi.

The range and severity of impacts described by Buckley and Pannell (1990) increase with increasing intensity of use, from bush walking and camping through to resort development. Some types of use , for example off-road driving are associated with quite widespread impacts whereas impacts of other uses are more contained.

Perhaps the most well studied aspect of tourism and recreation impact in protected areas is the impact of trampling of vegetation and compaction of soil by walkers and campers. Decades of work have been undertaken in temperate areas. The general findings are of a curvilinear relationship between the amount of impact and the damage to vegetation (density and diversity); that is, the most damage is done with the initial trampling.

The case study of the Wet Tropics WHA is of a tropical rainforest area. Only a small number of studies of the impacts of trampling are reported for tropical areas. Sun and Liddle (1993) found the general curvilinear relationship of temperate areas held for tropical grasslands. This was also the finding of Boucher et al (1991) who conducted studies of trampling effects on trails in mature rainforest in Costa Rica. In the Costa Rican study, it was found that continued, even low level use of tracks maintained the altered vegetation structure but that vegetation recovered quite quickly after closure of trails. Boucher et al (1991) observed that rainforest vegetation has characteristics associated with sensitivity to damage (year round vegetation growth, soft delicate leaves, adaptation to wet habitats with easily compacted soils) but is resilient with the ability to recover after damage. The performance of soils under trampling impacts is important to erosion. Soil compaction decreases water infiltration capacity and increases runoff and erosion (Jusoff 1989). A study in forested areas in Malaysia found that soils exposed to concentrated recreational use showed some compaction, but the effects were not alarming (Jusoff 1989). These results are not able to be adopted generally as soil type, rainfall regime and the density of use are all important determinants of impact.

The size and shape of protected areas is thought to determine the degree to which they are subject to edge effects such as incursions from feral animals, threats from fire etc. and the likely viability of populations of species contained within them (Primack 1993). These underlying conditions will determine sensitivity to added stresses such as the presence of tourists.

More detailed observations of biophysical impacts of tourism, with particular reference to the Wet Tropics WHA, are included in Chapters 4 and 6.

2.4.2 Social and cultural impacts of tourism in protected areas

Social and cultural impacts of tourism are documented for many areas around the world where tourism has brought changes to cities, towns and villages, and their inhabitants (Mathieson & Wall 1982, Craik 1991). It is not always straightforward to describe these changes as negative or positive. The direct social and cultural impacts of tourism in protected areas may be limited where there are no communities living in the protected area. There may however be indigenous people for whom the area is significant, people who are displaced through the creation of protected areas, and people who live adjacent to protected areas and traditionally use resources of the areas. In addition there are many protected areas in Australia and around the world with people living inside the boundaries[4]. All these people may experience social and cultural change due to tourism development. This section briefly discusses impacts of tourism on the Aboriginal and Torres Strait Islander individuals and communities who are traditional owners of land designated as protected areas. This is relevant background for issues relating to management of the social and cultural impacts of tourism in the Wet Tropics WHA.

The 'protected area' concept is 'western' in origin and is effected through laws of the Commonwealth of Australia and State/Territory and local governments. Protected areas have been declared under one system of law generally without regard for the system of attachment to the land that existed prior to European occupation. Issues of land rights are fundamental to impacts on traditional owners of any introduced land uses. Actions

[4] In Australia, traditional owners live in World Heritage Areas including Kakadu National Park, Uluru National Park, and the Wet Tropics WHA. The entire population of Magnetic Island, a suburb of Townsville, plus the staff of island tourist resorts, live within the boundaries of the Great Barrier Reef WHA..

taken in recent decades to recognise Aboriginal land rights include Commonwealth land rights legislation and the *Commonwealth Native Title Act 1993* and State legislation. The major portions of what is now Kakadu and Uluru National Parks have been titled to the traditional owners of that land. In both cases, granting of title was linked to arrangements for the land to be leased back by the communities to be run as National Parks (ANPWS 1991a, b). The *Commonwealth Native Title Act 1993* allows Aboriginal and Torres Strait Islander people to pursue claims over all or parts of protected areas. In time, it is likely that the ownership pattern of land in protected areas will be defined by decisions of the National Native Title Tribunal or the courts. Of course impacts of tourism may be experienced by traditional owners regardless of the outcome of land claims.

Aboriginal social and cultural issues can fall into two broad, overlapping categories. The first relates to evidence of past occupation (archaeological sites, landscape changes) and the second to present day interest and use, which may extend to interest in the evidence of past occupation (Horsefall 1991a). Both these interests are subject to impact from tourism. Indigenous people live within a number of protected areas in Australia. Others closely identify with land and landscapes within protected areas. Tourism can have a very direct effect on these people.

Potential positive impacts of tourism for indigenous people have been identified as including opportunities for employment and training, opportunities for investment and local control of tourism services, reasons for young people to stay in the community and learn their own customs, promotion of an arts and crafts industry, increasing pride in the culture and increased appreciation of the culture by visitors (ESD Working Group on Tourism 1991). Figgis (1994) reports Aboriginal people controlling or being involved in around 500 tourist businesses, employing 2,500 people.

Evidence to the ESD Working Group on Tourism (1991) was however that such involvement was of some, but limited, benefit to Aboriginal communities. Several aspects of tourism demands and Aboriginal culture and lifestyle do not fit neatly together. These include demands by tourism for access to sites, requirements for regular schedules, desires for face to face contact with Aboriginal people. In addition, lack of education and resources make it difficult for Aboriginal people to work and invest in the industry.

Some understanding of the impacts of tourism on traditional owners can be derived from understanding how Aboriginal people view tourism. Aboriginal perspectives on tourism were reported in a review article by Ross (1991). Due to the nature of Aboriginal people's associations with the land, they place importance on the regard that visitors show to the land. Aboriginal people are concerned to see irresponsible behaviours such as wasting fish, inappropriate disposal of rubbish, vandalism, transgression of sacred sites and the cumulative damage done by tourists.

Ross (1991) argues that perceptions by Aboriginal people of the amount of control they have over tourism on their land affects their response to tourism. Concepts of control are related to the ability to understand individuals by knowing about them and their interest in visiting the land. This cannot be achieved with any more than small numbers of tourists. Studies cited by Ross commonly report that Aboriginal people think there are too many tourists.

2.4.3 Crowding and amenity impacts of tourism in protected areas

The amount and type of tourism in an area can affect visitors' enjoyment of the area. The experiences of one individual may be enhanced or diminished by the presence of other tourists, the infrastructure of tourism and/or evidence of past presence. In the worst outcome for visitors, sites may be perceived as crowded, overdeveloped and/or damaged. The evidence from research into visitors' experience and opinions is that there is no fixed level at which these conditions are set. Different people have different tastes and expectations, and these may vary at different times.

At one end of the spectrum of recreational use is 'wilderness' which is generally interpreted to have minimal evidence of human presence and low numbers of encounters with other users. At the other end of the recreational scale is highly artificial sites where one would expect to encounter large numbers of people. The tendency for any site in a protected area to become more developed over time with the addition of human made tracks, facilities, larger numbers of users and evidence of cumulative damage is termed 'recreational succession' (ESD Working Group on Tourism 1991).

The model proposed by Butler (1980) of a 'tourist area cycle of evolution ' is an often quoted and useful conceptual model of how tourism use of an area may develop and change over time. Butler addressed his model to tourism in both natural and built environments - it is not restricted to protected areas. According to the model, initial visits to an area may be low in number and made by people who are prepared to live in local conditions. Butler calls this the 'exploration stage'. Over time, facilities are provided for tourists and visitor numbers increase. This is termed the 'involvement stage' as it is local residents who are mainly involved in providing tourism services. The next stage is the 'development stage' and growth in provision of facilities accelerates, as does growth in visitor numbers. Investment may come from outside the local area and local residents lose some control over development. The appearance of the area may change. At some point, Butler hypothesises, the critical range of at least some elements of the area's physical, biological and /or social carrying capacity will be reached. In the 'consolidation stage', growth slows. Stagnation may occur as growth stops. Without further input, visitor numbers may remain steady or may collapse. The area may however be rejuvenated and a new growth period commence.

The Butler model is often quoted in tourism literature as a cautionary tale that growth will not continue forever and that too much tourism can spoil the attractions of an area. Butler himself says 'what I was trying to say was that if we don't do anything and tourism is simply let loose in a laissez-faire way, then it will kill itself and change areas irreparably beyond what most people want' (Butler & Bramwell 1994, p.138).

The model proposed by Butler may be used to describe the process of 'recreational succession' in protected areas. The findings of research, mostly conducted in the United States, may provide an explanation of visitor perceptions of crowding and reduced amenity in natural environments and protected areas.

Watson (1988, p. i) writes that more than 20 years of research has produced common agreement that 'perceptions of crowding have more to do with the nature of visitor interactions, the settings and visitor attributes and expectations, than they have to do with visitor density'. Because visitors have varying desires for solitude or naturalness and varying expectations of what they will encounter in a protected area, reactions to encounters with others, evidence of environmental degradation, and the presence of built facilities, will vary amongst visitors. As a negative concept, 'crowding' of recreation areas can include too many encounters with other people, objectionable behaviour of other people, too few facilities, evidence of degradation and lack of success in hunting and fishing.

Ironically, another thing that has been established in the research is that visitors surveyed at any one time generally express a high level of satisfaction with their visits. Shelby and Heberlein (1986) propose several explanations for this:

- self-selection of visitors to known types of experiences;
- product shift where visitors adapt to the setting they encounter;
- displacement where visitors select other sites when previously visited sites change too much;
- multiple sources of satisfaction where the setting is only one source of satisfaction; and
- rationalisation where visitors are determined to be satisfied.

The result is that recreation settings may change and environmental degradation may occur and visitors may still express a high level of satisfaction. Only through studies of visitor perceptions over time are researchers able to map out displacement effects (Shelby & Heberlein 1986, Pearce and Moscardo 1994).

It is difficult to point to thresholds beyond which crowding and reduction in amenity reduce overall satisfaction, as management may continually change to accommodate more people and different expectations.

An important question is whether the reactions of tourists to crowding and amenity become self-regulating in terms of biophysical impacts, that is 'Will tourists respond to signs of environmental degradation before serious damage occurs?'. There are several forces acting to militate against self-regulation. One is the displacement effect just described, where those visitors most sensitive to environmental degradation are likely to be replaced by others less sensitive to environmental conditions, possibly in greater numbers.

A second consideration is that visitors must be able to perceive the critical signs of environmental damage in order to react. The visibility of ecologically significant indicators will vary from system to system. For example, in Nepal, visible impacts of tourism are erosion and littering. Less obvious to tourists are the potentially more ecologically significant impacts of over harvesting of forests to provide fuel for cooking and depletion of native wildlife for food for tourists (Brown et al 1995). In contrast, Hawkins and Roberts (1992, p.178) who studied coral reefs in Egypt observed that the loss of amenity caused by damage by divers can reduce the appeal of reefs to subsequent divers, even though the damage is 'relatively unimportant biologically'.

A third factor lessening the likelihood that crowding and amenity impacts of tourism are self-regulating is where tourists intend to visit an area only once, so even if they are disappointed the demand for visits is not likely to change. Tour operators will still promote visits to the area to other tourists, as this is in their commercial interest (and generally all negative impacts are external to their production function). It is possible however that word-of-mouth reports from disappointed visitors will eventually reduce demand. It is reported that word of mouth is an important source of information in the nature-based travel sector (Blamey 1995).

The negative impacts of crowding and reduced amenity are the flip side of personal benefits of tourism. If areas cease to provide those benefits, popularity may fade and personal and economic benefits may be lost. The issue is complex as it has to do with different and changing individual perceptions. As the tendency for increasing use impacts is not likely to be self-regulating to a level that is ecologically sensitive, or even optimises visitor benefits, it is necessary to set management goals externally and to apply active management towards meeting these goals.

2.5 Management of Tourism in Protected Areas

All of the various types of impact introduced above may be modified by the application of one or more of the numerous approaches to management that have been developed for this purpose. This section first looks briefly at some approaches to management which take concepts of recreational carrying capacity into account. Then the approaches to planning and management of tourism and recreation in protected areas that are available for use either singly or in combination are listed and discussed briefly.

2.5.1 Carrying capacity and approaches to visitor management

The term 'recreational carrying capacity' may be taken to imply that there is a unique level of visitor use which can be accommodated in a particular location without ill effects. This idea has been rejected by authors writing on recreation management (Watson 1988). It is commonly accepted that there are many alternative carrying capacities for tourism and recreation in an area, depending upon the criteria and standards used to define carrying capacity. While objective measurements of impacts are important in determining carrying capacity, so also are value judgements as to what impacts are acceptable. Management infrastructure and policies can be applied to change the impacts of visitor use and hence the capacity of an area to accommodate visitors (Dixon et al 1993).

In recognition of the place of value judgements in defining carrying capacity, Shelby and Heberlein (1986, p. 18) have proposed that ' carrying capacity is the level of use beyond which impacts exceed acceptable levels specified by evaluative standards'.

There is more than one dimension to carrying capacity. For example, Shelby and Heberlein (1986) identified four types of carrying capacity - ecological, physical (space), facility and social. According to these authors, the recreational carrying capacity at any site is the product of criteria set for all four characteristics.

There are often no obvious absolute measures of 'overuse' of a site. Even in defining ecological carrying capacity it is necessary to select indicators of environmental condition and to exercise a value judgement when determining the levels of impact that indicate overuse.

It has already been emphasised that the social/psychological dimension of carrying capacity may vary for every different visitor or class of visitors, so value judgements are needed to select criteria and standards to define a social carrying capacity for any particular site. Through selecting different criteria and standards for different sites, a range of different types of social experiences can be described, each of which will suit a proportion of visitors.

The application of management actions can be used to vary carrying capacity; through the expansion of facilities, by changing use so there is less ecological impact per visitor (for example, by closing areas in breeding seasons) or changing conditions that cause social impacts (for example, reducing crowding by dispersing use across time). An important point here is that there are many management strategies that may be used to meet carrying capacity demands, and limits on visitor numbers are but one of these strategies.

The development of approaches to recreation management in protected areas has evolved in the USA since around the mid-1970s to provide quite sophisticated approaches which deal with the concept of alternative levels of carrying capacity, the social/psychological dimension of visitor satisfaction and management of the tendency for recreational succession to occur in the face of increasing numbers of visitors. A brief account of key developments serves to introduce the ideas behind the approaches. It must be noted here that the development of this school of management approaches has involved many of the same players and has a thread of common evolution.

The concept of a Recreation Opportunity Spectrum (ROS) was formalised in a report for the United States Department of Agriculture (USDA) Forest Service in 1979 (Clark & Stankey 1979). This approach recognised that different recreational 'settings' were preferred by different visitors. A setting is the product of a number of factors including facilities, environmental impacts, encounters with other visitors, behaviour of visitors etc. Clark and Stankey proposed that managers use surveys of visitors to derive agreement on what factors and levels of use for each factor made up recognisably distinct settings, in order to develop a spectrum of 'opportunity setting classes' from wilderness (their term is 'primitive') to high use ('modern'). The managers were then to allocate opportunity setting classes across a recreation area, and manage to retain those settings. This would prevent a drift to higher use across the whole recreation area, guide managers on appropriate management for each setting and guide visitors in choosing the setting which best meets their desires for a recreation experience. In a sense, the managers are defining recreation and tourism 'products' and then allocating these across the recreation area. Through many years of surveying visitors, a fairly standard description of opportunity (setting) classes for US forest recreation has been developed.

The Limits of Acceptable Change (LAC) approach was developed some years later, and retains the concept of opportunity classes (Stankey et al 1985). This approach goes further than ROS by focusing on selecting indicators of ecological, social and other impact and establishing appropriate standards for these indicators for each opportunity class. These standards become the 'limits of acceptable change'. By focusing on the condition of indicators, the approach addresses outcomes rather than inputs such as visitor numbers. The LAC approach also recognises the need to make decisions not only on defining opportunity classes but also on allocating the opportunity classes across the recreation area. It incorporates steps which identify alternative allocations of opportunity classes, describe the costs and benefits[5] of alternative allocations, in terms of ecological impact, social impact and resource costs, and evaluates the alternatives to select a favoured distribution.

A further approach, Visitor Impact Management (VIM) was proposed in 1990 (Graefe, Kuss & Vaske 1990). The focus here is the use of indicators with standards set for particular sites or groups of sites, with perhaps more variation and flexibility than allowed with a set number of opportunity classes. One point of emphasis is in identifying the causes of change in indicators, so this information can be used directly in management to reduce impact. It is recognised that the appropriate management strategy can be selected from a variety available to suit the particular issues.

2.5.2 Current management approaches

The following is a menu of approaches available for managing tourism and recreation in protected areas. This list includes a mix of approaches including regulation, education and economic instruments.

Designation of protected area status.

This is a most crucial step for management of impacts of tourism (Kenchington 1990). Designation of protected area status confers overall goals for management on an area and at least some idea of guidelines on 'appropriate tourism'.

Planning - Zoning and Management Plans

Zoning is widely adopted as a broad scale approach, separating uses and defining uses within zones (Tisdell & Broadus 1989). A Recreational Opportunity Spectrum may be incorporated into planning at the level of zoning.

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[5] The author has found no examples in Australia where formal Benefit Cost Analysis has been applied to allocating opportunity classes.

More detailed management plans for smaller areas within the protected area may be developed to complement zoning plans and may regulate the intensity, types and locations of activities.

Quotas

Quotas on the number of people or vehicles allowed at particular sites at specified times may be applied to popular or sensitive sites.

Permits

It is common for some uses to be designated as only allowed under permit. Commercial tourist operations generally need permits to operate in National Parks and conservation reserves in Australia[6].

Provision and location of facilities

The provision and locations of facilities including roads, parking areas, tracks, campsites, picnic sites will determine where tourism occurs within a protected area, and may limit numbers if capacity is limited.

Hardening of sites

Hardening of sites refers to the construction of paths, board walks, boat ramps, picnic facilities etc to replace dirt tracks and trampled areas. Hardening is generally undertaken to reduce ecological impacts of tourism by solving an existing problem or preventing an anticipated one (Commonwealth Department of Tourism 1994).

Maintenance of sites and facilities

Regular maintenance of sites and facilities to remove rubbish, make repairs to tracks to prevent erosion etc., is the basic task of park management.

Education

Education is an important management tool in that it can influence people to act to minimise the impact of their presence in the protected area. Education of visitors can occur via information centres and signs located in the protected ares, printed pamphlets, and discussion with rangers.

Accreditation of tour operators

Accreditation of tour operators would involve assessing the quality of services and compliance with standards of operations, and public notice that standards were being

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[6] Permits for commercial tourist operations are required in the Commonwealth government controlled Kakadu National Park, Uluru National Park, Great Barrier Marine Park and in State Government controlled protected areas in all States.

met. Accreditation may be government or industry-administered, and voluntary or mandatory.

Tour industry involvement in planning and management

Direct and routine involvement of the commercial tour industry on a formal basis in planning, at the public participation stages, and on a less formal basis, may assist management.

Monitoring

Monitoring of the impacts of tourism can range from descriptions of obvious changes to systematic monitoring programs where regular measurements are taken of selected ecological and social indicators.

Research

Buckley and Pannell (1990) report that there is not much published research into the impacts of tourism in National Parks and conservation reserves. They were referring to research that employed properly designed experiments and yielded quantitative results.

Environmental Impact Assessment

There is legislation enacted in each State in Australia and the Commonwealth to allow for environmental impact assessment of major project proposals. Proposals for tourist developments in, or which may affect, protected areas may be designated to be assessed under this legislation.

Performance Bonds

Management agencies may require private sector developers of tourist facilities in protected areas to post performance bonds to cover the cost of removal of the facility and rehabilitation of the site should the project fail financially or have to cease or be modified for reasons of unforeseen environmental impact (ABARE 1993).

Surveillance and enforcement

This is a necessary management approach to deal with those visitors to protected areas who are not inclined to comply with the management rules that have been developed to minimise impact.

Rehabilitation

Site rehabilitation is commonly practiced in protected areas. It may require no more than the closing off of sites for a period of time or may require work to improve soil structure after trampling and replanting of previously existing vegetation or the rehabilitation, where possible, of fauna populations.

2.6 CONCLUSIONS

Tourism is increasing worldwide and it seems that visits to natural environment areas are being sought by more people. It can be predicted that larger numbers of visitors to natural environments can be expected in the future. These visitors wish to enjoy the features of the range of natural environment areas, including those areas identified as protected areas. While tourism is permitted, and may be actively encouraged, in protected areas, the primary reason for establishment is usually the conservation of the environment. Evidence has been presented that tourism can damage natural environments, and therefore a potential conflict arises.

In this chapter, several advantages and disadvantages of tourism in protected areas were highlighted. To a certain extent the disadvantages can be minimised via management, allowing the advantages to be enjoyed. There is however ultimately a trade-off between more tourism and environmental impacts which may be irreversible. In the next chapter, concepts important to this trade-off, those of economic valuation and sustainable development, are discussed. The issues presented in Chapters 2 and 3 are together drawn upon in Chapter 5 in proposing a model for sustainable tourism in protected areas.

CHAPTER 3
SUSTAINABLE DEVELOPMENT, ECONOMICS AND TOURISM

The first aim of this chapter is to introduce and discuss the concept of 'sustainable development' which is taken as a theme for the investigations in this thesis. The concept was brought into prominence by the World Commission for Environment and Development (the Brundtland Report) in 1987. The general findings of this Commission are discussed in Section 3.1. In Section 3.2, the concept of 'sustainable tourism' is discussed with reference to interpretations in the international literature. This provides background for the development of a working definition of 'sustainable tourism in protected areas', which is presented in Chapter 5, for use in this thesis.

This thesis concentrates on economic approaches to promote sustainable development. Section 3.3 introduces some new economics approaches, and considers whether standard neoclassical welfare economics is sufficient to move society towards sustainable development. Specific economic interpretations of tourism in natural environments and protected areas are introduced in Section 3.4, to provide a background for understanding why there is generally market failure associated with allocation of resources in this situation, and why this tends to lead to over-use of natural environments. The use of regulations and economic instruments to compensate for market failure is introduced, and user fees are discussed in some detail. Conclusions to this chapter are presented in Section 3.5.

Accompanying this chapter is Appendix A which outlines the Australian ESD process and its outcomes. The recommendations which emerged from this process provide useful reference points with regards what actions might be needed to pursue, amongst other things, sustainable tourism in protected areas.

3.1 Concepts of Sustainable Development

Concern about humankind's relationship with nature is age old. Many ancient religions emphasised the worship of the various gods of nature in order to ensure a continuing existence for the community (Nigosian 1994). More recently, early classical economists, including Malthus, described the dependence of the community on limited resources, specifically agricultural land (Christensen 1989). Warnings by these economists that population increases would bring society to the limits of resource availability came to be seen as largely irrelevant during the industrial revolution and the technological age that followed. It is only in the last third of the twentieth century that concern has again arisen about population growth and the limits of the planet's environmental resources.

This time, the concern is fuelled by scientific understanding of the physical and biological systems of the planet earth and the impacts of human activity on those systems. The emergence in the last decade of the concept of 'sustainable development' represents the latest thinking on how to approach the issues of human existence and expansion in the light of local and possibly global environmental limits.

3.1.1 The Brundtland Commission and Sustainable Development

In 1987, the World Commission on Environment and Development released a report entitled *Our Common Future* (known widely as the Brundtland Report after the Chair of the Commission). This is a very important milestone in the development of thinking about how society should interrelate with the natural environment on which it depends. The report launched the concept of 'sustainable development' as a goal for humankind. The Brundtland Report marshalled a lot of evidence about the adverse and unsustainable environmental impacts of many of our current activities. It looked at projections for growth of population and per capita consumption and predicted difficulties in the future if current practices continue. Evidence was presented on current inequity in global distribution of wealth and the suffering of many millions of people due to population growth and failures in the resources on which they depend. Projections into the future raised concerns for the ability of future generations to be supported by the depleted natural environment that will be a legacy of current use, if practices are not modified.

The solution proposed by the Brundtland Commission to the bleak future scenario painted by an extrapolation of current practices is to replace unconstrained economic growth (which it predicted not to be sustainable) with a sustainable development ethic. The definition of sustainable development offered by the Brundtland Commission is:

> 'Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (WED 1987, p. 43).

The two key concepts for sustainable development were identified as:

- 'the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and
- 'the idea of limitations imposed by the state of technology and social organisation on the environment's ability to meet present and future needs' (WCED 1987, p. 43).

Brundtland argues that economic growth of a certain kind is consistent with, and in fact necessary for, sustainable development. Because of the high priority placed on the plight of the world's poor, the Brundtland Report recommends that economic growth in developing countries is essential to meet the basic human needs of the present generation. For developed countries, economic growth is considered to be consistent 'provided the content of growth reflects the broad principles of sustainability and non-exploitation of others' (WCED 1987, p.44).

On the issue of what sustainable development means for our use of natural resources, the Brundtland Commission stated that 'at a minimum, sustainable development must not endanger the natural systems that support life on earth' (WCED 1987, p.45). Specifically, renewable resources should be retained, non-renewable resources should be used so that the rate of depletion should foreclose as few options as possible, and animal and plant species should be conserved.

The Brundtland Report has provided a general framework within which others have been working to provide the detail. Further development of the sustainable development concept has taken two main directions. One direction is in terms of support for the concept at a local, national and international level. The other direction is work on the detail of how sustainable development can be implemented.

Developments in support for the concept have included the concept being examined by various countries for adoption in national policy. This has trickled down to sustainable development becoming a basis of legislation and policy development. At an international level, the concept was adopted at the United Nations Conference on Environment and Development, held in Rio de Janerio in June 1992. At the conference, 27 principles to promote sustainable development were established. In addition, Agenda 21, a voluntary comprehensive action plan for movement towards sustainable development was adopted at the conference and the United Nations Sustainable Development Commission was established as a result of the conference (COA 1992b). In Australia, a National Strategy for Ecologically Sustainable Development has been developed, see Section 3. 1.4 below and Appendix A.

Work on implementation has included academic work in various disciplines. The writings of economists on sustainable development and new approaches to economic thinking are discussed in some detail below. The development of policy and legislation to promote the concept has required detailed thinking about application. Much of this work is built on research and practice already in place.

The Brundtland Commission was not by any means the first body to articulate many of the ideas brought together in its report. Its findings are important because it brings together information that was not previously assembled in a concise form, in a persuasive argument for serious concern for the implications of growth in population and consumption. As a general policy objective, the concept of sustainable development is hard to argue against, given the information presented by the Commission.

3.1.2 What is to be sustained?

There are now a plethora of terms that include some form of the word 'sustainable' which are used to describe potentially desirable forms of resource use and/or consumption. They can have quite different meanings as targets for action, in terms of what is to be sustained, so it is useful here to distinguish between them.

The concept of 'sustainable yield' has been in use possibly for centuries and refers to a sustainable yield of biomass from a harvested resource, for example a particular species of fish. Pearce et al (1993) point out that harvesting at a sustainable yield permits for both sustainable stocks and a sustainable quantity of output of that particular resource. The maximum sustainable yield occurs where the annual rate of harvest equals the maximum annual rate of growth. 'Sustainable use' is an extension of that concept where it refers to biophysical impacts that do not necessarily involve extraction, for example trampling of vegetation by tourists or waste discharge into the air or water. Sustainable use occurs where the rate of damage or discharge is at or below the recuperative or assimilative capacity of the resource, so the resource can sustain that rate of impact in the long term. Both these concepts address maintaining a pre-existing quantity and quality of resource and maintaining consumption of the specific good or service over time. If our scientific understanding of the impacts of use is good enough, the maximum rates of use that allow sustainable yield/use of any defined resource can be proscribed. The concepts of sustainable yield and sustainable use do not address the contribution of the use of the resource to human welfare, that is they do not include a concern for whether the benefits derived from resource use are used to make society better off, or are used inefficiently. Nor do these concepts address the possibilities for substitution of inputs in production or of outputs in consumption. They only make useful guides in respect of use of renewable resources, as it is not possible to have sustainable yield/use of non-renewable resources unless that rate is zero.

The term 'sustainable activity x' is used quite widely to refer to particular sectors of the economy, usually where the intention is to manage the activity in question to maintain attributes of the resource base or consumption. Some examples are 'sustainable agriculture', 'sustainable tourism' and 'sustainable forestry'. The example of tourism is discussed in greater detail later in this chapter. It can be observed here that the concepts implied by 'sustainable activity x' are fairly imprecise. Sustainable agriculture for example could arguably allow substitution of inputs and outputs and varying rates of input and output, so long as the activity is sustained. Each use of the term 'sustainable activity x' would need to be accompanied by a description of what is to be sustained in that instance, for it to be any use in guiding management.

The work on implementation of 'sustainable development' has generated many new definitions of the concept as writers have struggled to apply more concrete meaning to these two words and their general thrust. Pearce et al (1989) assembled a list of 24 definitions and descriptions of sustainable development, some of which had emerged post-Brundtland and some which are relevant from previous work.

'Sustainable development' as used by Brundtland clearly refers to concerns about the long term productive capacity of the resources on which we depend and to the long term availability of the goods and services required by all humans for at least a basic and humane standard of living. The term 'sustainability' is also used by writers who are concerned with both production and consumption and the breadth of issues implied by 'sustainable development'. Pearce et al (1993) distinguish between the two terms, saying that sustainable development is broader than sustainability and can include issues of the quality of economic development (embracing social goals other than monetary wealth) and concern for all capital assets in production. This distinction does not however seem to be kept to by Pearce et al in their subsequent writing and they use the terms 'sustainable development' and 'sustainability' interchangeably, as do other authors. What is important is that the concepts of sustainable development and sustainability are both more broad and fluid than sustainable yield and use. The former are targets rather than rates of use that can be defined and measured precisely. Sustainable development and sustainability both refer to aggregate, economy wide, levels of production and consumption, and therefore include the potential for substitution in aggregate production and consumption as between particular resources and environmental services. This is examined in the next section. For the remainder of this thesis, the terms sustainable development and sustainability are used interchangeably.

In Australia, the concept of Ecologically Sustainable Development (ESD) has been defined as meaning:

> 'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased' (COA 1990, p. (i)).

3.1.3 A constant stock of capital

It is proposed by Pearce et al (1989, 1993), that the literature developed on sustainable development within economics supports the concept that, in order to achieve intergenerational equity, future generations need to inherit as much wealth as is enjoyed by the present generation. The wealth of the present generation is made up of natural capital (services of natural environments and raw materials), manufactured capital (machinery and infrastructure) and human capital (human skills and knowledge). Some writers consider that a constant per capita stock should be pursued and others are more concerned with the challenges of maintaining constant absolute stocks.

A rule for achieving sustainable development, known as the 'weak sustainability' rule states that intergenerational equity will be delivered so long as succeeding generations inherit a stock of capital not lower than enjoyed by the preceding generation. Consistent with weak sustainability, non-renewable resources may be depleted so long as the rents are invested in capital formation, presumably to provide alternative sources of the same services (eg. energy). Under weak sustainability, renewable resources may also be depleted, provided rents are invested - there is no case for treating renewable resources differently.

The weak sustainability rule accommodates a blanket assumption that forms of capital are completely substitutable (Pearce et al 1993). The assumption of substitutability of manufactured and human capital for natural capital deserves to be questioned in the light of uncertainty about the behaviour of ecological systems and the potential for irreversible losses of natural capital. In recognition of the importance of natural environments in providing life support systems, the 'strong sustainability' rule was developed. This states that intergenerational equity will only be achieved by passing on at least a constant stock of capital, including a constant stock of natural capital (Pearce et al 1993).

A distinction is drawn by Pearce et al (1993) between all natural capital and 'critical' natural capital. The latter is described as ecological assets critical to 'well being or survival' (p. 16). Included in critical natural capital would be systems such as the ozone layer, geochemical cycles and diverse ecosystems. A further distinction is drawn by Tacconi and Bennett (1995) between non-renewable natural capital (NNC) and renewable natural capital (RNC) and between critical RNC and other RNC. Pearce et al (1993) sum up the strong sustainability rule as requiring the protection of critical natural capital, at a minimum.

It may be argued that protected areas are closely associated with critical natural capital. Such areas are usually declared to protect natural environments that have characteristics including rare and threatened species, biologically diverse biota, and/or representative examples of habitat types. The perceived importance of protected areas for ESD in Australia was discussed in Chapter 2. It is pointed out by Tacconi and Bennett (1995) that protected areas are considered by some as the most important means of conserving biodiversity, but may not on their own be sufficient to prevent loss of biodiversity. It may be that a protected area is not entirely critical natural capital, in the sense that some loss of natural features is possible without reaching a threshold of loss of biodiversity or ecosystem function. This is relevant to the question of the extent to which tourism can impact on protected areas without breaking the 'strong sustainability' rule. For any protected area, limits of acceptable ecological change must be set on a case by case basis. Tacconi and Bennett (1995) propose that, even if it is accepted that manufactured capital is not a substitute for natural capital, it is possible that manufactured capital and human capital can be used to extend the life of NNC and to restore RNC. This suggests that 'management' in the form of infrastructure and human skills can be applied to enhance the contribution of natural capital in protected areas to tourism benefits, and still be within the bounds of 'strong sustainability. Taking this one step further, limited substitution of manufactured capital for natural capital may be possible, while maintaining critical natural capital. The replacement of some vegetation with picnic areas and walking tracks is an example of such limited substitution.

3.1.4 Investing rents

It is the case that any rate of use of non-renewable resources other than zero will eventually deplete them. It was demonstrated by Hartwick (1977) that investing rents arising from the use of a non-renewable resource will result in constant per capita consumption over time (given constant population size). This has become known as the 'Hartwick rule'. Common (1995) notes that the Hartwick rule has been shown to extend to 'situations where many different resources are used in production' (p. 48). The Hartwick rule is important to sustainability in that it shows not only that investment in capital formation can lead to sustainability, but it shows how much investment there should be.

Hartwick (1977) demonstrated mathematically that the appropriate investment is the rent arising from use of the non-renewable resource in production. Rent (in this case 'scarcity rent') is the market price of the commodity minus the marginal cost of extraction (Pearce et al 1993). Provided the capital in which investment is made is non-depreciating, the result of investment of rent in each period will be constant capital over time. If population is constant, the income on the capital will allow for constant per capita consumption. Common (1995) points out that complying with the Hartwick rule is necessary but not sufficient for sustainability. For it to be sufficient, the assumption of substitutability of manufactured capital for natural capital would need to stand, and this may or may not be the case for different non-renewable resources. What Hartwick and other writers have shown is that investment is critical to sustainability. In other words, if more than the income from the capital resource base is used for current period consumption, the system will move away from sustainability.

The depletion of natural resources now, will reduce the availability of resources to future generations. The extent to which that will matter to future generations will be affected by two things: the ability to substitute manufactured capital for natural capital; and the amount of investment made in the current period in maintaining and producing capital, as opposed to consumption.

3.1.5 The Australian ESD process

In response to the release of the Brundtland Report, Australia's Commonwealth Government, in 1990, initiated a process which resulted in the production of a National Strategy for Ecologically Sustainable Development (COA 1992b). The Strategy outlines a goal, objectives and guiding principles for moving towards ESD. The National Strategy is intended to guide the development of policy and has no legal status. Some legislation that has been developed subsequently does incorporate principles from the National Strategy into law.

During the development of the National Strategy, there were a number of Working Groups set up to address sectoral and intersectoral issues. Of relevance to this study are the deliberations of the ESD Working Group on Tourism (1991). The report produced by this group developed a description of what they thought the requirements for sustainable tourism might be and made recommendations for changes to current practices.

A common theme in the reports of the various working groups and in the National Strategy is the need to include natural environment resources in economic analysis via pricing and other mechanisms. There are many recommendations throughout the reports on increasing the use of economic instruments in managing resource use.

A more detailed account of the process leading to the National Strategy, the findings of the Working Group on Tourism and excerpts from relevant documents are included in Appendix A.

3.2 Concepts of Sustainable Tourism

If the concept of sustainable development is to be operationalised, it is necessary to be able to define it in some way, so appropriate indicators can be identified. In addition, some qualitative or quantitative assessment is required of whether we are moving towards or away from the target. For the purposes of this study, the target may be described as 'sustainable tourism in protected areas'. A review of the literature of concepts of sustainable tourism was undertaken to see what definitions or descriptions of sustainable tourism have been proposed. Many writers have chosen to provide a description of conditions required to achieve sustainable tourism rather than define the term 'sustainable tourism'. The following are representative of the range of approaches to the concept of 'sustainable tourism'.

Bramwell and Lane (1993), in the introductory volume of the *Journal of Sustainable Tourism* provide a description of their vision for sustainable tourism.

> Sustainable tourism is a positive approach intended to reduce the tensions and friction created by the complex interactions between the tourism industry, visitors, the environment and the communities which are host to holiday makers. It is an approach which involves working for the long-term viability and quality of both natural and human resources. It is not anti-growth, but it acknowledges that there are limits to growth. Those limits will vary considerably from place to place, and according to management practices. It recognises that for many areas tourism was, is and will be an important form of development. It seeks to ensure that tourism developments are sustainable in the long term and wherever possible help to sustain the areas in which they operate. And, for good measure, sustainable tourism also aims to increase visitor satisfaction (Bramwell & Lane 1993, p. 2).

Butler (1993) prefers to make a clear distinction between 'sustainable tourism' and 'sustainable development in the context of tourism' on the basis that sustainable tourism may have no responsibilities to social or economic impacts. He proposes the following 'working definitions':

> A working definition of sustainable development in the context of tourism could be taken as: tourism which is developed and maintained in an area (community, environment) in such a manner and at such a scale that it remains viable over an indefinite period and does not degrade or alter the environment (human and

> physical) in which it exists to such a degree that it prohibits the successful development and wellbeing of other activities and processes.
>
> That is not the same as sustainable tourism, which may be thought of as: tourism which is in a form which can maintain its viability in an area for an indefinite period of time (Butler 1993, p. 29).

A similar distinction is also made by Tisdell and Wen (1996) who point out that sustaining indicators of tourism activity such as tourist numbers, receipts or financial benefits will not necessarily mean that tourism will be sustainable in terms of economic, social or biophysical criteria. These authors suggest that sustainability of total economic values is a potential indicator of sustainable tourism.

Hunter (1995) argues that concepts of 'sustainable tourism development' that have emerged in recent years have placed too much focus on tourism, and may fail to work towards, and may even work against, the broader goal of sustainable development. Specifically, Hunter is of the view that there has been too great a concentration on the tourism sector at the expense of other resource uses (including preservation) that might better promote sustainable development, and too much focus on controlling impacts at destinations rather than including consideration of the broader impacts of travel.

A fourth view is that there can be no such thing as sustainable tourism and that it is simply being held out as an excuse for further tourism development (Hunter & Green 1995).

A common approach emerging from these writers is that sustaining tourism activity is not the relevant target for concepts of sustainable tourism. A broad approach, following Butler's 'tourism in the context of sustainable development' and Hunter's concerns, would address tourism within the requirements for sustainable development.

A broad approach to the definition of sustainable tourism in protected areas is proposed in Chapter 5 of this thesis as a basis for evaluating the performance of tourism in protected areas. The approach proposed includes something not apparent in any of the definitions drawn from the literature, that is measurable targets for environmental and economic conditions consistent with sustainable tourism.

It is important to point out that some eminent writers express a fair degree of pessimism on the ability to achieve sustainability in the broad sense in the tourism sector overall (Butler 1993, Hall & Butler 1995). A distinction can be made about the potential to move all existing tourism to a more environmentally sound base and the potential to develop new tourism in a more sensitive manner. While the hope is expressed by writers that the sub-set of tourism that may be described as 'nature-based' and 'ecotourism' may be particularly in tune with natural environments, the irony is that this tourism targets the remaining intact natural environments, at an increasing rate. The issues raised with respect to the advantages and disadvantages of tourism in protected areas were discussed in more detail in Chapter 2.

Commentators on sustainable tourism are generally of the view that things must change to bring about a system that is even moving towards sustainability (Hunter 1995). There is a fair degree of agreement in the literature on the types of changes required, though not necessarily on priorities. A good example of the types of conditions suggested for promoting sustainable tourism are those proposed by the ESD Working Group on Tourism (1991), as listed in Box 3.1. Recommendations including the requirement for better planning, environmental impact assessment, research and monitoring and investment in management are similar to those found in international literature on sustainable tourism.

Box 3.1: Ideal characteristics for ecologically sustainable tourism

The ideal characteristics necessary for an ecologically sustainable tourism industry are:

- As tourism is a resource based industry, use of natural resources would be based on the best available information.
- Use of natural resources for tourism would be within the context of integrated land use plans which provide for the maintenance of biodiversity by means including a national system of conservation reserves.
- Tourism would operate within bio-physical limits, set with respect for risk and uncertainty.
- The range of opportunities for tourism experiences available to future generations would be at least those available now (through the avoidance of 'homogenisation' of tourism experiences).
- Biodiversity would be maintained.
- The ability of other sectors to achieve sustainability would not be impaired.
- On site impacts would be minimised through waste management , energy efficiency and design.
- Management of tourism in protected areas would be particularly sensitive and some areas could be off limits to tourism.
- Management would incorporate concepts of carrying capacity and limits of acceptable change (as the best available guidelines, though having limitations).
- Management of tourism in arid and semi-arid and alpine areas would balance the popularity of these areas with the particular vulnerability of these areas to human impact.
- Management of tourism in coastal areas would be underpinned by effective coastal management strategies.
- Management would plan ahead to accommodate predicted impacts of climate change.

Source: ESD Working Group on Tourism 1991

3.3 Economics for Sustainable Development

It is relevant to this consideration of sustainable development and the economic analysis in the remainder of this thesis to briefly consider the assumptions and models used in economics to judge resource allocation. Economics can be used in both a positive (descriptive) role to analyse what is happening with resource allocation and a normative (prescriptive) role to say how resources should be allocated to maximise social welfare. Aspects of both these roles are discussed here.

The current conventional approach to normative economic analysis, which has developed to its present form over the last 200 years, is termed 'neoclassical welfare economics'. This is a useful and internally consistent approach to resource allocation questions. However, the increasing interest in the contribution of and limits to resources from natural environments has exposed weaknesses in the use of economics in resource allocation. Some of these have arisen from failure to include the full range of market and non-market values in analysis. Neoclassical welfare economics has tools and approaches that can be extended to include goods and services that fall outside of conventional markets, but often these have been ignored in practice. Often a comprehensive economic analysis has been constrained by a lack of the biophysical information required to identify links between resource uses and environmental impacts (this problem is common to all economic approaches).

A number of new approaches in economics have arisen to better include the values of goods and services from natural environments in economic analysis. Of these, 'resource economics' and 'environmental economics' are firmly based in the tradition of neoclassical economics, with explicit recognition given to the services of natural environments. The most recent new approach, 'ecological economics' is taking a more comprehensive approach to linking the economy and the environment. It is also challenging some of the fundamentals of neoclassical welfare economics. The following describes the basic approaches of neoclassical welfare economics and new departures from it in the context of highlighting approaches relevant to moving towards sustainable development.

3.3.1 Neoclassical welfare economics

The neoclassical welfare economics approach can be applied to considering whether or not the current pattern of resource use is best for society, or could be improved. It can also be applied to evaluation of whether a proposed project or policy is desirable. A particular view of what constitutes social welfare is central to neoclassical welfare economics. In this approach, the aggregation of the preferences of individual consumers provides the criterion for the social benefit assessment (Common 1988).

The criterion used to judge whether an outcome is good for society is whether it is efficient, in the sense of allocative efficiency. This refers to the allocation of resources to produce the goods and services which are demanded by consumers. A change in allocation in resources is efficient if it provides a net benefit to society.

The convention of defining net benefits has developed from the work of the philosopher Pareto[1]. Hufschmidt et al (1983, p. 25) state that: 'Under the Pareto welfare criterion, the allocation of resources will be economically efficient when it is impossible to make one individual better off without making some other individual worse off'. A recognition that changes that may make some people better off rarely make no one worse off, has been incorporated in the Kaldor-Hicks principle of potential compensation, which has generally been adopted as an extension of the Pareto criterion. This states that a net benefit can be said to have occurred if the gainers due to a change could compensate the losers, and still be better off. According to this principle, it is not necessary for the compensation to actually take place for society to be considered to be better off as a whole (Hanley & Spash 1993). Given any initial allocation of resources, a change which can be described according to these criteria as a '(potential) Pareto improvement' is efficient.

The measure of the difference between benefits and costs over time is the net present value (NPV), which is the discounted sum of benefits minus costs in each year of the period of the analysis. Using the Pareto/Kaldor-Hicks criteria, any policy or project with a positive NPV is a positive contribution to social welfare. If there are several alternatives being considered, they can be ranked and the option with the highest NPV preferred (Hanley & Spash 1993). The measurement of benefits in this sense is the surpluses accruing to those who gain from the change. The costs are measured as opportunity costs, or surpluses that would have been earned had the change not occurred, or an alternative change made.

The measure of surpluses is in terms of aggregate consumer's surplus and producer's surplus. Aggregate consumer's surplus is the sum of consumer's surplus accruing to all individuals in an economy. Individual consumers are assumed to act rationally to maximise utility from their choice of goods and services. The marginal benefits gained from consuming extra quantities of a good, given a price structure and a fixed income,

[1] The Italian philosopher Wilfred Pareto lived from 1848 to 1923 (Common 1988).

can be represented as a demand curve[2]. For any good or service, consumer's surplus is represented as the area lying below the demand curve and above the price line[3]. It is the amount that consumers would be willing to pay for consumption of a quantity of the good minus what they actually have to pay.

Aggregate producer's surplus is the sum of producer's surplus measures of individual firms. This is represented as the area above the short run supply curve and below the price line. The short run supply curve represents the path of the marginal cost of production for each quantity produced. In the short run, it is assumed that fixed costs are sunk and firms will produce where average variable costs are covered. In the short run, supply is limited and the producers can earn a quasi-rent due to this scarcity[4] (Hanley & Spash 1993).

Under conditions of perfect competition, it is taken that markets will work to allocate resources efficiently. At market equilibrium, price will be set where marginal benefit equals marginal cost. No other level of output would be more efficient. Economic analysis applying the neoclassical welfare economics model can be used in a positive mode to investigate if the current allocation of resources is efficient, or to identify if the market has not been able to reach an equilibrium due to market failure of some type.

The neoclassical welfare economics model has a consistent internal logic. It is possible to define an improvement in social welfare as an improvement in allocative efficiency. The measure of an improvement in efficiency is whether either someone gains and no one loses (Pareto criterion), or the gainers can compensate the losers and still be better off (Pareto/Kaldor-Hicks criterion). The measure of benefits is via surpluses. Because the surpluses are the sums of individual surpluses, the whole concept of social welfare in based on the sum of the preferences of individuals. This is called the principle of consumer sovereignty. The model proposes that markets will deliver efficient resource allocation under conditions of perfect competition. Departures from this are known as

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[2] For private goods, individual demand is summed horizontally to equal aggregate demand. In the case of public goods, individual demand is summed vertically.

[3] Use of the area under the Marshallian demand curve as the true measure of surplus has been demonstrated to hold only for conditions where there is no income effect of a change in prices. Alternative measures of surplus (compensating variation or equivalent variation) may be more correct measures of surplus where income effects are significant. The consumer's surplus under the Marshallian demand curve is generally accepted to be a suitable measure of consumers welfare so long as the good or service in question is a small enough component of the consumers budget not to have income effects (Hanley & Spash 1993)

[4] In the long run it is generally assumed that all factors of production are variable and rent on factors of production become part of the cost of these factors. However, some factors of production may be in fixed supply by virtue of natural scarcity or government regulation (Varian 1993).

market failure. A considerable body of work has developed around means to adjust for market failure so that improvements in efficiency can be achieved.

This is a very simple description of some aspects of theory and practice that has been developed over two centuries. The point of introducing the model here is to draw attention to several aspects of its underpinnings that are being debated in respect of the utility of what has become the standard approach of economics when analysing resource allocation where sustainability is a goal. The allocative efficiency target of neoclassical welfare economics will not necessarily correspond with the targets of sustainability. Several reasons are discussed briefly here.

Market failure exists in relation to many of the services of the natural environment. In theory, neoclassical welfare economics can incorporate the resource costs of using goods and services from the natural environment, including waste disposal services, as factors of production. In theory, that is, market failure with respect to the natural environment can be corrected for where it is recognised. This has, however, not been the case in practice until recent decades, and is still not a universal practice in economic analysis. This is probably due both to a lack of focus on what are often goods and services without markets and the difficulty of identifying and valuing non-market goods and services.

If the 'strong sustainability' rule is adopted, it is necessary to identify critical natural capital but it is not necessary to place an economic value on it for purposes of trade, as the rule requires the critical natural capital not be depleted. 'Weak sustainability' rules allow the conversion of natural capital into manufactured capital, and recognition of the contribution of natural capital is required to be incorporated into analysis. It must be valued in terms of its contribution to welfare, that is its aggregate individual utility.

The use of the target of allocative efficiency will not guarantee the maintenance of critical natural capital. It could be efficient to deplete what is a potentially renewable resource if the net present value, as determined by the market, of doing so is greater than that of using the resource at a sustainable use level. Furthermore, there is no rule in neoclassical welfare economics that requires investment of rents in natural or manufactured capital goods, to achieve strong or weak sustainability respectively - all the surpluses could be spent on consumption goods. Compliance with the Hartwick rule is a constraint on standard welfare maximisation.

Consumer sovereignty is fundamental to neoclassical welfare economics. However the combined actions of individual consumers in markets will not necessarily move the system towards sustainability (Common & Perrings 1992). Even if consumers' preferences are consistent with sustainability, market failure makes it difficult to achieve this through consumer sovereignty. The ability of individual consumers to gain sufficient information on the impacts of their consumption choices is questionable. Where the full costs of resource use are not incorporated in prices of goods and services, the consumers have no signals in the market to modify their consumption of goods and services that arise from unsustainable practices.

The argument has been made that people may act differently in their role as consumers and as citizens (Blamey & Common 1992). Alternatives to the neoclassical model of how to achieve desirable outcomes for society include: democratic voting for representatives to exercise their views; voting on individual issues in referenda; and benign dictatorship. Most of the systems have some advantages and all have some disadvantages in trying to truly represent social welfare.

Equity is a central issue in the writings about sustainable development. The Brundtland Commission placed much emphasis on both intragenerational and intergenerational equity. Other writers have raised the issue of intraspecies equity (Proops 1989) The neoclassical welfare economics model of allocative efficiency does not have anything to say in a normative sense about distributional equity. The economic information generated however can be used to describe to whom benefits and costs accrue. Any judgement about whether this is good or bad, or how it should be adjusted, must be made externally by decision makers. One option is to ask decision makers to specify weights to sectors of society and use these weights in economic analysis. The other option is to leave all consideration of equity to decision makers after the usual analysis has been completed.

3.3.2. Ecological economics

The most recent direction in thinking about economics in relation to the natural environment is embodied in 'ecological economics'. The recent emergence of ecological economics can formally be traced from the creation of the International Society for Ecological Economics in 1988 and launch of the journal *Ecological Economics* in 1989. Ecological economics has in part evolved from standard neoclassical economics, resource economics and environmental economics but has some points of departure that are distinct, as will be discussed below.

Resource economics and environmental economics have made significant contributions to addressing relationships between natural environments and economic systems.

Resource economics deals with natural resources as inputs to production processes, including issues of optimal rates of use of renewable and non-renewable resources. Environmental economics has been described as economics that deals with issues such as pollution and environmental impacts (Common 1995). This distinction is not necessarily made in general use of the term 'environmental economics' which has come to be inclusive of resource and environmental economics. There are varying opinions on what may be called the origin of modern resource and environmental economics. Hufschmidt et al (1983) trace developments from 1936 when benefit-cost analysis was developed as a response to United States government legal requirements for evaluation of water resource projects. A notable early development of the economics of forestry, which now 'rediscovered', guides modern forestry economics, was the work of German forester Faustmann in 1849 (Bowes & Krutilla 1989). Both resource and environmental economics are based on neoclassical economics (Norgaard 1985). The major technique used to extend neoclassical economics to take account of resource inputs and outputs to the environment is to use prices that reflect the full social costs of extraction or impact.

The new direction of ecological economics has been described by Costanza (1989, p.1) as follows:

> 'Ecological economics addresses the relationships between ecosystems and economic systems in the broadest sense...(i)t will include neoclassical environmental economics and ecological impact studies as subsets but will also encourage new ways of thinking about the linkages between ecological and economic systems'.

Ecological economics is in a developmental stage. Many of the approaches taken are consistent with neoclassical economics however, it is argued that ecological economics differs from previous approaches to economics in two dimensions. One dimension is that it takes a wider view of economy-ecology interactions. For example it attempts to incorporate all the relevant ecological effects of fishing, not just focus on the harvested species. This is a progression from previous work rather than a distinct difference, as examples of quite sophisticated economy-environment modelling were undertaken before the emergence of ecological economics.

The other dimension is in questioning consumer sovereignty as a basis for defining social welfare. The reasons for questioning this follow from the criticism that consumer sovereignty can lead to outcomes that are not necessarily what society as a whole might desire. One of the things that society might desire is 'sustainability' and all that stands for. Standard neoclassical economics can be considered amoral in that no particular outcome is promoted - other than improvements in efficiency. It is understood that the promotion of sustainability is an ethical issue (Daly & Cobb 1989). Ecological economics has adopted sustainability as at least a problem to be addressed (Proops 1989, Costanza 1989) and for some writers as a guiding ethic (Jacobs 1991).

Some of the approaches adopted in environmental economics and ecological economics, are summarised here. Many of these approaches come from neoclassical economics but an ecological economics approach places perhaps more emphasis on the economy-ecology links.

1. Acknowledgment of interdependence of economic and ecological systems.

Interdependence is accepted as the starting point for ecological economics. From an anthropocentric view point, the environment provides services of resource inputs, waste assimilation, amenity and life support (Common 1988). Whereas in resource and environmental economics, we assume we know what the particular limited link between systems is, (for example, a harvested resource or pollutant), in ecological economics an assumption of complex interdependence is fundamental. Ecological economics addresses both inputs and outputs of production and consumption from and into natural environments.

2. Limits to environmental systems are considered explicitly.

Writers in ecological economics recognise that the earth is a closed thermodynamic system with the only net input being solar energy (Christensen 1989). The resources of the planet are recognised to be finite and this raises the possibility of limits both in extraction and waste assimilation. There is uncertainty regarding whether limits will be reached or whether technological advances will stave off limits in a general sense. Costanza (1989) points out the differing world views held by technological optimists and technological pessimists to the question of limits. He argues that the dominant paradigm in recent times has been optimism and that ecological economics should at least contribute information on the pessimistic option to policy debates.

3. Value environmental resources.

Following the developments in resource and environmental economics, ecological economics requires that market resources are valued to reflect their full social cost in use. This may include shadow pricing non-renewable resources to reflect their scarcity value, not simply costs of extraction. The contribution of non-market resources in production, consumption and waste assimilation should also be valued in commensurate dollar values where possible. Where this is not feasible, techniques should be adopted to incorporate the contribution of unpriced goods and services in policy analysis. (Techniques for valuing non-market goods and services are described in Section 3.4).

4. Intervene in markets to promote sustainability.

In ecological economics, a recognition of the desirability of intervening in markets to direct them to other outcomes may arise from two sources. The first is where market failure is identified, such as the existence of externalities. The second is where the market, were it to work 'perfectly' would still deliver an outcome different to that considered sustainable. In the first instance, there are a range of regulations and economic instruments available to adjust market action. In the second case, constraints may be set externally, for example, using safe minimum standards (see next Section).

5. Consider intra and intergenerational equity.

The equity implications of projects or policies can be demonstrated by identifying to whom the benefits and costs of an action accrue and what the magnitude is. Intergenerational equity may be promoted by use of discount rates in analysis which support the conservation of natural capital. James (1989) illustrates that lower discount rates will generally lead to a slower rate of depletion of natural resource stocks, though this will not necessarily always be the case. An approach of indicating increasing scarcity value over time of natural environment resources was popularised by Krutilla and Fisher (1975).

6. Deal cautiously with risk and uncertainty.

Ecological economics recognises the precautionary principle, which states that:

> where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation (COA 1992b, p.9).

Application of the precautionary principle requires that economic analysis incorporates sensitivity analysis where there is uncertainty about the value of particular variables. The imposition of constraints on resource use in the face of uncertainty is a technique to try to prevent irreversible losses.

Approaches to analysis

The approach of ecological economics has so far not led to a complete abandonment of the neoclassical measures and tools, such as Benefit Cost Analysis (BCA). The use of 'hybrid' approaches to analysis, incorporating standard economic efficiency analysis and adjustments to promote sustainability has been articulated by James (1989). One of the hybrid approaches proposed by James is placing constraints on resource use or quality reduction. He describes it thus:

> 'Here, on a priori grounds, the range of options before the decision maker is curtailed, or he is forced to design new alternative options with stricter environmental measures (and hence costs)' (James 1989, p.130).

This approach can be described as constrained optimisation, where 'modelling of a fairly conventional kind, extended to represent better the interdependence of economy and environment' is employed (Common 1995b, p.11). Randall (1991, p. 66) has suggested that 'biodiversity issues may be decided by consulting an BC analysis [Benefit Cost Analysis] but subject to a safe minimum standard or similar constraint'.

The setting of constraints is an extension of the safe minimum standards approach (SMS). The SMS approach was popularised by Bishop (1978)[5]. The problem addressed by these authors was awarding an economic value to conservation of endangered species under conditions of irreversibility and uncertainty. In regard to the possibility of species extinction, Bishop pointed out that it is an irreversible process, and the extent of loss is uncertain where we do not know what the future value of a species might be. SMS for endangered species would maintain sufficient population and habitat to ensure survival of the species. Game theory was employed to investigate the possible losses incurred if the species was allowed to become extinct or if SMS were imposed[6]. The recommendation arising was that 'SMS should be adopted unless the social costs of doing so are unacceptably large' (Bishop 1987, p.10). It was proposed by Bishop that the SMS approach could be applied more widely to any situations where the characteristics of irreversibility and uncertainty were associated with resource use.

While the SMS approach is a useful guiding principle, application of this approach relies on having sufficient information on which to make decisions on what the environmental limits should be. It is pointed out by Hohl and Tisdell (1993) that the difficulties of setting a SMS compound when considering the standards required to protect an ecosystem rather than a single species.

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[5] Bishop drew on the work of Ciriacy-Wantrup (1968).

[6] A simple two way matrix of losses was devised to compare the outcomes of strategies to allow extinction or to impose SMS, if the species proved to be economically unimportant or if to proved to be economically important. The strategy that minimised maximum possible losses, the minimax strategy, was found to be conservation using SMS (Bishop 1978).

3.4 ECONOMIC ANALYSIS OF NATURE BASED TOURISM

3.4.1. The economics of natural environments and protected areas

To understand the economics of tourism in natural environments and protected areas, it is relevant to look first at the economics of natural environments and protected areas as a whole because the benefits and costs associated with tourism flow from the values associated with natural environments and because the same approaches to measuring values in economic terms are used.

The study of the economics of natural environments and protected areas has grown out of a concern to be able to compare the values of alternative uses of terrestrial and marine environments in the face of proposals for change and development, including the alternative of retaining the environments in their natural state. The declaration of areas of the natural environment as protected areas formalises this conservation objective. One reason for placing economic values on the various uses made of already declared protected areas is to use this information in developing optimum management arrangements for these areas.

Values of natural environments

Natural environments provide humans with a range of goods and services. A number of alternative lists and diagrams have been developed to identify and classify these goods and services and identify the sources of 'total economic value' (De Lacey & Lockwood 1992, Munasinghe 1994). Common (1995) has summarised the goods and services from natural environments into four types. Natural environments provide non-renewable resources such as minerals and renewable resources such as fish and trees that may be extracted from them. They provide an assimilative capacity for the disposal of wastes from production. Natural environments provide amenity services both to people who visit directly for tourism and recreation and for those people who may never visit but nevertheless value the environment. Fourthly, natural environments provide life support services for human existence on the planet.

At levels of use higher than the sustainable yield level for extracted resources or the assimilative capacity of wastes and physical impacts, natural environments will degrade and their capacity to deliver all four types of services will be diminished. The natural capital nature of the areas will be diminished. (The earnings from natural capital may be transformed into socially useful components of manufactured capital or they may be spent on consumption goods.) Within sustainable use levels, some services may compete with others, for example even ecologically sustainable logging of forests may detract from recreational use.

The values that arise from any particular natural environment are a consequence of direct use, including tourism and recreation, and services rendered to people who do not necessarily set foot in that area. The latter group of 'indirect', 'passive', or 'vicarious' users may derive 'existence value', 'bequest value', 'option value' and/or 'quasi option value' from knowledge that an area exists and is protected for the future. Krutilla and Fisher (1975) discuss the components of preservation benefits of a natural environment in terms of: existence value being the value of knowledge that unspoiled wilderness, biologically diverse environments or particular features of natural environments exist; bequest value being the value of knowledge that the environment is preserved for bequest to future generations; option value being the value of the preserving an option to consume the services of the natural environment in the future (perhaps by visiting) in the face of uncertainty; and quasi-option value as the value of refraining from undertaking irreversible actions now when better information (for example on the economic value of genetic resources) is expected in the future. The authors point out that these values may be held differently by different individuals. Since that time, the concepts of existence, bequest and option value have been adopted widely in the literature (with quasi-option value being identified separately from option value less frequently). The term 'total economic value' has been given to the total of direct use and preservation values arising from natural environments (Pearce et al 1989, De Lacey & Lockwood 1992).

Many of the goods and services from natural environments, especially those enjoyed by indirect users, do not enter conventional markets. Such values are termed 'non-market' values. That the values of natural environments include many non-market values makes comparison of conservation and development benefits difficult and leads to under supply of non-market attributes by conventional markets.

Market failure in allocation and use of natural environments

A major cornerstone of neoclassical economics is that efficient resource allocation will be delivered by markets working according to the conditions of perfect competition. If the conditions of perfect competition are not met, market failure will occur and the result is that resources will be allocated at lower or higher levels than the efficient amount. The conditions that need to be met for the achievement of perfect competition are:

(i) the absence of external effects;

(ii) the absence of public goods/ public bads;

(iii) all households and firms have perfect information; and
(iv) all households and firms act as price takers (Common 1988, p. 79).

These conditions are generally not met where natural environment resources are concerned due to the particular characteristics of the resources. These include a lack of well defined private property rights, which allows for the presence of externalities, and the public good nature of some services from the natural environment. These conditions mean that many goods and services enjoyed from natural environments are outside conventional markets. In addition, markets also are expected to fail where there is not 'perfect' information and it can be argued that this is often the case with natural environments. The final condition for perfect competition may or may not hold for particular natural environments depending on management arrangements (see the discussion of monopoly pricing later in this section).

Underlying the efficient operation of markets is a system of property rights that allows trade in the resources or services in question. In the absence of a system of property rights, market failure can occur. Where the land or sea is held in common property and access is open to all, in the presence of sufficient demand for resource use, the tendency is for natural environments to become degraded through over-use (Tietenberg 1992). This is because no incentives exist to encourage individual users to limit their physical impact or to limit extraction to sustainable levels. Users know that because access is unlimited, anything they leave behind can be degraded or extracted by another user.

It is the 'open access' part of the arrangement that provides the incentives for over-use. Resources held in common property by governments, and where a management regime limits access in one way or another, can in theory be managed consistently with the requirements of allocative efficiency. The extent of property rights awarded will however affect how well property rights regulate use. Pezzy (1992, p. 340) notes that 'even when habitats such as forests are owned, many other benefits such as preventing soil erosion or maintaining biodiversity, are unowned and thus ignored by markets.'

The fact that property rights do not exist in open access common property natural environments allows for the existence of externalities. 'Externalities' is the term given to effects which are the product of activities by an agent who does not experience the costs or benefits of the effects him or herself. Positive externalities occur where benefits accrue free of charge to others as the result of an action by one individual. For example, the rehabilitation of a degraded environment may increase the amenity of many people. Negative externalities occur where one person's action causes costs to others that are not compensated. The discharge of pollution which negatively impacts economic activities and non-market values downstream is a negative externality. Where property rights are not specified, there is no basis for claims for compensation for benefits provided or costs incurred. This is why the agent responsible 'does not experience the costs or benefits'.

A sub-set of goods and services from natural environments have 'public good' characteristics and markets cannot be relied upon to supply efficient levels of these goods. Public goods such as clean air and biodiversity have the characteristics of being non-rival in consumption and non-excludable. Non-rivalness means that consumption by one person does not diminish the ability of others to also consume the good. Non-excludability refers to the impracticality of trying to exclude anyone from consuming the good. 'Private goods' by contrast can be separated into units and sold to individuals whose consumption of the good will prevent anyone else consuming that unit. In between these extremes are classes of goods displaying varying combinations and degrees of rivalness or excludability, termed 'impure public goods' (Cornes & Sandler 1986). Where private or public owners of natural environments take actions to supply public goods, they will not be fully compensated by all the beneficiaries and therefore a market based system of allocation will not provide the efficient amount of public goods (found by vertically summing the individual demands for public goods). Beneficiaries may act as free riders knowing that supply to some people will mean supply to all. For suppliers of public goods to supply the efficient amount, they would have to identify beneficiaries and employ differential pricing, charging each individual what they are willing to pay. That is clearly not a practical option.

The non-market characteristic of goods and services from natural environments means that natural environments tend to be used as though they are free goods of nature and as though they are unlimited. The inefficient allocation that results is therefore generally a greater than efficient level of use of these resources. As high rates of use are more likely to lead to environmental degradation, market failure in respect of natural environment resources is usually in the direction that endangers maintenance of natural capital.

It is not appropriate to blame all environmental degradation on market failure. Governments can also fail both in the sense of not identifying actions that would lead to improvements in social welfare or in failing to meet stated aims due to ineffective actions. Centralised economies have not escaped environmental degradation and so government failure can be identified as a cause of the loss of natural capital in those countries. Tietenberg (1992) attributes environmental degradation in formerly centrally planned economies to the fact that the maintenance of environmental quality was not amongst the goals of governments. In mixed economies, the influence of rent-seeking lobby groups is identified by Tietenberg (1992) as contributing to government failure. In Australia's mixed economy, the potential exists for both market and government failure.

Valuing and comparing the benefits and costs of protected areas

An exercise of valuing and comparing the benefits and costs of protected areas may be undertaken in the context of comparing conservation as an option against development proposals or in designing management to optimise the net benefits of protected areas. The net benefits of the option of declaring a natural environment to be a protected area are an opportunity cost of any development alternative. Benefits of protected areas include market and non-market benefits to direct users and to indirect users. Costs will include management costs and the opportunity costs of loss of other land use options (Dixon & Sherman 1990). The value of any environmental damage that occurs as a result of direct use may be measured as a separate component of costs or as a net reduction of benefits. Obviously care needs to be taken in any particular analysis to avoid double counting items that appear as opportunity costs.

Because of the prevalence of non-market values, most analyses will require measurement and comparison of both market and non-market values. Over the last two decades or so, a suite of techniques has been developed to estimate dollar values for non-market goods and services arising from natural environments. These are listed in Table 3.1.

Market based techniques rely on finding values expressed in markets for goods and services associated with a change in the quality or quantity of natural environments. The change in productivity and change in income approaches attempt to link changes in environmental quality with impacts on market goods that rely to some extent on the resources of the environment. The other market based approaches listed in Table 3.1 can be described as cost-based approaches. Dixon and Sherman (1990) point out that these approaches focus on the costs involved in avoiding a loss of benefits from natural environments. Approaches include calculating the difference in cost between a project that would involve loss of environmental benefits and one that would not (opportunity cost), the cost of preventing or repairing environmental damage and the cost of replacing services arising from natural environments. The costs are estimated from market prices.

They do not measure benefits as determined by consumer sovereignty, rather, if the costs are judged by decision makers to be worth meeting, they estimate a minimum willingness to pay to avoid losses.

Table 3.1: Environmental valuation techniques

Market Based Techniques	
Dose-response approach†, (change in productivity**)	examines changes in the dollar value of outputs resulting from a change in the quality of an environmental good, eg loss of production from a fishery affected by water pollution.
Human capital approach†, (change in income*)	examines forgone earnings and cost of illness to value an environmental good, eg the impact on health of air pollution.
Opportunity cost approach†	if the benefits of a project that causes environment damage are greater than an alternative with no damage, the difference is the opportunity cost of not causing damage.
Cost-effectiveness analysis**	look for the least cost way of meeting an unquantified benefit.
Preventative expenditure†	examines expenditures made to mitigate the effects of a fall in environmental quality, eg. park management expenditure.
Mitigation cost**	uses estimate of the cost of repair or rehabilitation of environmental resources after environmental damage.
Replacement cost** (shadow project**)	uses estimates of the cost of replacing the services of damaged productive assets, for example engineering works to prevent soil erosion after land clearing.
Relocation cost*	uses the cost of relocating activities to an area of higher environmental quality.
Surrogate Market Techniques	
Hedonic price method†	uses differences in prices of market goods (property, wages**) to value an environmental good.
Proxy good*	uses value of a close market good substitute to value an environmental good.
Travel cost method†	uses travel cost to impute a value for an environmental good.
Survey Based Techniques (simulated or hypothetical market techniques)	
Contingent valuation method†	uses survey techniques to directly elicit people's willingness to pay or to accept compensation for different qualities of an environmental good.
Contingent ranking method*	uses survey techniques to directly elicit people's choice between alternatives with different environmental effects.
Trade-off game**	uses survey techniques to directly elicit people's ranking of environmental goods with other goods.
Priority evaluator*	uses hypothetical prices and hypothetical budget to determine ranking of preferences for environmental and market goods.
Choice modelling‡	uses preferences for a set of scenarios to determine preferences for attributes of the environmental good being examined.
Delphi technique†	uses opinion of a panel of experts to value an environmental good.

Sources: Based on Izmir 1995†, p. 306, with additional items from DEST et al 1995*, Dixon & Sherman 1990**, Rolfe & Bennett 1995, p. 294‡.

Surrogate market techniques utilise information on markets for related but different goods to construct markets for goods and services from the natural environment. The method used most widely with regard to valuing the benefits of tourism in natural environments is the travel cost method (TCM). This technique uses information on expenditure on travel to a natural environment site to estimate what people would be willing to pay for access to the natural environment attractions of the site. The method measures direct benefits of visiting only.

Survey based techniques involve going directly to the consumers of non-market goods and services from natural environments and asking them to place a value on a change in the amount of goods and services they receive. The value can be expressed in dollars or in some form of ranking of effects. These approaches focus most directly on the total economic value of natural environments, including existence and bequest values. Survey based methods are theoretically the most complete measures of total economic value of environmental goods and services. There are however difficulties in implementing survey based techniques, mostly because of the hypothetical nature of the markets proposed.

Analysts need to select one or more of these techniques according to the problem being investigated. Often provision of partial analysis will be sufficient to inform a decision. For example, valuing only one of the many functions of wetlands, the contribution of wetlands to commercial fishing (using the change in productivity approach), may be sufficient to make a decision favouring conservation of wetlands if the 'partial' conservation value is greater than the total benefits of an alternative land use. One major difficulty in applying some of the techniques is that ecological links have to be understood and quantified before dollar values can be generated. If the total economic value of a natural environment is sought, this poses a greater challenge, as the use of CVM is not only technically challenging but also not universally accepted by economists and decision makers.

Financial versus economic measures

It is relevant to make a distinction between financial values and economic values arising from uses of natural environments. Financial values are the tangible flows of dollars that arise from economic activity, usually associated with a direct use of a protected area such as tourism. Investment in the form of capital and labour, valued in dollars, is combined with the services of natural resources to provide a product that is sold in the market, generating dollar values. The flow-on of the dollars in the local community or elsewhere generates benefits in the form of employment and other economic activity. Gross financial values include the turnover of the tour industry while net financial values are the turnover minus costs of production. Flow-on impacts are described in terms of 'multiplier effects'. Much of the 'economic' information associated with uses of protected areas that is most readily available, in published data sources for example, is in fact financial values. Financial values are useful for measuring the 'economic impact' of uses of protected areas but do not measure full economic values (Wells 1994).

Economic values are the benefits and costs measured according to consumer's surplus and producer's surplus and include both market and non-market values. Because of the non-market component, complete economic values of protected areas are rarely readily available and have to be determined using investigation and analysis. At times all or part of these values may be realised in dollar terms, for example where entry fees to a protected area captures some of the consumer's surplus arising from visits to the area. It is economic values that are the basis of microeconomic analysis such as benefit cost analysis.

Distributional effects of creating protected areas

The distribution of benefits and costs arising from protected areas varies with the management regimes adopted but some generalisations are made here. If a natural environment area is not protected, it may be being damaged by direct uses, for example by logging. The costs that arise include loss of existence, bequest and option values that fall upon the people who derive vicarious use benefits from the natural environment. Another group who may suffer losses are local communities who depend directly upon the area for their livelihoods. If damage is irreversible, losses will continue to be suffered by future generations. Benefits from timber harvest accrue to the companies undertaking the logging, the community owning the resource (but only to the extent that governments extract resource payments from logging companies), and local people who may be employed in the industry. If the logging companies are foreign owned, profits may be repatriated out of the country.

Where a natural environment becomes protected, the distribution of benefits will change. Benefits of conservation, in the form of existence, bequest and option values, will accrue to the vicarious users of the area. Local direct users may be excluded from the area and may suffer lost subsistence or cash benefits formerly enjoyed from the resources of the area. Local, regional or national communities must provide the funds required to manage the protected area. In this example, the major beneficiaries - vicarious users - may be remote from the area, while opportunity costs and costs of management may fall on local communities. This illustrates why conservation can be a particular burden on developing countries. The distributional issues where tourism is allowed in protected areas are discussed in the next section.

3.4.2. The economics of tourism in protected areas

Tourism is a direct use of natural environments (including protected areas) and the economics of tourism involves both market and non-market values arising from natural environments. This section reviews the economics of tourism in protected areas in order to explore the forces driving tourism as a direct use and the outcomes in terms of efficiency, sustainability and equity.

The situation considered here is typical of the early stages at least of tourism in natural environments. It is an open access regime, with no entry fees collected by the public owners of the resource, and where people visit privately or on commercial tours, with no limits placed on entry or expansion.

The popularity of visits to natural environments is well established. The demand function for visits to a natural environment is the curve representing marginal benefits from visits. As illustrated in Figure 3.1, the curve labelled DD is downward sloping to the right, indicating that the higher the price of visits, the fewer will be made. It has been illustrated in the literature that the demand for locations offering rare attractions such as the Galapagos Islands of Ecuador and the Mountain Gorilla sites in Rwanda can be quite inelastic, at least over a significant range of prices (Tisdell 1988, Lindberg 1991). Where there are more substitutes for the attractions, demand can be expected to be more elastic.

The supply curve represents the schedule of marginal costs of production of tourism services. This is labelled OPC in Figure 3.1 to indicate that it is the private supply curve. The private suppliers rarely meet the full costs of tourism to natural environments. In addition to costs of production of tourism services, there may be some or all of the following costs; damage to the environment, management funding by public agencies, crowding costs on other tourists and social impacts on local communities (for example, traditional owners). All of these latter group are typically non-market values. They are the externalities associated with tourism to protected areas. A social supply curve, OSC, indicates that total costs are greater than private costs, in this example over virtually the full range of visitor numbers.

The equilibrium situation arrived at by market forces, taking only market costs into account is quantity Q of visits at price P. This is a greater number of visits than if full social costs are taken into account, where the efficient quantity of visits is Q* at price P*. This tendency to an inefficient level of tourism in natural environments under open

Figure 3·1

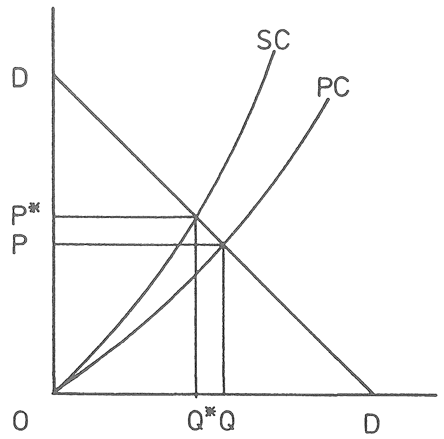


Figure 3·2

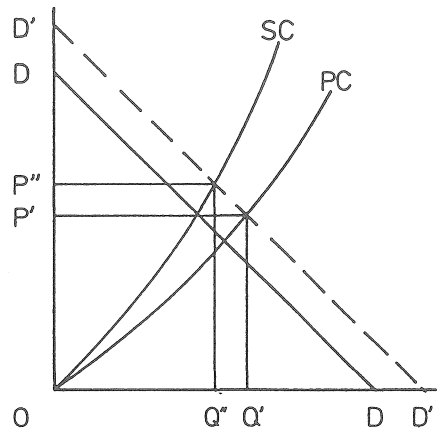


Figure 3·3

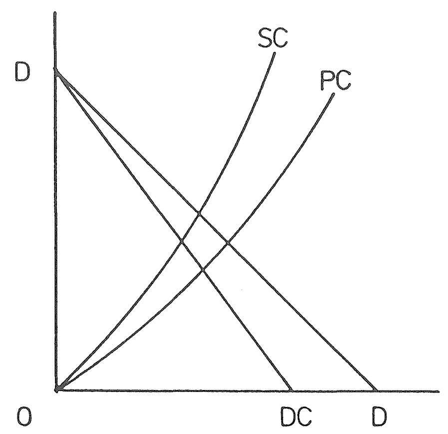
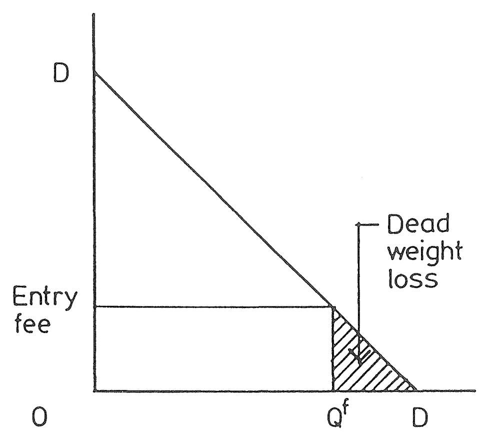


Figure 3·4



access situations is widely recognised. Much of the economic analysis of tourism in natural environments is aimed at identifying causes of and suggesting solutions to this.

If demand for tourism increases due to external influences such as increases in population, income and leisure time, as has been occurring in many countries, this is represented as a shift to the right of the demand curve, illustrated in Figure 3.2 as curve D'D'. In the short term, the incentive exists for private firms to supply Q' visits, where the efficient solution which takes full social costs into account is Q". Because they do not incur the external costs of tourism, private firms each have an incentive to expand the quantity of visits they supply as long as they make individual profits (Lindberg 1991, Steele 1995).

Thus in an open access situation, the trend in the face of increasing demand for tourism, in the short term at least, is for visitor levels to increase and for these to be greater than is efficient, and to potentially threaten environmental integrity (Brown et al 1995, Steele 1995). Because negative impacts are externalities to the tourists causing the impacts and to tour companies, this trend will continue unless there is an 'internal brake' on expansion. In this unregulated situation, the only internal brake on expansion occurs if the externalities of tourism impact adversely on other tourists. That is, if crowding costs and costs of environmental damage and/or social impacts that are noticeable to tourists and translate into a reduction in demand for tourism in the longer term. This is illustrated in Figure 3.3 (after Tisdell 1988) where demand falls from D to DC. Social costs remain above private costs due to continuing external costs to groups other than tourists. In Chapter 2, it was suggested that whether or not an effective 'internal brake' exists will vary between protected areas.

On the supply side, open access conditions encourage the entry of new participants supplying tours and encourage competition amongst operators. This competition tends to dissipate any scarcity rent that may arise due to unique attractions of the site, the rent being captured by tourists. Lively competition under open access can also dissipate profits and lead to low profit and wage levels in the industry or even to financial losses and bankruptcy (Steele 1995). In areas where tourism is seasonal, the tendency under open access conditions is for operators to cater for the maximum demand in the high season, with the result that they may be left with having to meet the costs of unused capacity for several months of the year, exacerbating their precarious financial position (Steele 1995).

Therefore, in an open access situation, the tendency is for the market to deliver visitor numbers that are greater than the efficient level. Over time, demand might contract due to visitor's reactions to the impacts of tourism, but the system might not reach an efficient solution due to the continuation of external costs on other direct and indirect users.

Distributional effects of tourism in protected areas

Tourism is often an allowed use of a protected area and is often allowed on an open access basis, at least in the early stages of development. The distributional implications, if no environmental damage occurs, include the same flow of benefits to vicarious users as for a protected area without tourism. If damage occurs, the flow of these benefits will be reduced. Local, regional or national communities may need to expend more money managing the area to avoid the impacts that potentially accompany greater direct use. If no use fees are collected from tourists or tour operators, the community will need to fund all the management. Local people may no longer be allowed to use the area for traditional subsistence or cash earning activities (though these activities may have been disallowed primarily because they conflict with protection for conservation objectives rather than with tourism) but they may find employment and business opportunities in tourism.

Tourists benefit from the opportunity to visit, and their benefits are highest where no use fees are charged. In early stages of tourism, there may be no external costs on tourism but as tourist numbers increase and amenity changes, tourists may have their benefits reduced. In the longer term, this may lead to a reduction in demand. Tour operators benefit from profits earned from supplying tourism services. In the early stages of tourism, operators may earn above normal profits due to the capture of scarcity rent. In an open access situation, competition will dissipate rents and even profits. Foreign owned tour companies may repatriate profits out of the country.

A possible scenario for developing countries is for the beneficiaries of tourism to be foreign tourists and tour companies with foreign ownership and for costs of management and opportunity costs of no longer using the area for traditional uses to be borne by the local inhabitants. If tourism damages the environment, locals are left with a legacy of damage while tourism investment may be directed out of the area, reducing even local employment opportunities. Thus, developing countries may be subsidising the tourists of developed countries, unless intervention is made to more equitably spread the benefits and costs.

3.4.3. Economics of intervention to manage tourism in protected areas

From a neoclassical economics perspective, the problem with tourism in natural environments is market failure leading to an inefficient allocation of resources. This calls for intervention to move the system to a more efficient solution. Intervention is also called for if systems are to be moved towards sustainability. Mechanisms available for intervention into market systems are regulations, economic instruments or a combination of both (James 1993). A considerable variety of intervention processes, aimed at avoiding the overuse expected of open access systems, are associated with management of tourism in natural environments. A list of such management mechanisms including regulations, education and economic instruments was presented in Chapter 2.

Economic instruments include mechanisms to adjust prices faced in markets to reflect full social costs, and mechanisms to award property rights so that markets can function efficiently, without externalities. Specific instruments include taxes and charges, fines (which act as incentives for compliance), tradeable property rights, performance bonds and subsidies (Clough 1993).

There are several examples of the use of economic instruments in managing tourism in Australia, (see Table 3.2). The recommendations of the ESD Working Group on Tourism include the greater use of economic instruments and user fees in managing tourism in general, and tourism in protected areas in particular (ESD Working Group on Tourism 1991).

Two examples of approaches to intervention via regulations and economic instruments are covered here briefly. The first type discussed aims at increasing the carrying capacity of areas, by reducing the impact per visitor, using investment in management. The other intervention approach discussed addresses the open access problem.

Increasing carrying capacity

A common form of intervention is to increase the biophysical carrying capacity of sites by 'hardening' them via applying hard surfaces, board walks, drainage etc. to reduce the per visitor impact (Tisdell 1988, Steele 1995). This can be financed by public funds or revenue raised from users, via entry or other user fees. The effect of hardening is to lower the social cost of use of the site. Other management approaches may have the same effect. Dixon et al (1993) describe measures that could be taken to increase the carrying capacity of marine areas for SCUBA diving, at a greater management cost. There is obviously a trade-off between increasing benefits to greater numbers of visitors and increasing expenditure on management. The efficient level for applying management is where the marginal cost of management equals the marginal benefit of damage control.

Table 3.2: Economic instruments used for management of tourism in Australia

Instrument	Applications	Comments
Park entry fees	Many instances in Australia, but not universal.	Generally used to raise revenue, not to ration use.
Beach car parking charges	City councils in Sydney	Funds raised used for beach management.
Performance bonds	Great Barrier Reef	Tourist operators post bonds against costs of rehabilitation.
Fees for commercial concessions in public protected areas	Many instances, eg ski lodges, kiosks in parks, commercial tour operators	Provide a return or commercial use of public resources.
Government run sales outlets in National Parks	NSW National Parks	Dorrigo National Park funds all management from proceeds of cafe and shop.
Tourism marketing levy	Northern Territory, Gold Coast	Levy on accommodation, funds used for tourism promotion, not environmental management[3].
Tax deductable donations	Tourism industry run conservation projects	Several past projects cited. Some tour operators make direct contributions to ecological research[4].
Levy on discharge of waste	Great Barrier Reef	Discharge of waste from tourist resorts attracts a charge based on quality of treatment[7].

Sources: 1. ABARE 1993; 2. James 1993; 3. RAC 1993; 4. Preece et al 1995; 5. Young et al 1996;7. Stanley 1994.

Limiting access

There are various intervention approaches that have the effect of limiting access to natural environments. Dealing with open access is often characterised as a two stage process, the first being a decision on overall ownership, and the second being selection of regulations or instruments for limiting use (Brown et al 1995). Options for ownership of protected areas are suggested to be public, private or community based (Steele 1995).

Declaration of a protected area is not effective on its own in solving the overuse that follows from open access if tourism continues to be an allowed use and is able to operate and expand with no limits. A common approach to managing protected areas is to place limits on access via zoning and requiring tour operators to obtain permits. Planning using zoning has the effect of limiting the overall proportion of a protected area available for tourism and thus places an upper limit on supply, although individual sites still have the potential to become congested and degraded. Placing environmentally sensitive areas off limits has the effect of directing tourism to those sites where the social costs of supply of tourism services are less than they would be at the more sensitive sites. Issuing permits for tours is only effective in closing off open access if limits are placed on the total capacity. Without such limits, new entrants can continue to enter and tourism expand as in open access regimes.

Economic instruments that could be employed to ration use include a system of tradeable permits, which would award property rights in the form of access to a quota of visitor numbers (or other indicator). Where permits are tradeable, these become an economic instrument to move towards an efficient allocation of resources within the quota.

Distributional effects of intervention to manage tourism in protected areas

The distributional effects of intervention will vary with the type and goal of intervention. Some generalisations are made here. Any intervention that limits environmental damage will allow the non-market benefits of conservation to continued to flow to vicarious users, and to other direct users of goods and services of protected areas such as watershed protection.

Charging fees of visitors captures some of the consumer's surplus in tangible funds that can be employed in management, thus relieving communities of effectively subsidising tourists' enjoyment of the area. Limiting access by tour companies may allow the permitted companies to become more profitable. Whereas under open access conditions, scarcity rent and even normal profit can be dissipated by competition, under a limited entry regime, profit can be retained. If any scarcity rent exists, tour companies may retain this, unless public managers take steps to secure this by auctioning permits or charging fees.

3.4.4 Entry fees as a tool for management

The potential for use of entry fees for management of visitor use of the Wet Tropics WHA is to be considered later in this study. Background on entry fees as an economic instrument is provided in this section.Entry fees for protected areas are perhaps the most familiar type of user fees levied on visitors to such areas. In Chapter 2, the incidence of entry fees in Australia and the rest of the world was considered. Of the examples given, most fees were low, especially relative to the total costs of visiting an area. In many cases the revenue generated was not sufficient to cover management costs or was not spent in the protected area in which it was raised.

User fees implement the 'user pays' principle which broadly states that beneficiaries of government services should pay according to the benefits they receive (ABARE 1993). User fees potentially have efficiency and equity benefits. Efficiency benefits arise if users face closer to the full costs of their presence in the protected area. Equity benefits arise if those who cause the actual, or potential, environmental cost of direct use of natural environments pay the costs of damage, or of avoiding damage. User fees can work in several ways, with different results for efficiency, equity and sustainability, depending upon how they are applied. The following describes various options for the application of entry fees to publicly owned protected areas.

Entry fees can be used as charges designed to achieve efficiency in resource allocation by raising costs of visiting protected areas, to represent full social costs. If entry fees were to be used in this way, it would be necessary to construct a variable schedule of fees equating to the social cost function. The social cost function SC, for a protected area was shown on Figure 3.1. Managers are not likely to manage entry via a variable social cost function for a number of practical reasons. To derive the social cost curve, a function equating environmental damage to the number of visitors would first need to be constructed. If that were feasible, dollar values would need to be assigned to the damage using a methodology such as CVM. Management agencies would need to administer differential pricing, perhaps based on the number of visitors expected on any day. Clarke, Dwyer & Forsyth (1994) caution that there is likely to be uncertainty with respect to much of the information required to determine an efficient price.

Another approach could be to use entry fees as a form of 'rationing' device to constrain visitor numbers to a predetermined quantity limit (perhaps set with regard to the precautionary principle). In a practical sense, limiting visitor numbers by quota (regulation), rather than fees may provide more certainty.

Entry fees can be targeted simply to raise funds for management. By focussing on raising funds, it is possible to incorporate consideration of the use of management funds to lower the unit social costs of visitor use and/or increase capacity (Clough 1993). If all management costs are to be met from fees, the fees would need to be set to cover the costs of meeting a target of environmental impacts not exceeding limits of acceptable change, with increasing visitor numbers. It is likely that such a cost schedule would have a number of thresholds representing discrete investments in facilities. It is easier to develop such a cost schedule for avoiding damage than measure the social cost of damage function as described above. The role of entry fees to raise revenue in an approach to sustainable tourism in protected areas is further explored in the case study presented in later chapters.

The most usual situation where fees are charged, is that fees are set at a low level for partial cost recovery (and perceived acceptability). If no limits are set on use, fees set without regard to information on demand and supply cannot be relied upon achieve efficiency, or to limit use to levels consistent with sustainability. In addition, users benefit from public subsidy of tourism at the expense of taxpayers, vicarious users and perhaps future generations. If no fees are charged and there is some financial or economic cost involved with visits, the potential for misallocation and overuse of resources is further exacerbated.

A further option is for public or private owners of protected areas where demand is fairly inelastic to engage in monopoly pricing to maximise revenue to the 'owner' and in doing so limit the risk of environmental damage. Tisdell (1988) shows how this might be rational for managers of public resources in developing countries to maximise rent extraction from foreign tourists. He warns however that this strategy may not be viable in the long run if tourists complain of high prices on their return home and thereby reduce demand.

The effect of necessary entry fees is illustrated in Figure 3.4. Where there are no entry fees, visitors benefit in the form of consumers' surplus, represented as the total area below the demand curve. The effect of introducing entry fees, whatever their level will be to reduce demand for visits to the protected area. The degree to which demand will be reduced will depend upon the price elasticity of demand for the particular area. The benefits of visitor use will be reduced by a 'deadweight loss', due to the reduction in visitor numbers. The remaining benefits will be redistributed between the management agency in the form of fees paid, and visitors, in the form of the remaining consumers' surplus.

For any protected area, there are several issues to be considered in the design of a system of entry fees. Issues include efficiency and equity as well as practical aspects of whether fees can be collected in a cost effective manner. Options for a fee system are discussed in turn.

Direct versus indirect use fees

Economists point out that it is most efficient to set fees closest to the resource use of concern (Clough 1993; Clarke, Dwyer & Forsyth 1994). Therefore entry fees, or even facility use fees, are the most relevant points at which to set fees for tourism use of protected areas.

Often however, it is not cost-effective to collect entry fees where protected areas have many entry points and access is low level and dispersed. This is one reason why arguments have been made to levy charges to raise revenue for environmental management indirectly at accommodation houses or at airports. The other reason for indirect fees is to target visitors for contributions to management that is otherwise borne by local residents.

There are problems with the use of indirect fees. Firstly, there is no guarantee that all people who enter a region via an airport or who stay in commercial accommodation will visit the protected area in question. Visitors who drive to a region or who stay privately with friends or relatives will not be subject to such fees, so not all users will pay. The ability to use indirect fees to ration total use with any sensitivity would not be guaranteed. Indirect fees could be used to raise revenue for management.

One particular class of indirect fees is where fees are levied on commercial tour operators rather than directly on visitors. The extent to which operators can pass on the full fee levied depends on the price elasticity of demand for visits. If demand is relatively inelastic and the fee is low, it is likely to be passed on completely, with no reduction in clients. Conversely if demand is elastic and the fee is high, the operators may not be able to raise the tour price to fully pass on the fee, without losing a proportion of clients.

Differential fees

There are a number of reasons why charging different fees of different users of a site may be considered. On efficiency grounds, higher fees may be required in peak seasons to account for the externalities of crowding and increased environmental impact when there are greater visitor numbers. Demand for different sites in a protected area estate may differ according to the attractions of the sites, and supply costs may vary with fragility of environments. Differential fees could be used to promote efficiency, as it is inefficient to charge the same fees across sites if it means that sites are either under priced or over priced. On strict efficiency grounds, it is not efficient to charge any price where the marginal cost of extra use is zero, as might occur where new facilities have been installed and no crowding is occurring.

A common practice on equity grounds, particularly in developing countries, is charging lower fees of local residents. This latter practice may be combined with charging relatively high fees of visitors, exploiting opportunities for monopoly pricing for visitors where this is possible.

An argument is made for charging differential fees for regular and occasional users of a protected area. The costs of management are usually made up of elements that can be identified as fixed costs and an element that varies with the level of use. If regular visitors pay the same fee as occasional visitors, the regular visitors are contributing a greater proportion of fixed costs (Clough 1993). It follows that regular users may be entitled to a discount, such as a seasons pass. This strategy recognises the protected area as a form of club good (Cornes & Sandler 1986).

If the goal of management is sustainability, it may be prudent to charge differential fees to spread use to preferred sites and over time. Clarke, Dwyer & Forsyth (1994) caution that setting differential fees may result in higher overall environmental impacts if visitors who wish to avoid higher fees reject visits to hardened sites and instead visit sites that are not being managed to minimise impacts.

One area for caution on equity grounds is where differential fees are charged for practical reasons rather than efficiency or equity reasons. This can occur where it is not cost effective to collect fees from some users, and an attempt is made to 'make up' the difference where fees can be charged. This may occur where use of some areas is dispersed and users of other areas have to access through a gate, or where private visitors are not charged, but visitors travelling with commercial tours are charged. The latter is the case in the Wet Tropics WHA, but current inequities are not great as the fees are low, and higher costs are incurred in managing commercial tour permits.

Earmarking

It is usual for central treasuries to argue that revenue raised from visitors to protected areas should be used in what is judged to be the most socially desirable manner at the time, and not necessarily be applied to management of the area in which they were raised.

Strong arguments are made against the practice of sending all revenue raised to central treasury and in favour of earmarking (or hypothecation) of funds raised from users of protected areas (Young et al 1996). There are several aspects to this issue. Firstly, adherents of earmarking see this of a way of guaranteeing that the appropriate management costs are actually met. Secondly, transparency of use of revenue is seen as important for compliance with fees charged, especially where fees are charged via third parties such as tour operators. Tour operators in the Wet Tropics WHA object to fees raised through them not being clearly earmarked for application to management in the Wet Tropics WHA (A Steele, pers. comm). It is possible that promotion of information on how fees raised are used for management of the protected area would make visitors more enthusiastic about paying when asked (Young et al 1996). Earmarked revenue from users is probably the best source of funds for management to promote sustainability as it guarantees investment in maintenance of critical natural capital.

Cost-effectiveness

Collection of entry fees can be cost effective where there is one, or a few, entry points to a site but may not be so where there are multiple entry points, such as in the Wet Tropics WHA.

Where there are multiple entry points, there may be two approaches taken to implementing an entry fee system. The first is to try to enforce fee payment by having sufficient staff in the field. This approach may have too high a cost in terms of other duties not undertaken by field staff. Another approach is to try to develop a culture of paying fees. Such an approach may be based on recognition that not everyone will pay fees, but sufficient revenue can be collected from those visitors who derive benefits from knowing they are contributing to management. This latter approach is often based on selling passes off-site. This type of system works best when it is implemented on a region or state wide approach and followed up with education programs. Pass systems have been introduced in Tasmania and Western Australia. In September 1996, the Queensland government announced the intention to implement a Park Pass system for Queensland National Parks from 1 March 1997. However, in December 1996, this decision was reversed and the system cancelled. It is questionable if an entry fee system for the Wet Tropics WHA would be cost-effective if not administered in the context of a statewide approach.

3.5 Conclusions

This chapter dealt with a variety of different but related topics that form important background to development of an approach to operationalising the concept of sustainable tourism. The concepts of sustainable development and sustainable tourism were introduced. This study is taking an economic approach to the issue and so it was necessary to provide background on alternative economics approaches. Two broad approaches were reviewed and an argument was made for selecting an ecological economics approach to the sustainable tourism problem. An economic interpretation of the reasons for managing tourism in natural environments and protected areas was put forward. The observation was made that there is generally a need for intervention in the system to promote both efficiency and sustainability objectives. One form of intervention, via the economic instrument of user fees, was discussed in some detail.

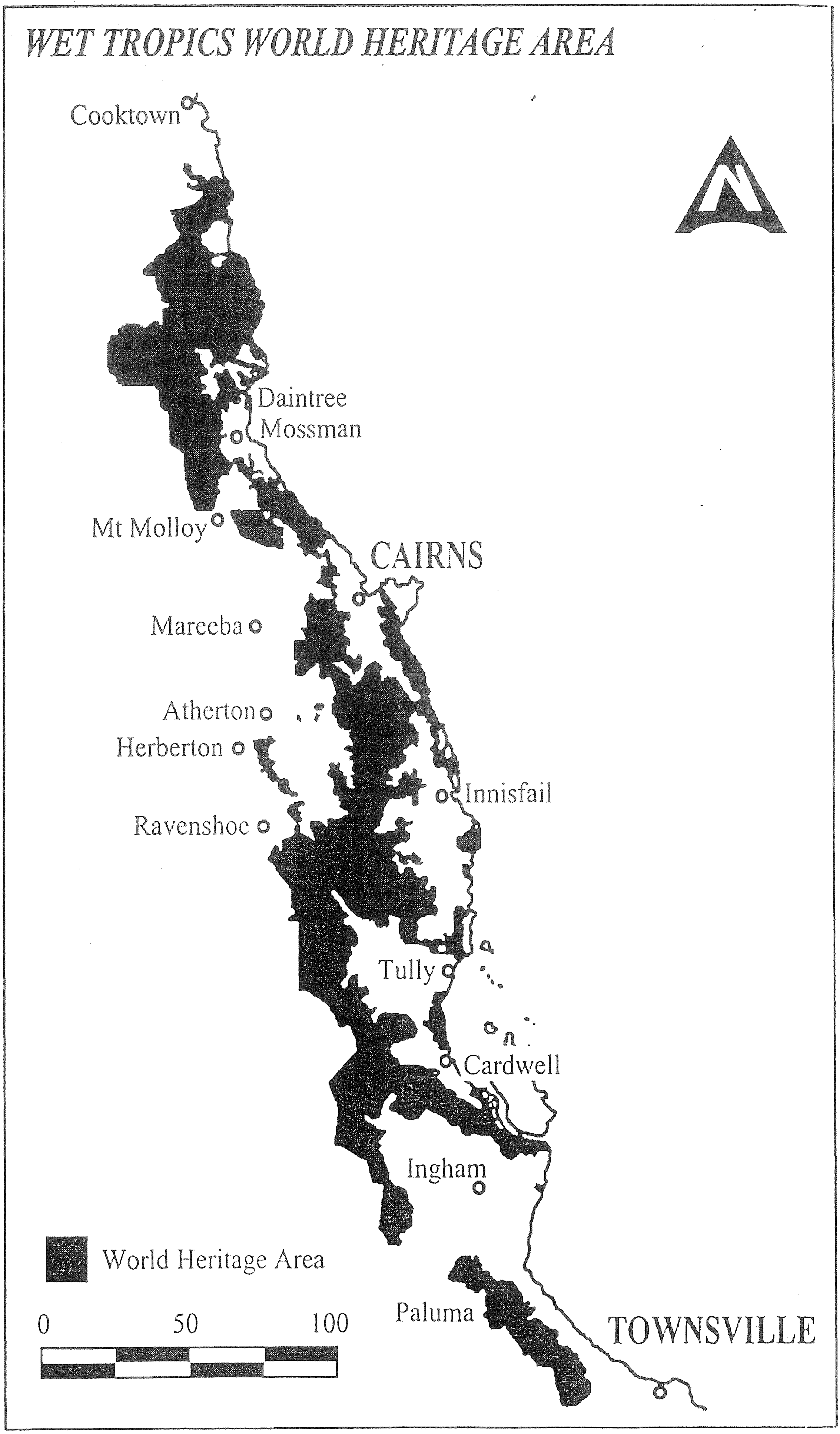
CHAPTER 4
THE WET TROPICS WORLD HERITAGE AREA

The case study in this thesis is of tourism in the Wet Tropics WHA. The Wet Tropics WHA is located in North Queensland, Australia. The area incorporates much of the tropical rainforest remaining intact in this region. World Heritage Area status was awarded in recognition that the natural environment of the region is biologically diverse, with many rare and threatened species, and represents stages of the earth's evolutionary history. Acceptance of the area onto the World Heritage List occurred in December 1988. The Wet Tropics WHA covers 9000 square kilometres and is made up of discontinuous large and small areas of rainforest and associated forest. It is surrounded by cleared land used for extensive and intensive agriculture. The coastal cities of Townsville and Cairns are nearby, as are many smaller towns. Tourism is a major economic activity in the adjacent region. See Map 1 for the extent of the Wet Tropics WHA.

The Wet Tropics WHA itself attracts a growing number of visitors including local residents and tourists who travel from other parts of Australia and overseas. It is possible that annual visitor numbers may double between the years 1992 and 2001 (Office of the Co-Ordinator General 1993). Access to the area for tourism and recreation is the major direct use of the area. Visitor use is accommodated under the management regime for the Wet Tropics WHA via planning for use and provision and maintenance of facilities. A commercial tour industry assists visitor access and provides economic benefits to the wider region.

The natural environment of the Wet Tropics WHA is the attraction to these visitors. It is of course relevant in this situation of expanding tourism in an especially valued natural environment to raise the question of what impacts current tourism is having on the natural environment and whether the area can accommodate tourism growth without sacrificing environmental integrity. Initial investigation of this issue revealed little published information or current research effort into the ability of the area to withstand impacts of tourism. A cautious approach in management is being taken, but there is no real basis on which to evaluate whether this is enough to prevent unacceptable impacts. So, the question remains important and unanswered at this point.

In this chapter, information that was able to be assembled as background for the investigation of sustainable tourism issues is set out. The chapter begins in Section 4.1 with a description of recent history and management arrangements for the Wet Tropics WHA. In Section 4.2, the focus is on the natural environment of the Wet Tropics


WET TROPICS WORLD HERITAGE AREA
Cooktown
Daintree
Mossman
Mt Molloy
CAIRNS
Mareeba
Atherton
Herberton
Innisfail
Ravenshoe
Tully
Cardwell
Ingham
World Heritage Area
0
50
100
Paluma
TOWNSVILLE

WHA, and threatening processes. This includes a discussion of what is known of potential impacts of tourism. As well as having natural values worthy of inclusion as a World Heritage Area, the natural environment of the area is an attraction for a significant number of visitors including residents of North Queensland and people who come to the region as tourists. The use of the Wet Tropics WHA for tourism and recreation is described in Section 4.3. Brief conclusions on the material presented in this chapter are presented in Section 4.4.

4.1 History and Management of the Wet Tropics WHA[1]

The Wet Tropics WHA was inscribed onto the World Heritage List in late 1988. This listing was opposed at the time by the Queensland Government and a proportion of the population of the local region, because logging was to be banned in the WHA and the Commonwealth was to acquire management powers. The Queensland Government sponsored a delegation to UNESCO in Paris to oppose the listing. Events surrounding the listing included a confrontation in the town of Ravenshoe between hostile crowds and the then Commonwealth Minister for the Environment, Senator Richardson (Toyne 1994). It is interesting to note that by 1993, support in the North Queensland region for the Wet Tropics WHA had grown to 80% (WTMA 1994b)[2].

The listing had major ramifications for management of the land included within the boundaries of the Wet Tropics WHA. It created an obligation for the Commonwealth Government, as a signatory to the World Heritage Convention, to ensure that the area is managed to protect its World Heritage values (WTMA 1995d).

In 1983, the Commonwealth Government had translated its responsibilities as signatory to the World Heritage Convention into the *World Heritage Properties Conservation Act 1983*. When the Wet Tropics WHA was placed on the interim World Heritage List in late 1987, prior to final assessment for listing, this Act came into effect giving the Commonwealth Government power and responsibilities for management of the area. The then Queensland Government opposed the nomination and the Commonwealth Government's plan to halt logging in the area. In January 1988, the Commonwealth

[1] Names of the Queensland and Commonwealth Government departments have changed since listing of the Wet Tropics WHA. The names used in the text are generally those relevant at the time of the events discussed. See the Glossary for full names.

[2] The WTMA conducted surveys about awareness and support for the Wet Tropics WHA in 1992 and 1993. In 1992, support in North Queensland was 73% and strong opposition was 17%. In 1993, support was 80% and strong opposition was 10% (WTMA 1994).

Government enacted regulations under the *World Heritage Properties Conservation Act 1983* to ban forestry operations in the area (DEST 1995)[3].

Prior to listing, the land now included within the boundaries of the Wet Tropics WHA had been under a variety of tenures, crown and private. The Wet Tropics WHA is not a tenure in itself, it overlies existing land tenure. The current land tenure has not changed much from the situation prior to listing, although some parcels of freehold and leasehold land have been purchased by the crown. Within the area in 1992, there were 620 separate parcels of land under the following tenure: freehold (91 parcels, 2% of the area); leasehold (110 parcels, 16%); local government reserves (53 parcels, 1%); and State and Commonwealth lands (366 parcels, 81%). Twenty nine percent of the area was National Park and 38% was State Forest (WTMA 1992a).

The above listing of tenure does not include recognition of native title. In the words of the WTMA (1995b, p. 46), 'the nature, extent and location of the rights of native title holders is currently unknown to many people'. It is possible that in the future determinations will be made under either the Commonwealth *Native Title Act 1993* or the *Native Title (Qld) Act 1993*, that will define native title rights to lands within the boundaries of the Wet Tropics WHA.

Prior to creation of the Wet Tropics WHA, the lands were managed by separate authorities according to different objectives. The Queensland Government had management responsibilities for the majority of land in the area. Significantly, the State Forests were managed for multiple-use including logging while the National Parks were managed primarily as conservation reserves. Other Commonwealth and State Government responsibilities in the area prior to listing include defence, transport, communications and water resources. Land within the boundaries of the Wet Tropics WHA lies within 14 local authorities including two Aboriginal community councils (WTMA 1992a). There are 16 Aboriginal language groups whose territory covers parts of the Wet Tropics WHA and surrounding region (WTMA 1992a).

Following listing, there has been a transitional stage in management, that will continue until the initial Wet Tropics Management Plan is in place. Three distinct stages can be identified in this overall transitional stage. The first stage was between late 1988 and 1990. The then Queensland National Party Government was opposed to the listing and did not co-operate with the Commonwealth Government in developing management

[3] The Wet Tropics WHA is one of only three World Heritage Areas in Australia where the Commonwealth Government has enacted regulations under the *World Heritage Properties Conservation Act 1983* to override the intentions of the relevant State Government. The others are the Tasmanian Wilderness WHA and the Great Barrier Reef WHA.

arrangements. The Queensland Government continued to fund the management of National Parks and State Forests in the area.

In 1990, a Labor Party Government was elected in Queensland which supported the World Heritage status of the Wet Tropics WHA, and this marked the commencement of stage two. A Management Scheme was drawn up between the Commonwealth and Queensland Governments which set out arrangements for management of the area (DEH 1992). The Management Scheme gave the major management role to the Queensland Government, with the Commonwealth Government retaining an overview of management and being a partner in funding of management[4].

The Management Scheme included setting up the structure illustrated in Figure 4.1. The Wet Tropics Management Authority consists of a board of part time members appointed by the Commonwealth and Queensland Governments, with the Chairperson appointed by Ministerial Council. The Authority reports to a Ministerial Council consisting of two Ministers each from the Commonwealth and Queensland. The Ministerial Council has responsibilities for co-ordinating policy between the governments.

The Board of the Authority is advised by a Community Consultative Committee and a Scientific Advisory Committee. According to the Management Scheme, the Wet Tropics Management Agency houses the staff with expertise in planning, policy development, public information and environmental management. The important function of co-ordination of on-ground management between Queensland Government departments and other agencies is undertaken by the Management Co-ordinating Committee which includes representatives of relevant agencies.

The responsibilities and activities of local government and Queensland Government departments including the Department of Environment and Heritage (now the Department of the Environment), the Department of Primary Industries - Forest Service (now the Department of Natural Resources) and the Department of Transport continue, subject to the programs and policy approved by Ministerial Council. Significantly, the Management Scheme committed the Commonwealth Government to a $10 million capital works program for the Wet Tropics WHA, commencing in 1991-92.

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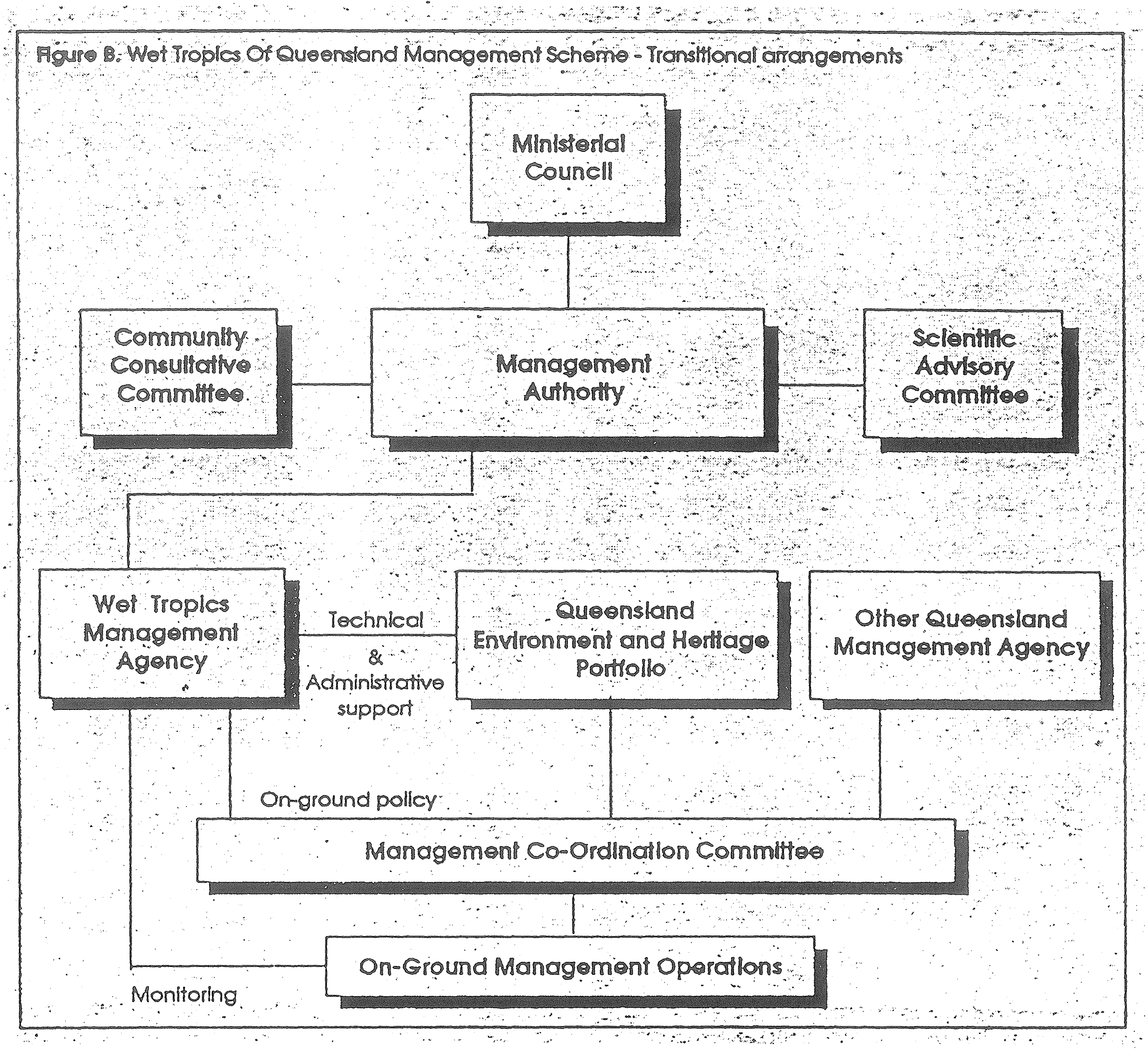
[4] This model of vesting most management responsibility with the State Government with Commonwealth Government involvement being mainly through the Ministerial Council and funding provisions is one of a number of different models for management of World Heritage Areas in Australia (DEST 1995).

Figure 4.1: Structure of management of the Wet Tropics WHA
Source: DEH 1992, p.6.



The third stage of the transition was heralded by the proclamation of Queensland's *Wet Tropics World Heritage Protection and Management Act 1993* and the complementary Commonwealth *Wet Tropics of Queensland World Heritage Area Conservation Act 1994*. The Queensland Act sets out all the management obligations and arrangements for the Wet Tropics WHA. The Management Scheme remains important in defining management arrangements and is a Schedule to the Queensland Act. The Commonwealth Act is a short act which gives effect to the Management Scheme, requires the Commonwealth Minister to appoint an Aboriginal representative to the Board of the Authority and advisory committees, and to table the Annual Report of the WTMA in the Commonwealth Houses of Parliament.

Under the new legislation, the 'Agency' has been renamed the 'Wet Tropics Management Authority' and what was previously known as the 'Authority' is now the 'Board of the Authority'.

The functions of the Wet Tropics Management Authority as defined under the Queensland Act include:

- 'developing and implementing policies and programs within the Wet Tropics WHA;
- making recommendations to Ministerial Council;
- preparing management plans;
- administering funding;
- facilitating and entering into cooperative management arrangements;
- rehabilitation; and
- education through the gathering and dissemination of information' (WTMA 1995a, p. 4).

The Queensland Act allows for the participation in management by Aboriginal people 'particularly concerned with the land' through joint management agreements, although no agreements have been drawn up yet.

A major responsibility of the WTMA is the preparation of a management plan for the Wet Tropics WHA. The Authority may also prepare management plans for parts of the Wet Tropics WHA. When the Wet Tropics Plan is prepared and gazetted, the transitional management phase will be completed. At that time, Sections 56 and 57 of the Queensland Act will be proclaimed. Section 56 prohibits the destruction of forest products and Section 57 sets out compensation provisions (WTMA 1995a)[5].

The stages required in preparation of the Wet Tropics Plan are:

1. public notification of intent to prepare a plan, invitation for public submissions and consideration of submissions;
2. preparation and advertisement of a draft management plan, invitation for public submissions and consideration of submissions; and
3. presentation of a final plan to Ministerial Council for recommendation for approval by the Governor in Council.

On approval, the Wet Tropics Plan will have statutory force for seven years. A plan may be amended by advertising the proposed amended plan and following steps (2) and (3) above. Preparation of more detailed management plans for parts of the Wet Tropics WHA must follow steps (2) and (3) at least.

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[5] In the meantime, the regulation under the *World Heritage Properties Conservation Act 1993* remains in force.

The Wet Tropics Plan prevails over any local authority planning scheme and all activities and approvals by local authorities must be consistent with the Wet Tropics Plan. If there are inconsistencies between the Wet Tropics Plan and other plans made under the Queensland *Nature Conservation Act 1992*, that is for National Parks in the Wet Tropics WHA, the Minister (the Queensland Minister for the Environment) must determine which plan prevails.

The first Wet Tropics Plan is currently under development. A document entitled *Wet Tropics Plan: Strategic Directions* was released in 1992 for public comment (WTMA 1992a). There have been unforseen delays in developing the Draft Wet Tropics Plan. The delay of at least 12 months in releasing the Draft Plan has been attributed by the Executive Director of the WTMA to 'the need for further consultation with State Government Departments' (WTMA 1995a, p. 3). The Draft Plan was released in late October 1995 (WTMA 1995b). Public comments were invited until 1 March 1996. At the time of writing, the Plan had not been finalised.

It is intended that a series of Area Plans will be developed to complement the Wet Tropics Plan (WTMA 1995b). These will be more detailed plans for sections of the Wet Tropics WHA that require these by virtue of high demands for use and/or environmental sensitivity. Area Plans will also be statutory plans in force for seven years but they may be developed or altered over that period as the need arises. Opportunities for public comment are required as part of the process of modifying Area Plans. At present, four Area Plans have been developed to a preliminary draft stage pending release of the Wet Tropics Plan (Chappell, M. 1995, pers. comm.).

4.1.1 The Draft Wet Tropics Plan

Features of the Draft Wet Tropics Plan (WTMA 1995b) are described in Appendix C. The basis of the Draft Plan is a zoning scheme which consists of four zones covering the entire Wet Tropics WHA. The four zones proposed are: Core Natural Zone (covering 52% of the area), Future Core Natural Zone (covering 46% of the area), Natural Zone (covering 2% of the area) and Visitor Facility Zone (covering less than 1% of the area). The proposed Core Natural Zone includes relatively undisturbed land and it is proposed that access and activities will be quite limited. The intention for the Future Core Natural Zone is for phasing out most current activities and rehabilitation where affordable. The Natural Zone is distributed along the network of roads, powerlines etc, providing a buffer between these and more highly protected areas. All current visitor facilities and some potential future sites are included in the Visitor Facility Zone.

There are a number of overlays to the zones which describe priority ecologically vulnerable areas and existing use rights. There are three sets of guidelines overlaid which propose how use should be managed. Significantly, there is a proposed set of Visitor Management Guidelines which include a set of Visitor Opportunity Classes and guidelines for management of tourism and recreation. These are detailed in Appendix C.

4.1.2 The Daintree Rescue Program

In 1994, the WTMA acquired an additional management task, administration of the Daintree Rescue Program.

The area north of the Daintree River to Cape Tribulation is ecologically significant, featuring some of the last remaining areas of lowland rainforest and inhabited by rare and threatened species of flora and fauna. The land in the area is a mix of National Park, Timber Reserve, Vacant Crown Land and some private land included in the Wet Tropics WHA, and freehold land not included in the Wet Tropics WHA. According to Brannock Humphreys (1993) a significant proportion of the rainforest on freehold land not included in the Wet Tropics WHA has values that would generally support World Heritage listing.

During the 1970s and 1980s, freehold land was subdivided, some into blocks as small as 1 ha, and sold to investors, many of whom have not taken up residence. A considerable number of these blocks are not cleared and are for sale. By 1993, approvals for commercial and tourism developments were such that the combined existing and approved accommodation would support a development greater in capacity than Port Douglas (Brannock Humphreys 1993). Tourism activity has expanded in the area in recent years with several resorts and accommodation establishments on private lands and a busy day trip sector that is straining existing facilities. The increase has been such that visitor facilities have needed to be upgraded, but this has generally been behind the need for the containment of impacts and proper presentation of the area.

The Daintree Rescue Program was announced in 1994 in response to public and government concern that clearing by private land holders and pressure from the growing tourism presence would threaten the integrity of rainforest and biodiversity values both inside and outside the Wet Tropics WHA. The WTMA administers the Daintree Rescue Program although many of the activities are directed to lands outside the Wet Tropics WHA. The WTMA plays a co-ordinating role aimed at managing the area as an entity with the participation of State and local government[6], Aboriginal communities, property owners and the tourist industry. The program is jointly funded by the Commonwealth and Queensland Governments at $23 million, initially meant to be spent over three years (WTMA 1995a).

The elements of the DRP are:

Rainforest Protection (budget $17 million)
- buy back of land;
- Cooperative Management Agreements (CMAs) with land holders;
- education/extension programs with land holders; and
- capacity to oppose development applications in court.

Tourism Planning and Infrastructure (budget $6 million)
- upgrading of existing public tourism and recreation facilities;
- development of additional tourism and recreation facilities; and
- planning for visitor management.

All the measures that relate to private land holders are entirely voluntary. There has been greatest interest in the buy back scheme in particular, (see Table 4.1). The CMAs propose involving the land holders entering into an agreement which is binding on title to conserve and maintain specified areas of native vegetation on their blocks in exchange for benefits that include material assistance such as earthworks, fencing, revegetation and solar power.

Table 4.1: Daintree Rescue Program, status of implementation, March 1996

Number of properties offered for sale	353
Number of properties assessed by scientific/technical teams and passed on to the Department of Lands for valuation	68
Number of properties valued by the Department of Lands	32
Number of properties under negotiation	7
Number of properties purchased	25
Area of land purchased	244.8 ha
Number of owners interested in CMAs	112
Number of agreements under negotiation	6
Number of agreements signed	nil

Source: WTMA 1996

The DRP emphasises community support through information via an extension program that employs a Cassowary Conservation Officer and a Rainforest Officer. The tourism

6 The area lies within the Douglas Shire and the Douglas Shire Council has been a significant force in promoting and implementing the Daintree Rescue Package.

infrastructure program aims to minimise impacts through planned and integrated adequate facilities on crown and private land, inside and outside the Wet Tropics WHA. The infrastructure program also aims to encourage community support by providing some recreation facilities for locals only.

The community north of the Daintree River has been divided over a number of issues regarding future development and lifestyle in the area. Implementation of the DRP has been slower than anticipated, partly due to this division.

4.1.3 Funding of management of the Wet Tropics WHA

Following implementation of the Management Scheme, the Commonwealth and Queensland Governments have jointly funded management of the Wet Tropics WHA. A significant injection of $10 million into capital works has allowed upgrading of formerly inadequate facilities for conservation and visitor management. The expenditure on management from 1990-91 to 1994-95 is shown on Table 4.2. The 1996-97 budgets of both the Commonwealth and Queensland governments (excluding the DRP) are much less than those of recent years. A discussion of the possible implications is included in Chapter 6. A detailed analysis of the management budgets to date and the component spent on visitor management is included in Appendix D.

Table 4.2: Actual Expenditure on Management of Wet Tropics WHA 1990-91 to 1994-95.

	1990-91	1991-92	1992-93	1993-94	1994-95
Capital C'wealth	0	1 854 052	2 867 190	3 555 058	2 156 783
Recurrent C'wealth	1 000 053	4 280 196	4 741 886	5 566 652	3 796 439
Qld Cash	950 924	2 225 791	1 856 568	4 206 331	2 491 267
Qld In-kind	2 726 786	3 690 692	3 802 683	3 039 956	3 627 892
DRP C'wealth	0	0	0	0	305 234
DRP Qld	0	0	0	0	860 020
Total Recurrent	4 677 763	10 196 679	10 401 137	12 812 939	9 915 598
TOTAL	4 677 763	12 050 731	13 268 327	16 367 997	13 237 635

Source: Wet Tropics Management Authority unpublished, WTMA 1994, WTMA 1995a

4.1.4 Future Management of the Wet Tropics WHA

The WTMA has articulated a primary goal for the Wet Tropics WHA. The Primary Goal is 'to implement Australia's international duty to protect, conserve, present, rehabilitate and transmit to future generations the Wet Tropics WHA within the meaning of the World Heritage Convention' (WTMA 1992a).

There are a number of current issues which are likely to be important to future management directions. Central to all future management is the implementation of the Wet Tropics Plan and development and implementation of Area Plans. The incorporation of Aboriginal interests directly into management will be required, regardless of the outcome of Native Title determinations. There exists a firm proposal by the Queensland Government to transfer land within the Wet Tropics WHA in State Forest and Timber Reserve tenure into National Park (WTMA 1995b). There may be an opportunity for rationalisation of management if the DNR is no longer involved in the area. The predictions are of continuing increases in visitor demand. Increases in visitor numbers will have to be managed via facilities and strategies to minimise impact. Threats to the integrity of the WHA continue to exist from adjacent influences and cumulative impacts including those of human activities, fragmentation and invading plants and animals. Recent decisions on funding indicate that governments expect management to be performed with reduced funding, and this will be a real challenge to effective management.

4.2 THE NATURAL ENVIRONMENT AND THREATENING PROCESSES

The Wet Tropics WHA essentially includes the majority of native forest cover remaining in the strip between the coast and the Great Dividing Range from north of Townsville to south of Cooktown. The core of this forested area is the tropical rainforest and associated acacia and eucalypt forests that cloak the ranges, and these have been largely retained in the form they were before European settlement. The areas have not been cleared but parts have been subject to other impacts, notably logging. Also included in the Wet Tropics WHA is a portion of what remains intact of the lowland rainforest and associated coastal mangrove vegetation. These vegetation assemblages once covered the coastal strip but have been extensively cleared for agriculture and urban settlement. To the west of the ranges are the Atherton and Evelyn Tablelands, areas of which were once covered with rainforest but which have been so extensively cleared for agriculture that only remnant patches of rainforest vegetation remain (House & Moritz 1991). Tall open eucalypt forests also occur on the western fringe of the Wet Tropics WHA.

Some relatively small but significant areas of rainforest held under freehold title are not included in the Wet Tropics WHA. North of the Daintree River, some of the last remaining areas of lowland rainforest are held as freehold title.

The Wet Tropics WHA includes the largest assemblage of rainforest in Australia and includes most of the continent's tropical rainforest. Significantly, the Wet Tropics rainforests contain many endemic species. According to Rainforest Conservation Society (RCS) 1994, 'the Wet Tropics is the only habitat for more than 500 species of plants and 30 species of animals that are regarded as rare, vulnerable or endangered' (p. 43). A feature of the Wet Tropics WHA is refugia areas, mainly on mountain tops and in valleys, where species of flora and fauna have been able to continue existence through drier and colder periods in the past.

The rainforests of the Wet Tropics WHA are of international significance in terms of biodiversity and as a historical record of evolution. These qualities of the area have earned the area's placement on the World Heritage List. To merit inclusion on the World Heritage List, an area must meet at least one of four criteria for outstanding natural heritage. The Wet Tropics WHA has been judged to meet all four natural heritage criteria and is one of only about twelve natural World Heritage sites in the world to meet all four criteria (WTMA 1995d). To meet these criteria, the area must:

- be an outstanding example representing the major stages in the earth's evolutionary history;
- be an outstanding example representing ongoing geological processes, biological evolution and man's interaction with his natural environment;
- contain superlative natural phenomena, formations or features or areas of exceptional beauty; and
- contain the foremost natural habitats where threatened species of animals or plants of universal interest still survive (WTMA 1992a, p.11).

The flora and fauna of the Wet Tropics WHA represent major stages in the evolutionary history of life on earth. To quote the Wet Tropics Management Authority:

> These forests are living museums. They contain one of the most complex and diverse living records of the major stages in the evolution of the land plants, from the very first plants on land to the higher plants (gymnosperms and angiosperms). They also provide one of the most important living records of the history of the marsupials and the songbirds (WTMA 1992a, p.11).

The Wet Tropics WHA, as is typical of rainforests, has a high floral diversity. This area has been rated as one of the world's twelve tropical rainforest priority 'hotspots' for preservation based on having high biological diversity, high levels of endemic species and being under threat of species extinctions (Primack 1993).

More detail on the origins and development of the rainforests of the Wet Tropics WHA and their characteristics is presented in Appendix B. The emphasis in this section is on potential threatening processes to the continued viability of the ecosystem or its elements. Although the Wet Tropics WHA has been listed as a protected area and the threats of logging and clearing have been excluded, there are a number of processes, due directly or indirectly to human influences, which are continuing to place the natural environment under stress. This section explores the range of these processes and their significance, and places tourism impacts in perspective.

4.2.1 History of human use

Aboriginal use

There is firm evidence that Aboriginal people have lived in the area for at least 5,000 years, and 'there is no reason to suppose that Aboriginal people have not lived in the region for most of the 40,000 years' that Aboriginal people have inhabited Australia (Horsfall 1991a, p. 39). The rainforest Aboriginal culture that existed at the time of European settlement is likely to have a history of around 9,000 years corresponding with the form and extent of the rainforest in the current Holocene period (Horsfall 1991a). North Queensland appears to be the only area in Australia where Aboriginal people developed a distinctive 'rainforest culture' (Horsfall 1991b, p. 80) Aboriginal land management practices are likely to have modified the environment to some extent. Horsfall (1991a) notes that Aboriginal use of fire might explain pockets of sclerophyll vegetation within the rainforest. Fire may have been used as a tool for clearing areas for campsites, for hunting wallabies and promoting the growth of certain species, for example a grove of *Cycas media*, a fire resistant plant important for food. The cultivation or encouragement of food species may explain some plant distribution patterns. Questions still remain about the extent to which past human use of fire has influenced the location of the sclerophyll/rainforest margins. Overall, the influence of Aboriginal land use practices on the natural environment likely to have been minor in comparison with modifications effected since European settlement.

European settlement to World Heritage Listing

European settlement of this area dates back around 135 years to the 1860s. Clearing and logging have been the most widespread influences on the rainforest since the late 19th century. There continues to be debate about the actual extent of rainforest at the time of first European arrival in the area. Some estimates are that 50% of the original rainforest vegetation has been cleared since that time.˙ Other estimates are that 30% of the vegetation between Townsville and Cooktown, including 20% of the rainforest has been cleared. The lowland areas have been most extensively cleared with only 20% of original vegetation remaining and much of that in fragmented remnants (Winter et al 1991).

Selective logging has been practiced over a large area of the rainforest now included in the Wet Tropics WHA. The areas available for logging prior to World Heritage listing were the crown lands under State Forest and Timber Reserve. One estimate is that by 1986, 42% of the North Queensland rainforest remained as virgin forest and the remaining 58%, subject to access, had been conservatively and selectively logged (Rainforest Conservation Society of Queensland (RCSQ) 1986). The Wet Tropics WHA was inscribed on the World Heritage List in 1988. A year prior to that, logging was banned within the interim boundaries of the area.

The area has also been utilised for activities including roading, water reservoirs, rubbish disposal, gravel extraction, mining, grazing, recreation and tourism, telecommunications facilities, collecting of vines and seeds, as well as traditional hunting, gathering and fishing

The WTMA (1992a) has published an assessment of the condition of the natural environment of the Wet Tropics WHA as able to be assessed based on information available in 1992. This has been presented in terms of categories of disturbance,(see Table 4.3).

Table 4.3: Wet Tropics WHA, areas of disturbance, 1992

Category	Area (ha)	% of WT WHA	Management implications
Not disturbed Areas where there is little or no known disturbance.	462,000	51.8	Predominantly self managing (where natural ecological and evolutionary processes continue). Generally no active field management required.
Disturbance ceased Areas that have been logged at least once.	71,000	7.9	Do not require active management to remove disturbance and may recover over time.
Disturbance remains Includes current cattle grazing, old forestry roads, defence exercise areas.	213,000	23.9	Areas require active management to remove disturbances. May recover over time once disturbing processes have ceased.
Severe disturbance Significant impacts on World Heritage values from; mines, quarries, agriculture, forestry treatment areas.	73,000	8.1	Rehabilitation may be possible if disturbance ceases.
Ongoing disturbance Long term or permanent from; roads, powerlines, dams, water supplies, telecommunication, recreation facilities.	72,000	8.0	Ongoing management and rehabilitation will be required to contain and minimise the impact of disturbances.

Source: WTMA 1992a, p. 15

According to the WTMA (1992a), around 52% of the Wet Tropics WHA has not been disturbed by past activities. Around 16% has been severely disturbed or is subject to ongoing disturbance. The remaining 32% has been subject to disturbance that had ceased or is subject to disturbances that are mostly being phased out (eg grazing). Drawing on the estimates made by the RCSQ and the WTMA, between 48% and 58% of the area of the Wet Tropics WHA has seen some direct disturbance in the past (but by no means has all this area been disturbed).

The condition of natural environment integrity must be appreciated in the context that, as of 1988, the area was deemed suitable for inclusion on the World Heritage List. The management of the natural environment since listing has been and will continue to be significantly different from the experience of the period from the 1860s to 1988. The primary goal for management is 'the protection, conservation, presentation, rehabilitation, and transmission to future generations of the Wet Tropics WHA' (WTMA 1992a, p. 10).

4.2.2 Current threatening processes

Despite the listing of the Wet Tropics WHA and the banning of logging, the natural environment of the area will continue to be threatened by human induced impacts. It should be appreciated that human induced changes will occur in an environment undergoing change due to natural causes including cyclones and landslips which are a feature of the dynamics of the Wet Tropics WHA (Winter et al 1991).

Impacts on the environment of the Wet Tropics WHA will come from sources including direct uses which are currently allowed. The degree of impact of any of the uses allowed in the Wet Tropics WHA is very much dependant upon the management approach adopted. Current uses allowed either as of right or under permit include; tourism and recreation, recreational fishing, grazing (not in rainforest), mining and quarrying, seed collecting, traditional hunting and gathering, and construction. Grazing has the effect of maintaining a grassy understorey, preventing re-establishment of rainforest. There are nine existing mining leases and 68 quarries, many of which are unused (WTMA 1995b). Mining, especially tin and gold mining which is based on alluvial deposits, causes erosion and sedimentation of waterways (Winter et al 1991). It is likely that grazing and mining will be phased out over time.

There are communication facilities located on some of the mountain tops. There may be greater pressure for constructions on these sensitive sites in the future as the telecommunications industry continues to expand. The area is traversed by roads that carry regional traffic as well as tourists. Projections for future road widening have been made in the light of predicted population growth in the region and growing tourism (WTMA 1995b). Road kills of fauna of various species are numerous. Traffic kills are one of the main sources of cassowary mortality (Crome & Moore 1990).

Another source of threatening processes is activities and environments outside the Wet Tropics WHA. Outside areas are potential sources of feral animals, weeds, pest insects, wildlife diseases, pathogens and fire. Feral animals including pigs, cane toads, cats, dogs and cattle pose a threat to native wildlife either by direct predation, poisoning, competition for food or damaging habitat. The introduction and spread of exotic plants was rated as the greatest threat to the integrity of the Wet Tropics WHA by Fisher and Stanton (1991). There are over 100 species of weeds or introduced plants found in the Wet Tropics WHA. These have effects of varying degrees of severity (WTMA 1992a). The fungal disease *Phytpohthora Cinnamonii*, which attacks plants, already occurs in the Kirrama and Carbine Tableland areas of the Wet Tropics WHA (WTMA 1992a).

Clearing is likely to continue in rainforest outside the Wet Tropics WHA. This may reduce populations of species which currently inhabit areas inside and outside the boundaries, and affect forest areas dependent on these species for seed dispersal (Crome 1991). Agricultural areas are a source of fire which may penetrate the boundaries of the protected area and prevent re-establishment of rainforest in areas often burnt. The settlement of people brings exotic plants and household pets. Dogs and cats may hunt in the Wet Tropics WHA or turn feral. The presence of people, noise and lights may disturb fauna which live close to the boundary of the Wet Tropics WHA.

Human induced global climate change is a less direct outside influence which has potential to effect change to the distribution of habitats.

Features of past use such as logging and clearing will continue to have an influence on the condition of the natural environment of the Wet Tropics WHA as fragmentation has reduced and isolated populations of flora and fauna and exposed areas of rainforest to edge effects (House & Moritz 1991).

The types of activity likely to exacerbate problems for rare and threatened species are listed on Table 4.4. This table is based on the outcomes of the 1992 expert workshop on rare and threatened species (Nias et al 1993, Werren 1992). The table lists the processes that may threaten Wet Tropics biota and rates the level of threat, according to the views of the workshop participants. The workshop considered tropical forest areas inside and outside the Wet Tropics WHA. Clearing is included as a potential threat, and this is more likely to occur outside the Wet Tropics WHA. All the processes listed were rated as having a medium to high level of threat to one or more categories of biota. Several of

Table 4.4 An overall assessment of the relative importance of various threat categories to biota of the Wet Tropics

Threatening process or category	Plants	Terrestrial invertebrates	Aquatic invertebrates	Fish	Frogs	Reptiles	Birds	Mammals
Vegetation clearance								
• lowland rainforest	H	H	L	L	M	M	H	H
• summit zones	H	H	L	L	M	H	L	H
• riparian (stream-side)	H	M	H	M	M	H	M	M
Infrastructure development	H	L	M	H	M	M	M	M
Fire	M	M	M	L	L	M	M	M
Water management (impounding etc)	M	L	H	H	H	L	L	L
Feral species								
• pigs	M	M	M	M	M	M	M	L
• others	L	M	H	H	M	L	M	H
Weeds	H	L	L	L	L	L	L	L
Collection	M	L	L	L	M	M	L	L

H = High, M = Medium, L = Low
Source: Nias et al 1993, p. 27

the processes are directly or indirectly linked with visitor use inside or outside the Wet Tropics WHA. Small scale clearing and infrastructure development are associated with tourism in the Wet Tropics WHA. The direct presence of visitors in the rainforest was not included amongst the threatening processes identified.

4.2.3 Environmental impacts of tourism in the Wet Tropics WHA

Any exploration of the environmental impacts of tourism in the Wet Tropics WHA must acknowledge the difficulties of attributing observed impacts with certainty to tourism activities, given the range of threatening processes discussed above. While the biophysical impacts of tourism are separated out as far as possible for this study, in reality tourism impacts must be seen in the context of all processes that impose human-induced change on the Wet Tropics WHA.

The relationship between tourism inside and outside the Wet Tropics WHA must also be acknowledged. Some of the impacts of tourism outside the Wet Tropics WHA can be attributed to tourism attracted by the Wet Tropics WHA. While tourism inside the Wet Tropics WHA can be fairly carefully controlled, the application of policies like minimising accommodation inside the boundaries of the Wet Tropics WHA, removes some of the problems outside. The growth in tourism in the Cairns region has led to an expansion of built facilities for tourism onto formerly agricultural land and land formerly under native vegetation, including rainforest not included in the Wet Tropics WHA. The expansion in the tourism industry has also had flow-on effects on employment and support of the local economy, generating residential expansion. It would only be speculation to try to put a figure on what proportion of this development is attributable to the attractions of the Wet Tropics WHA. Developments outside the Wet Tropics WHA in turn generate processes that threaten natural environments both outside and inside the Wet Tropics WHA.

The following matrix, Figure 4.2, presents a schema of the relationships between tourism and environmental impacts inside and outside the Wet Tropics WHA.

The remainder of this section concentrates on the effects of tourism inside the Wet Tropics WHA on the Wet Tropics WHA, ie cell 1.1 in Figure 4.2.

Figure 4.2: Relationships between tourism and environmental impacts

	Effects on Wet Tropics WHA	Effects on adjacent rainforest and other natural environment
Tourism inside the Wet Tropics WHA: Commercial tours, private visits, facilities.	Direct impacts of trampling, road kills, minor clearing, litter, effects of human presence on wildlife, introduction of weeds, bacteria, risk of introducing disease and pathogens.	Erosion and sedimentation from disturbances inside Wet Tropics WHA. Impacts on fauna that cross boundaries.
Tourism outside the Wet Tropics WHA: Accommodation, attractions, services and transport for tourists attracted by the Wet Tropics WHA. Urban facilities for people supported by tourism.	Clearing causing reduction of habitat for fauna that cross boundaries, Road kills of fauna that cross boundaries. Source of feral animals, exotic plants, fire crossing boundaries.	Clearing for accommodation, services, residential development for people supported by tourism causing loss of vegetation and habitat. Road kills of fauna. Feral animals, exotic plants, fire.

A review of the literature available on the Wet Tropics WHA revealed very little information on biophysical impacts of tourism, or the management of impacts of tourism. Significantly for this study, there has been no overall assessment made of the extent or severity of tourism impacts, if indeed any exist. There are a small number of reports and papers which address aspects of the relationship between tourism and the environment of the Wet Tropics WHA, but the findings of these studies cannot be extrapolated to the entire Wet Tropics WHA.

The lack of published information prompted further investigation of the impacts of tourism and its management via a survey of scientists and managers. The results of the information collection exercise is reported in Chapter 6. Some general observations, as gleaned from published information, can be made here about the nature of impacts of tourism in the Wet Tropics WHA.

To place the scale of tourism in the Wet Tropics WHA in perspective, tourism has a limited direct physical presence in terms of the scale of the Wet Tropics WHA. Figures quoted earlier showed less than 8% of the Wet Tropics WHA being subject to ongoing disturbance. The Draft Wet Tropics Plan (WTMA 1995b) gives an assessment that the nodes containing visitor facilities and the roads used for tourism cover 3% of the area in total. The linear pattern of roads however means that the adjacent area potentially affected by tourism is larger than if the 3% were in one parcel of land. Experienced bushwalkers may venture over a broader area but the intensity of use is low. The concentration of tourism use is illustrated in a study of use of walking tracks. Of the 201 walking tracks in the Wet Tropics WHA, with a total length of 928 km, it was estimated that in 1992, 95% of the visits were made on 25 tracks, of just 36 km in total length (Prociv 1992).

Tourism does however occur in at least one area of particular ecological significance, the lowland rainforest north of the Daintree River. This is one of the few areas of lowland rainforest remaining uncleared and contains many endemic plant species and rare and threatened fauna. Tenure in this area is a mix of National Park and Timber Reserve, which is within the Wet Tropics WHA, and privately held allotments which are not. General concerns are expressed in a number of sources (Brannock Humphries 1993, Figgis 1994) that growth of tourism in recent years has caused observable damage in the form of clearing, erosion, dust and weed infestation. Impacts on fauna and rare plant species are not documented.

Any impacts of tourism will be a product of both the activity and management efforts made to contain impacts. Tourism has been managed for many years under National Park and State Forest policies. Tourism in the areas has generally been kept at a low level of intensity consistent with the management policies for National Parks and State Forests long before the declaration of the Wet Tropics WHA. Important features of this are restricted clearing, in the National Park areas in particular. There are no tourist resorts or large scale accommodation establishments within the boundaries of the Wet Tropics WHA. The management agencies have provided hardened tracks, day use areas and camping facilities and practiced some maintenance of these facilities. In recent years, a system of licensing of commercial tour operators has given management agencies the capacity to monitor and direct their use of sites within the Wet Tropics WHA.

A distinction can be made between the direct effects of the presence of visitors in the Wet Tropics WHA and the infrastructure that supports their activities, and the indirect effects of their activities, although the distinction may be hazy in some cases. Direct effects include: trampling; clearing to provide facilities; direct kills of animals through accidents, permitted hunting and fishing and illegal behaviour; the introduction of weeds or pathogens on vehicles and footwear; littering and leaving human waste; impacts on fauna directly targeted for viewing; and disturbance of sensitive fauna. Indirect effects include: keeping roads open; success of species tolerant to human presence at a cost to intolerant species; and flow-on ecological effects of direct impacts on some species.

Very little information is available on the scale or significance of any of these types of impact in the Wet Tropics WHA. Information that was available from the literature is reported here.

A study by Graham (1994) is the first published study of the impacts of trails in the Wet Tropics WHA. Trails on four soil types on the Atherton Tablelands were studied for; bulk density, surface (water) infiltration rates, root occurrence, soil microbial activity, earthworm occurrence, and soil seed banks. Comparisons were made between the trails and the adjacent rainforest sites, the four soil types and cut and uncut trail surfaces. The study found some differences between forest and trail sites and amongst soil types, but that 'the significance of these differences suggests that well designed and maintained walking tracks do not cause important problems in the adjacent physical and biological systems of the rainforests of the Atherton Tablelands' (Graham 1994, p. 1). The differences found were: increased bulk densities, decreased infiltration rates, lower near-surface fine root concentration and increased microbial activity on most trails as compared to forest sites. Graham includes a number of recommendations for planning, construction and management of trails to minimise impacts. It is emphasised that the study sites were all located on the Atherton Tablelands and that different conditions may prevail at the steeper and higher rainfall sites of the ranges.

The areas in the Wet Tropics WHA most sensitive to human impacts include those mountain areas that are refugia for flora and fauna that give the Wet Tropics WHA its special value but are rare or uncommon. The mountain areas receive the highest rainfall, making them sensitive to erosion if disturbed. Currently these areas are only accessed by bushwalkers at much lower density than other recreation sites experience. Fisher and Stanton (1991) have commented on the potential for cumulative impacts of even low levels of use and the potential for introduction of pathogens to these areas by bushwalkers.

The most controversial road within the Wet Tropics WHA is the unsealed road from Cape Tribulation to Bloomfield. It was constructed in 1984 amidst protests that it would destroy wilderness values and, through erosion, cause impacts to the adjacent fringing reefs of the Great Barrier Reef Marine Park. The occurrence of reefs fringing the mainland is rare in the Great Barrier Reef. The road was not well designed or constructed. It crosses several streams and is very steep in places. It is open to 4WD vehicles only and is generally unusable in the wet season. After monitoring the runoff from the road, Hopley et al (1990) found that even a small increase in the sediment load could potentially result in irreversible deterioration of corals in the adjacent reef, and that this could be brought about by the next major cyclone in the area.

In a study for the Wet Tropics WHA, Natural Resource Assessments (1994) found that linear clearings for roads and power lines have 'a continuing impact on the integrity of the environment through which they pass'. Roads in general have impacts associated with definite breaks in the canopy. Light infiltration is a major agent shaping the rainforest. Light loving pioneer species are favoured by roadside conditions but exotic weed species also thrive (Winter et al 1991). Gaps that are barriers to animal movement may affect gene flow and the viability of populations. Animals may also be isolated from food sources (Natural Resource Assessments 1994). The effect of road width on disrupting fauna has been little studied. Burnett studied only roads of less than 15 m width and found no evidence of isolation of populations of ground dwelling mammals (Winter 1991). Canopy breaks may disadvantage arboreal mammals. Roads in the Wet Tropics WHA have been observed to be major barriers to the movement of female Bennetts Tree Kangaroos (Natural Resource Assessments 1994).

Arboreal mammals of the upland areas of the Wet Tropics WHA, including rare tree kangaroos and possums, are of particular interest to visitors interested in natural history. The animals are difficult to see; they are nocturnal, distributed at low densities and some species are very sensitive to human presence and move away when approached. Currently a few tours operate doing spotlighting at night to see these animals. The RCS (1994) note that although no specific threats have been identified to the Bennetts Tree Kangaroo, 'it is rarely seen near areas of human habitation or areas of high tourist use and may vacate areas subject to human disturbance' (p. 45).

The golden bower bird is possibly being directly impacted by tourism (Werren 1992). It has been the practice for tours which focus on viewing of fauna to visit bowers. Recently it has been observed that birds have abandoned bowers and that the reproductive success of these species may have been reduced. It is thought that the proximity of people has interfered in the ability of males to attract females and to mate.

Cassowaries are spectacular in appearance and are a tourist attraction, although not commonly seen in the wild. Continuing threats to the species include: habitat loss, predation by humans, predation by dogs, traffic accidents, disease, competition from pigs, and restriction of movement along regular routes (Crome & Moore 1990). A number of these threats can be exacerbated by tourism. Clearing of rainforest that is not included in the Wet Tropics WHA continues and some of this is for tourist resorts, associated facilities and residences for staff. This may increase problems that cassowaries face, for example from restricted movement and the presence of dogs. Traffic accidents are a major source for concern as they were the major killer of cassowaries in the Mission Beach area from February 1986 to August 1988, accounting for 17 out of 26 deaths (Crome & Moore 1990).

The picture painted of tourism in the Wet Tropics WHA by the information available is of an activity that is restricted in a physical sense but which may have important direct impacts on rare fauna or on restricted habitats such as the lowland rainforest north of the

Daintree River. However, the lack of research into direct and indirect impacts of tourism means that it is not possible to make any assessment of the scale or significance of impacts from published information. The paucity of information raises questions about how well tourism can be managed without adequate research or monitoring of its effects

4.3 Tourism in the Wet Tropics WHA

The majority of visits to the Wet Tropics WHA are day trips taken by people who visit as independent travellers by private car, or hire car, or on a commercial tour. Visitors include local North Queensland (NQ) people plus tourists from other places in Australia and from overseas. Facilities within the Wet Tropics WHA for day visitors include roads, picnic grounds, walking tracks, board walks, lookouts and toilet facilities. There are 94 sites with some type of visitor facility[7]. The location of roads and facilities currently defines where tourism takes place in the Wet Tropics WHA.

There is virtually no commercial accommodation within the Wet Tropics WHA. Camping is allowed, but a number of camping areas are actually adjacent to, but outside of, the WHA. Recent surveys indicated that the greatest number of visitors to the area stay in Cairns and Port Douglas (Manidis Roberts et al 1994). Some accommodation establishments are located close to the Wet Tropics WHA, in the Daintree, Mission Beach and Atherton Tablelands areas. Visitors staying at these locations can walk into the Wet Tropics WHA, but for most visits some motorised transport is used.

Information reported in this section draws on sources of data on tourism to the Wet Tropics WHA available prior to the conduct of the survey undertaken for this study (results are reported in Chapter 7). The most important source of data was the results of the only comprehensive survey of visitors to the area, the *1993 Wet Tropics Visitor Use Survey* (Manidis Roberts et al 1994), hereafter referred to as the *1993 WTVUS*. This survey was the first attempt to get a picture of visitor numbers, visitor characteristics and their use of the Wet Tropics WHA. Data was collected by questionnaire at 56 sites, during the Wet Season (March/April) and the Dry Season (September/October) 1993 and scaled up to an estimate of annual use with data collected using traffic counters. Other data sources drawn upon were previous studies of tourism in the region,

[7] This data is from unpublished raw data from the Wet Tropics Ecotourism Strategy which was made available to the author for this study. The Draft Ecotourism Strategy is yet to be released.

brochures, interviews with tourist operators and land managers[8], and raw data from the unpublished Wet Tropics Ecotourism Strategy.

4.3.1 Independent visitors

Local NQ residents travel by private car to recreation sites such as swimming holes and picnic areas. Raw data from the *1993 WTVUS* was analysed to provide information on recreation visits to the Wet Tropics WHA by local residents[9]. The survey showed that the vast majority of visits to sites by local residents were from the nearest population settlement. The average number of sites visited per day by local residents was 1.3 and the modal number was one.

Visitors who travel to NQ in their own car, or who hire a car in NQ, may visit a number of sites in a day, at their own pace. Visits to sites within the Wet Tropics WHA may be combined in a day trip with visits outside the Wet Tropics WHA to commercial attractions, beaches, and places to eat and shop. Popular day visits for independent visitors are Kuranda and the Atherton Tablelands, Mossman Gorge and the Daintree River, and north of the Daintree River to Cape Tribulation. The latter option has been somewhat restricted in the past as the road was not sealed. Sealing of the road to two wheel drive standard has been progressively undertaken since 1994 and Cape Tribulation is generally accessible by two wheel drive. Hire car companies however do not yet allow two wheel drive vehicles to be taken north of the Daintree River. Independent visitors who drive to NQ may visit sites in the south of the Wet Tropics WHA.

There are currently no limits placed on the number of independent visitors to sites in the Wet Tropics WHA.

4.3.2 The commercial tour sector

The range of commercial tours offered in the Wet Tropics WHA in 1994 is shown in Table 4.5, along with the number of tours and companies involved. Price ranges of commercial tours are shown in Table 4.6.

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[8] Information provided by the QDEH and QDPI - FS included lists of operators holding permits, visitor numbers to some sites, information on policy, but not the number of passengers carried by individual permit holders.

[9] The raw data was provided to the author by the Wet Tropics Management Authority.

Table 4.5: Commercial tours in the Wet Tropics WHA

Tour Description	Number of Tours offered daily*	Number of tours offered regularly**	Number of Companies
Cape Tribulation day tours (including Bloomfield Track)	30	4	28
Cape Tribulation overnight	5	1	4
Cape York via Cape Tribulation	1	34	14
Daintree area day tour	7	4	11
Kuranda day tours	18	9	14
Kuranda and Atherton Tablelands day tours	11	1	9
Other Atherton Tablelands day tours	5	1	6
Atherton Tablelands overnight	1	2	2
Nocturnal wildlife viewing day/night tours	3	5	6
Cairns area day tours	9	0	6
Rafting and Kayaking tours	9	9	6
Mountain bike, horseriding and trekking	5	8	4
Townsville to Cairns via Wet Tropics WHA sites	0	2	2
Southern Wet Tropics WHA day tours	0	2	2
Other	1	2	2
Total	105	84	56

* Tours are advertised as being offered daily, but many run only if minimum passenger numbers are reached.

** Tours are advertised as being offered on a regular basis; several days a week, weekly or at scheduled dates throughout the year.

Sources: Permit registers of the QDEH and QDPI-FS, Company brochures and interviews with operators.

Table 4.6: Price ranges of commercial tours in the Wet Tropics WHA, 1994

Tour Description	Minimum price $	Maximum price $	Mean for day trips $
Cape Tribulation day tours (including Bloomfield Track)	59	145	92
Cape Tribulation overnight	74	235	more than 1 day
Cape York via Cape Tribulation	300	1740	more than 1 day
Daintree area day tour	45	85	66
Kuranda day tours	33	113	65
Kuranda and Atherton Tablelands day tours	47	85	65
Other Atherton Tablelands day tours	28	88	67
Atherton Tablelands overnight	169	238	more than 1 day
Nocturnal wildlife viewing day/night tours	69	160	98
Cairns area day tours	55	275	129
Rafting and Kayaking day tours	65	122	84
Mountain bike, horseriding and trekking	49	890	includes more than 1 day
Townsville to Cairns via Wet Tropics WHA sites	230	475	more than 1 day
Southern Wet Tropics WHA day tours	-	-	-

Sources: Company brochures and interviews with operators.

Tours were run by 56 different companies which held permits to visit sites in the National Parks and State Forests in the Wet Tropics WHA and which were actively running tours in 1994. In addition, a number of permits were held by people who did not run regular tours in 1994. These included some operators who may have made one or more visits as part of longer tours to other sites on the east coast of Australia, and operators whose businesses had lapsed. The information shown on the table was drawn from the permit registers of the QDEH and QDPI-FS, supplemented by printed brochures, investigation in the field and interviews with tour operators. The author did not have access to the individual permit return data held by the land managers.

The majority of tours which visited the Wet Tropics WHA originated from Cairns, with Port Douglas being a secondary origin. The largest number of tours was offered to the Cape Tribulation area. As a result of sealing of the road from the Daintree River to Cape Tribulation, Coaster buses, carrying more passengers, have been able to replace 4WD vehicles for this trip. The 22 seat Coaster bus has been designated by QDEH as the maximum vehicle size for use by commercial tour operators in National Parks in this area. Some tour operators have retained 4WD vehicles and added a trip all or part of the way along the unsealed Bloomfield Track, to provide a '4WD experience'. The tours are generally conducted by one driver/guide.

A typical day tour emanates from Cairns or Port Douglas and may visit Mossman Gorge on the way to the Daintree River. Virtually all tours include a wildlife cruise on the Daintree River, or at Coopers Creek north of the Daintree River. After crossing the Daintree River, tours stop at several sites on the way to and from Cape Tribulation. Individual tour operators design their itinerary in order to avoid arriving at sites at the same time as other operators, and so no two itineraries are identical. The sites on public land visited by most tours are Cape Tribulation itself and the Marrdja boardwalk. Other sites in the Daintree National Park may also be visited. A number of operators visit undeveloped sites on privately owned land which may be used for rainforest walks, swims in swimming holes and picnic lunch stops. There are several resorts and food outlets which are used by tours as lunch stops. In addition there is one commercial interpretive centre in the area. A feature of all tours is interpretation of the area provided by the driver/guide while passing through the area and usually a short 'interpretive' walk is included.

A number of tour operators offer tours which combine the day trip with an overnight stay for one or more nights at commercial establishments in the area. In a very few cases, the tours are run by the commercial accommodation establishments. The Coral Coaches company runs a bus service which provides transport for many of the people who stay overnight in the area. This service does not have the interpretive features of the tours.

All of the safaris to Cape York advertise at least one way of the trip travelling from the Daintree River to Cape Tribulation and along the Bloomfield Track, conditions permitting. These tours generally spend the best part of a day travelling through parts of the Wet Tropics WHA, finishing at Cooktown overnight.

The QDEH recorded that a total of 82,890 people visited the Daintree River to Cape Tribulation area of the Daintree National Park on commercial tours in 1994. The months with the highest visits were July and August with 10,500 and 10,100 visits respectively and the month with the lowest number of visits was March with 4,600 visits[10]. The total number of visits to sites in the Daintree National Park approved under commercial tour permits awarded by 1994 was found to be significantly higher than current use The total number of visits to sites in the Daintree National Park approved under commercial tour permits awarded by 1994 was found to be significantly higher than current use[11]. The Minister for the Environment and Heritage imposed a moratorium from March 1994 on the issue of new permits to access the Park and on increases in capacity of existing permit holders (Kelly, G. 1994, pers. comm.).

Day trips from Cairns and Port Douglas also operate as far as the Daintree River. These tours generally combine a wildlife river cruise with a visit to the Daintree township, private interpretive centres in the area, exotic fruit or coffee farms and a visit to Mossman Gorge in the Daintree National Park.

Although the Daintree River originates in the Wet Tropics WHA and passes through the Wet Tropics WHA at its mouth, ironically the stretch of the river where the wildlife cruises are conducted is not within the Wet Tropics WHA. This stretch of river is bordered by a fringe of rainforest environment, beyond which land is cleared for canefields and farms. The approximately 7 cruise operations o n the Daintree River are therefore not included in the list of operations that hold a permit to conduct tours in the Wet Tropics WHA and are technically not part of the Wet Tropics WHA tour industry. In reality, these operations are dependant on the rainforest environment that remains. It is probable that this stretch of river is most suitable to tour operators due to the proximity of the road to the river in this area.

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10 This data comes from unpublished records of the QDEH. The accuracy of these records, based on permit returns of operators is unknown, so should be interpreted as a minimum.

11 The then Department of Environment and Heritage would not provide the author with an assessment of the permitted capacity.

The other major destination for visitors from Cairns and Port Douglas is Kuranda and the Atherton Tablelands. The Kuranda Scenic Train runs between Cairns and Kuranda several times daily, passing through Barron Gorge National Park in the Wet Tropics WHA. Prior to August 1995, most commercial tours to Kuranda alone or Kuranda and the Atherton Tablelands combined a one way trip on the train with coach travel the other way. All tours allow several hours in Kuranda for shopping and visits to privately run operations which display features linked to rainforest and/or the Aboriginal culture of the area. These displays include a butterfly display, a noctarium, Army Duck tours through rainforest, an Aboriginal dreaming trail and two Aboriginal dance theatres. Outdoor markets are held four days a week and shops remain open on other days. It is arguable whether the tours that visit Kuranda alone provide a rainforest experience apart from the travel by road and rail through the Barron Falls National Park. The Jum Rum Creek environmental park which is in the Wet Tropics WHA is adjacent to a secondary street in Kuranda, but it is not known what proportion of the people who visit Kuranda visit this park.

The Skyrail cable car, which runs between the coast just north of Cairns and Kuranda opened in August 1995. The commercial tour sector is adapting to the availability of this facility by setting up tours which combine travel by train one way and cable car the other way. The consequences of this for coach based tours is yet to be clear.

A number of day tours offer a two hour stay in Kuranda and then proceed on to the Atherton Tablelands. The tours visit sites in the remnant areas of rainforest included in the Wet Tropics WHA. Sites visited include the Curtain Fig tree and Lake Barrine. Tours return to Cairns via the Gillies Highway which runs through the Wet Tropics WHA. The nature of the large scale clearing of the Tablelands means that much of the time is spent travelling through agricultural landscapes. Again it is arguable how much of a rainforest experience is gained by visitors. The Wet Tropics WHA sites are however a feature of these tours and visits are accompanied with some interpretation of the environment. These tours are conducted in coaches (of 44 seats or more) or Coaster buses.

The Atherton Tablelands are a feature of a smaller number of day tours which do not visit Kuranda and concentrate on visiting several of the remnant Wet Tropics WHA sites. An even smaller number of tours to those sites run for more than one day. A number of accommodation establishments on the Atherton Tablelands hold permits to conduct activities including rafting and horseriding at nearby sites in the Wet Tropics WHA.

Specialised nocturnal tours for wildlife viewing are conducted at sites on the Atherton Tablelands and the Mt Lewis area inland from Port Douglas. These are one day trips which depart around midday and return around midnight. During daylight hours the tours visit sites where they can see birds and features such as scrub turkey nests, at night they spotlight for nocturnal arboreal mammals. Conditions have been placed on commercial tours spotlighting and visiting sites of Golden Bowerbirds, to try to minimise any impact on fauna.

The rivers of the Wet Tropics WHA provide a resource for whitewater rafting and kayaking. Activity is concentrated on rivers within a day trip distance from Cairns, with only a few commercial trips per year on the Herbert River in the south of the Wet Tropics WHA. The largest number of rafters participate in day tours on the Tully River. The majority of visitors are carried by the two companies which developed this sector. Half day tours are now offered on the tamer Barron River. A number of tours lasting several days are offered on a regular basis on other rivers. The most tightly controlled of all commercial tourism activities is whitewater rafting on the Tully and Barron Rivers. Here a total quota of the maximum number of rafters per day on commercial tours has been set and the quota divided amongst operators. There is no limit on private use, but on both rivers it is relatively low on most days.

Activity based day tours for mountain biking, horseriding and trekking are offered in areas including the Atherton Tablelands and on the 'Bump Track' near Port Douglas.

Day and half day tours around Cairns including Lake Morris and the Whitfield Range behind Cairns are an emerging sector but attract a smaller number of visitors than the Cape Tribulation/Daintree and Tablelands destinations. These tours cater for visitors with limited time. Some of these tours offer a 4WD component, providing this adventure option close to Cairns.

There are very few commercial tours operating in the southern Wet Tropics WHA. Two tours originate from Townsville which travel to Cairns over three days, including visits to sites in the Wet Tropics WHA along the way. One Townsville company runs regular day tours to Mount Spec National Park. A Cardwell tour company was running occasional tours to the Wet Tropics WHA, but may have ceased by 1994.

A number of Aboriginal groups run guided walking tours in areas around where communities are based including at Murray Falls, Deeral and Mossman Gorge.

It was possible to compare the information collected for this study with similar information collected on the commercial tour sector for 1991[12] to see if there had been any changes in the structure of the industry over that time. The evidence points to a very similar structure in 1994 as in 1991, with no new routes or destinations added since 1991 (with the possible exception of the route between Kuranda and Port Douglas via Black Mountain). A summary for 1991 is given in Table 4.7.

There has been a reduction in the number of different trips offered to Cape Tribulation, Daintree and Cape York and in the number of companies offering trips. As data on visitor numbers is not available on a comparative basis between 1991 and 1994, it is not possible to say if the reduction in trip numbers was accompanied by a reduction in visitor numbers. All the anecdotal and other evidence points to visitor numbers continuing to grow. The reduction in trip and company numbers is most likely a consolidation in the industry following rapid expansion since the late 1980s. There has been an increase in the number of day tours offered close to Cairns, including to Kuranda and the Lake Morris and Black Mountain areas. In the southern part of the Wet Tropics WHA, commercial tourism continues to struggle and the number of tours offered reduced over the period to 1994.

4.3.3 Sites and facilities

The roads and major sites currently used by tourism in the Wet Tropics WHA are shown on Map 2.

Rainforest is dense and difficult to penetrate and navigate through. Cleared access routes and recreation sites are essential features of infrastructure for visitors to rainforest. Even experienced bushwalkers need roads to access departure points for walks. The pattern of visitor use in the Wet Tropics WHA is defined by the roads which existed prior to listing. Since listing, some roads have been upgraded but no new routes have been cleared.

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[12] The data come from an unpublished table prepared as background for the report by NCST&T 1992.

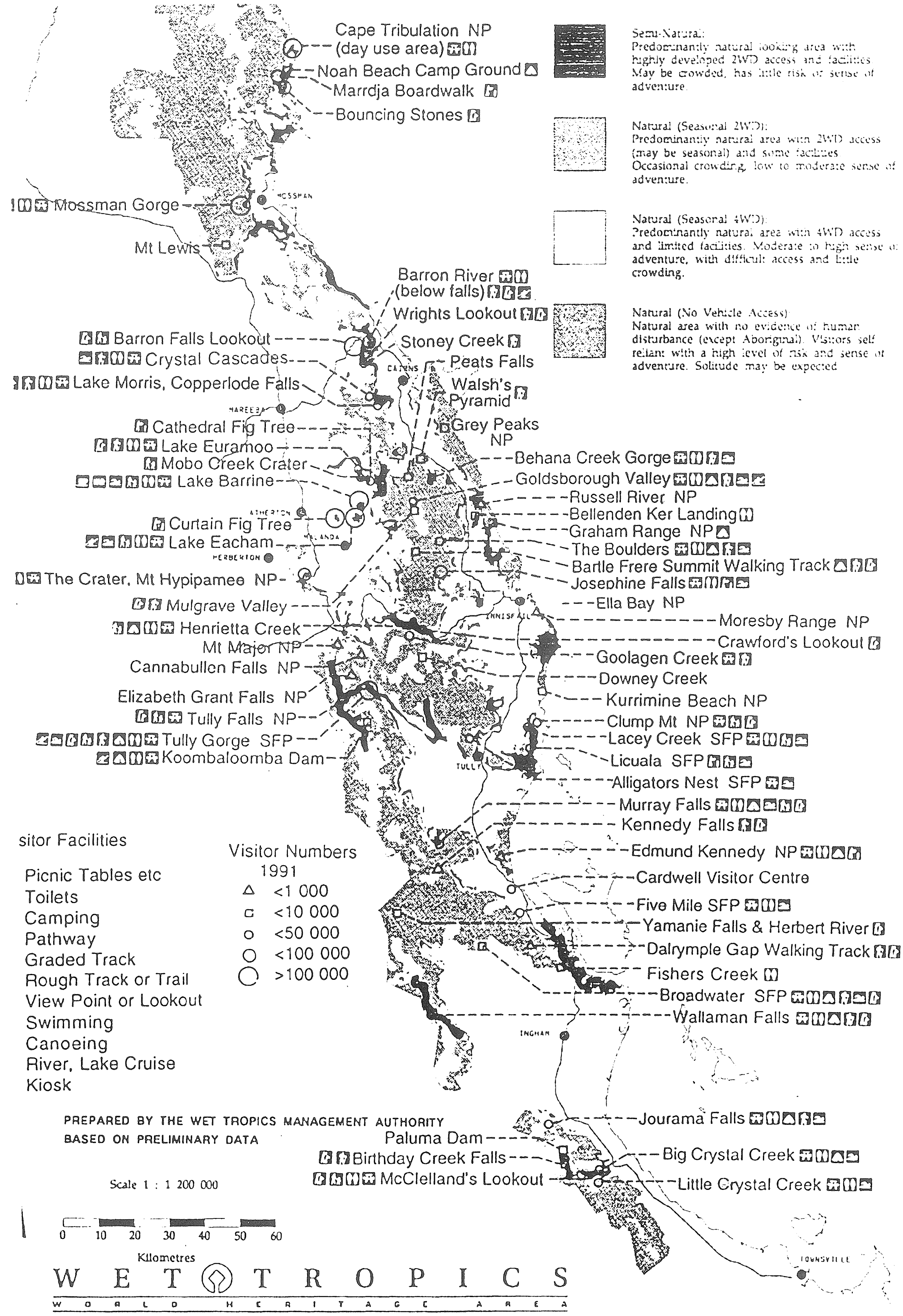
Cape Tribulation NP
(day use area)
Noah Beach Camp Ground
Marrdja Boardwalk
Bouncing Stones
Mossman Gorge
Mt Lewis
Barron River
(below falls)
Wrights Lookout
Barron Falls Lookout
Crystal Cascades
Stoney Creek
Peats Falls
Lake Morris, Copperlode Falls
Walsh's Pyramid
Cathedral Fig Tree
Grey Peaks NP
Lake Euramoo
Mobo Creek Crater
Lake Barrine
Behana Creek Gorge
Goldsborough Valley
Russell River NP
Bellenden Ker Landing
Curtain Fig Tree
Graham Range NP
Lake Eacham
The Boulders
Bartle Frere Summit Walking Track
The Crater, Mt Hypipamee NP
Josephine Falls
Mulgrave Valley
Ella Bay NP
Henrietta Creek
Moresby Range NP
Mt Major NP
Crawford's Lookout
Cannabullen Falls NP
Goolagen Creek
Downey Creek
Elizabeth Grant Falls NP
Kurrimine Beach NP
Tully Falls NP
Clump Mt NP
Tully Gorge SFP
Lacey Creek SFP
Koombaloomba Dam
Licuala SFP
Alligators Nest SFP
Murray Falls
Kennedy Falls
Edmund Kennedy NP
Cardwell Visitor Centre
Five Mile SFP
Yamanie Falls & Herbert River
Dalrymple Gap Walking Track
Fishers Creek
Broadwater SFP
Wallaman Falls
Jourama Falls
Paluma Dam
Birthday Creek Falls
Big Crystal Creek
McClelland's Lookout
Little Crystal Creek
MOSSMAN
CAIRNS
MAREEBA
ATHERTON
HERBERTON
INNISFAIL
TULLY
INGHAM
TOWNSVILLE
Semi-Natural:
Predominantly natural looking area with highly developed 2WD access and facilities. May be crowded, has little risk or sense of adventure.
Natural (Seasonal 2WD):
Predominantly natural area with 2WD access (may be seasonal) and some facilities. Occasional crowding, low to moderate sense of adventure.
Natural (Seasonal 4WD):
Predominantly natural area with 4WD access and limited facilities. Moderate to high sense of adventure, with difficult access and little crowding.
Natural (No Vehicle Access)
Natural area with no evidence of human disturbance (except Aboriginal). Visitors self reliant with a high level of risk and sense of adventure. Solitude may be expected
sitor Facilities
Picnic Tables etc
Toilets
Camping
Pathway
Graded Track
Rough Track or Trail
View Point or Lookout
Swimming
Canoeing
River, Lake Cruise
Kiosk
Visitor Numbers
1991
<1 000
<10 000
<50 000
<100 000
>100 000
PREPARED BY THE WET TROPICS MANAGEMENT AUTHORITY
BASED ON PRELIMINARY DATA
Scale 1 : 1 200 000
0 10 20 30 40 50 60
Kilometres
WET TROPICS
WORLD HERITAGE AREA

Table 4.7: Commercial tours in the Wet Tropics WHA, 1991

Tour Description	Number of Tours day or regular	Number of companies	Min. price $	Max. price $	Mean price day trip $
Cape Tribulation day tours (including Bloomfield Track)	34	32	56	110	82
Cape Tribulation overnight	3	2	125	245	more than 1 day
Cape York via Cape Tribulation	51	23			more than 1 day
Daintree area day tour	12	10	40	98	62
Kuranda day tours	5	4	52	89	72
Kuranda and Atherton Tablelands day tours	15	11	35	96	55
Other Atherton Tablelands day tours	4	4	35	98	59
Atherton Tablelands overnight	3	3	80	295	more than 1 day
Nocturnal wildlife viewing day/night tours	4	3	63	89	77
Cairns area day tours	1	1	69	69	69
Rafting and Kayaking tours	10	4	55	109	82
Mountain bike, horseriding and trekking	7	2	12	399	includes more than 1 day
Townsville to Cairns via Wet Tropics WHA sites	2	1	480	759	more than 1 day
Southern Wet Tropics WHA day tours	6	3	15	70	35
Other	1	1	-	-	-

Source: Unpublished data, NCST&T 1992.

An unpublished internal audit of recreation sites prepared by the Wet Tropics Management Authority in 1993 identified 69 recreation sites with facilities. Research undertaken for development of the Ecotourism Strategy identified 110 sites regularly used by locals or tourists, 94 of these sites with some infrastructure. Sites include: lookouts where drivers can pull off roads to enjoy views; carparks at the heads of walking tracks or board walks; cleared picnic sites with tables; toilets; and camping grounds. Many of the cleared picnic sites are located near freshwater (crocodile free) swimming holes. There are many short walking tracks of 1 to 3 km associated with recreation sites, and there are a small number of tracks of 5 to 10 km, however there are no longer cleared tracks for long day walks or overnight walks.

4.3.4 Visitor numbers

The extensive area of the Wet Tropics WHA and large number of access points and sites makes counting and monitoring visitor numbers extremely difficult. Further, because visitors move around from site to site within the space of a day, determining the number of individuals visiting or 'visitor-days' spent in the Wet Tropics WHA is complex.

There has been no history of systematic recording of visitor numbers to the Wet Tropics WHA. The first attempt to get a comprehensive picture of visitor numbers was undertaken in 1993. Some monitoring of visitor numbers has occurred since this time but as data on visitor numbers are not published, the *1993 WTVUS* remains the only source of comprehensive visitor number estimates.

The survey strategy included using traffic counters at sites in the Wet Tropics WHA and conducting surveys with independent visitors and visitors on tours. Questionnaires were administered at 56 sites, over periods of time in the Wet and Dry Seasons of 1993. Survey data were scaled up to estimates of the population using data from traffic counters and on-site observations (Manidis Roberts et al 1994). The population was reported in terms of 'visits' which is 'visitor numbers to sites'. Unfortunately, the published report of the *1993 WTVUS* did not describe how the population estimate was reached. As an individual visitor may visit more than one site per day, the number of visitor-days will be a smaller figure. Major results of *1993 WTVUS* are presented in the following tables (see Table 4.8 to Table 4.10).

Table 4.8: Visits to nominated Wet Tropics WHA sites 1993

Visits	Wet Season	Dry Season	Total	Percentage
Commercial	807 885	729 656	1 537 541	32%
Independent	1 561 594	1 676 350	3 237 944	68%
TOTAL	2 369 479	2 406 006	4 775 485	100%

Source: Manidis Roberts et al 1994

Table 4.9: Vehicles to nominated Wet Tropics WHA sites 1993

Vehicles	Wet Season	Dry Season	Total
Commercial	58 005	51 638	109 643
Independent	517 258	556 531	1 073 789
TOTAL	575 263	608 169	1 183 432

Source: Manidis Roberts et al 1994

Table 4.10: Features of visitor use, Wet Tropics WHA

	Number	Unit
Most highly used sites (excluding lookouts)		
. Lake Eacham	369 082	visits
. Mossman Gorge	331 492	visits
. Lake Barrine	312 281	visits
. Daintree Cape Tribulation	282 545	visits
. Curtain Fig	220 073	visits
Average length of day visit to site	1.2	hours
Average independent vehicle occupancy	3.2	persons
Average commercial vehicle occupancy	14.2	persons
Local (North Queensland) visits to sites	47.9%	
Other Australian visits to sites	31.1%	
Overseas visits to sites	21.0%	

Source: Manidis Roberts et al 1994

As mentioned above, the actual number of visitor-days to the Wet Tropics WHA was not published in the report. It is necessary for analysis undertaken later in this study to have an estimate of 'visitor-days' to the Wet Tropics WHA. Raw data from the *1993 WTVUS* was obtained and analysed with the aim of finding the mean number of sites visited per day, so that the total number of 'visits' could be converted to 'visitor-days'. It was anticipated that this exercise might be possible as the questionnaire contained a question asking how many sites respondents had visited up to the time of interview, and the time of interview was recorded.

Respondents were actually asked to nominate (by name) up to five sites they had visited that day, up to the time of the interview. Analysis of the responses revealed only one per cent of visitors had visited five sites, so it was assumed that an even smaller proportion would have visited more than five sites. Therefore, the mean based on the responses would be close to the actual mean number of sites visited, including people who had visited more than five sites.

The data were analysed to see if the time of the interview might have affected the number of sites nominated (as people interviewed earlier in the day could have then gone to visit more sites). Perhaps surprisingly, there was found to be no significant difference between the number of sites nominated by people interviewed; before 11 am, 11 am to 2 pm, and after 2 pm.

It was possible therefore to assume that the mean number of sites nominated as visited by respondents at the time of the survey was a good estimate of the mean number of sites visited in a day. The mean was 1.4 sites, and when that was applied to the estimate of 4.7 million visits, gave an estimate of 3.4 million visitor-days.

It is difficult assess the likely accuracy of the estimate of 3.4 million visitor-days. The basis for estimating the number of visits at 4.7 million is not reported in the *1993 WTVUS*, and there has been no repeat of this survey method, so the estimate must be accepted for the purposes of this study. Analysis of the raw data for the *1993 WTVUS* indicated that there was not much difference in the mean number of sites visited by local residents (1.3 sites), Australian tourists (1.5 sites), and tourists from overseas (1.5 sites). Observations in the field by the author led to the expectation that tourists would visit more sites per day than local residents. The result that the modal number of sites visited by local residents was one site per day, accords with field observations However it was expected that tourists would generally visit more than 1.5 sites per day. For this reason, there is concern by the author that the figure of 3.4 million visitor days may be an overestimate (if indeed 4.7 million visits is an accurate estimate of total visits).

The only other published estimate of visitor-days to the Wet Tropics WHA, based on data from 1990 and 1991, was 2.6 million visitor-days (see the next section). The estimate of 3.4 million visitor-days is likely to be of the right order of magnitude but not necessarily accurate. Because the number of visitor-days is a critical number in the economic analysis undertaken in Chapter 9, sensitivity analysis is applied to also include lower estimates of visitor-days. Estimated visitor-days are shown in Table 4.11.

Table 4.11: Estimated visitor-days to the Wet Tropics WHA

	Mean number of sites visited per day	Estimated number of visitor-days
All visitors	1.4	3 407 000
Local residents	1.3	1 635 000
Australian tourists	1.5	1 056 000
Overseas tourists	1.5	715 000

Previous estimates of visitor days

Previous estimates of visitor numbers to the Wet Tropics WHA were published by the National Centre for Studies of Travel and Tourism (NCST&T) 1992, (see Table 4.12).

Table 4.12: Visitor days to Wet Tropics WHA, NCST&T 1992

Market Segments by Transport	Number of Visitor Days
Residents on commercial tours	87 000
Tourists on commercial tours	719 000
Residents using own vehicle	820 000
Tourists using own vehicle	845 000
Tourists using rented vehicle	185 600
Total	2 657 100
Segment by commercial/private	
Commercial tours: residents and tourists	806 000
Private visits: residents and tourists	1 851 100
Segment by origin	
Residents	907 000
Tourists	1 750 100

Source: NCST&T 1992, p. 64.

The NCST&T do not report in detail how their estimates have been reached. It is believed that they are based on data collected for the Queensland Visitor Survey and Day Trip surveys (NCST&T 1991) conducted in Queensland regions. The NCST&T were the consultants who conducted both surveys and they had access to raw data from the surveys.

It is not appropriate to compare the results of the NCST&T study with those of the *1993 WTVUS*, as the methodology used was different. The difference in the results illustrates the uncertainty surrounding estimates of visitor numbers in a multi-site and multi-entry area such as the Wet Tropics WHA. All visitor numbers used in this study should therefore be treated as estimates only.

4.3.5 The Regional Context

The Wet Tropics WHA lies within the Far North Statistical Division, which is centred on Cairns and the Northern Statistical Division, which is centred on Townsville. These regions are adopted for reporting of tourism statistics by the Queensland Tourist and Travel Corporation (QTTC). That the Far North region is the focus for tourism in North Queensland is evident from reported visitor-nights in commercial accommodation. In 1992/93, the number of visitor-nights in the Far North region was 5.7 million, with 1.6 million in the Northern region (QTTC 1994).

The following discussion of regional tourism significance and trends is taken from reports compiled for the *Cairns Region Tourism Strategy* (Office of the Co-Ordinator

General 1993). The Cairns Region equates with the Far North region. No similar study has been undertaken for the Northern Region.

Tourism is a major economic activity in the Cairns Region. In 1992, tourism contributed 25% of both Gross Regional Product and employment in the Far North region (Horworth & Horworth 1993). This region has seen significant growth in tourism numbers and infrastructure over the last decade. The region experienced a 24% increase in international visitors and a 21% increase in international visitor nights per annum between 1985/86 and 1990/91. Growth in domestic visitor numbers was 5% per annum over that time, though domestic visitor nights increased only 0.1% per annum (NCST&T 1993).

The infrastructure servicing tourism has also expanded. The overall number of hotels, motels and hostels grew by 36% between 1982 and 1992, and during this period the size and quality of establishments increased. The capacity of these establishments, in bed numbers, expanded by 221%. In 1992, almost half the rooms available in Cairns were 4 or 5 star quality (NCST&T 1993).

Projections made in 1993 for tourism growth in the Far North region to the year 2001, were for an increase of between 5.2% and 11.4% per annum in visitor nights, with the medium projection resulting in a doubling in visitor nights over the 1992 level (Office of the Co-Ordinator General 1993). Based on the medium projection of visitor nights, the projected contribution in 2001 of tourism to both Gross Regional Product and employment in the Far North region is 32% (Horworth & Horworth 1993).

The natural environment is the major tourist attraction to North Queensland. The most commonly nominated reasons for visiting the area in the late 1980's were to enjoy the weather and to see the Great Barrier Reef (Vanclay 1987). In 1992, it was stated that the attraction of the rainforest did not yet rival these other motives, though an increased profile for rainforest attractions was predicted (NCST&T 1992). Pearce and Moscardo (1994) report the results of a Factor Analysis conducted on responses of visitors using road transport to access North Queensland. They identified three groups of travellers. Visiting the Wet Tropics was a significant travel motive for one group which represented 24% of travellers, and not important for the other two groups. The survey of visitors to rainforest sites conducted for this study revealed that for the majority of these people, the rainforest was 'one of a number of important attractions' to North Queensland (see Chapter 7).

The majority of accommodation and associated infrastructure is located in Cairns, Port Douglas, Townsville and other coastal towns. The most distinct pattern for tourism is for people to visit the natural attractions of the Great Barrier Reef and the Wet Tropics WHA on day trips from the accommodation centres. There are some accommodation establishments in more isolated areas; those adjacent to the Wet Tropics WHA include camping grounds, caravan parks, backpackers lodges, family motels and small resorts. A number of these are promoted as 'ecotourism' facilities.

The *Cairns Region Tourism Strategy* addresses infrastructure requirements to meet the projected growth. The Strategy acknowledges that increased pressure will be placed on natural areas and suggests that limits may have to be placed at some sites and that additional sites will have to be opened up to tourism. The Strategy does not address the question of whether there are ultimate limits to tourism in natural areas (Office of the Co-Ordinator General 1993).

It was acknowledged in the *Cairns Region Tourism Strategy* that considerable demand for use of sites and facilities in the region comes from the local population. Projections of population growth were made as part of the strategy. These ranged from a low growth scenario of 1.9% per annum to a high growth scenario of 3.1% per annum. Growth over the last two decades averaged 2.8% per annum which exceeded the Queensland state average (Department of Geographical Sciences, University of Queensland 1993).

Attempts have been made to measure the contribution to the regional economy of tourism to the Wet Tropics WHA. The two studies undertaken used measures of gross expenditure by visitors and are thus measures of financial benefits and are not measures of net economic benefits[13]. An assessment of the gross expenditure associated with visits to the area north of the Daintree River was undertaken in 1992. It was estimated that the direct expenditure attributable to visits to the Wet Tropics WHA was $44.5 million (Economic Research Services 1992). The gross expenditure associated with all visits to the Wet Tropics WHA in 1992 was estimated at $377 million (Driml 1994). In both these studies, an output multiplier of about 2 was suggested to estimate direct plus indirect regional economic impacts. It was pointed out by Driml and Common (1996) that the gross expenditure associated with visits to the Wet Tropics WHA of $377 million was in real terms, ten times the gross value of sales of timber from the logging and sawmilling industries of $25 million in 1987.

[13] Both studies used the approach of adding direct expenditure on visits to the Wet Tropics WHA plus the cost of two nights accommodation in North Queensland. The results of Driml were based on an estimate of 2.6 million visitor-days.

4.3.6 Management of tourism in the Wet Tropics WHA

Prior to listing, management of tourism and recreation in the natural environments that are now in the Wet Tropics WHA was undertaken by the relevant State and local government agencies. There were, and continue to be, 38 National Parks which were managed by the Queensland National Parks and Wildlife Service (subsequently the Department of Environment and Heritage, now the Department of Environment). Recreation areas within the 41 State Forests were managed by the Queensland Forest Department (subsequently the Department of Primary Industries - Forest Service, now the Department of Natural Resources). Research undertaken at the time of the listing of the Wet Tropics WHA found that both these organisations considered the funding available to them for visitor management was inadequate (IAER 1988). Three National Parks in the area were experiencing annual growth in visitor numbers of 10% to 25%. The visitor facilities were generally considered inadequate to meet visitor demand and there were 15 to 20 field staff for 38 National Parks (IAER 1988).

Following the banning of forestry operations, the activities of the QDPI-FS within the Wet Tropics WHA focussed on improving and managing visitor facilities in State Forests and Timber Reserves in, and adjacent to, the Wet Tropics WHA, and management of commercial tour operations on the lands under their jurisdiction.

The Management Scheme has guaranteed a continuation of management activities by these State Government 'land management' agencies. The roles of the land managers include providing day-to-day management in the field through the provision of staff and support facilities including accommodation, vehicles etc. The agencies have a major role in planning the location and design of visitor facilities. Staff in the field oversee the construction of visitor facilities and maintain them. Field staff have public contact responsibilities for education and enforcement. Staff in the field also monitor sites for safety, visitor experience and environmental impact, to the extent possible given limited resources. Staff of both agencies also undertake management planning for areas under their responsibility.

Commercial tour operators are managed via permits and conditions. A permit is currently required to conduct a commercial tour in a State Forest or National Park. Operators are subject to a set of general conditions and extra conditions may be set for specific locations or activities. For example, a time allotment system has been adopted for the popular Curtain Fig Tree site and operators are allocated a time period through the day in which they may take tours on the site. Operators conducting night-time spotlighting tours for wildlife viewing are subject to guidelines for conducting spotlighting to avoid distress to the animals and allocations as to when they may visit designated spotlighting sites, to limit the number of spotlighting episodes to which the animals are subjected (Hess, L. 1995, pers. comm.). The only area where a moratorium is in place is the Daintree National Park. Operators are charged a fee per passenger of $1.15 for a visit of up to three hours to a National Park or State Forest and $2.30 for more than three hours. The land managers retain a register of operator permits and passenger numbers reported as part of the fee system.

The agencies also participate in planning at a broader level through input to the Draft Plan, a major role in developing Area Plans and development of the Wet Tropics Ecotourism Strategy. Both the DoE and the DNR are represented on the Wet Tropics Tourism Liaison Group which is convened by the WTMA and includes representatives of managers and the tourist industry.

The land management agencies have been able to upgrade and provide expanded facilities through the $10m capital funding injection provided by the Commonwealth. A proportion of the Commonwealth and Queensland Government recurrent funding dedicated to Wet Tropics WHA management is directed to field activities by the land management agencies.

The role of the WTMA in tourism management is via co-ordinating and providing funds for infrastructure provision, providing funds for management of tourism, preparation of the Wet Tropics Plan and policies and co-ordination of the Wet Tropics Tourism Liaison Group, the Wet Tropics Ecotourism Strategy and the Daintree Rescue Package.

The Wet Tropics Ecotourism Strategy

A strategy for ecotourism in the Wet Tropics WHA and adjacent forested areas is being developed as a joint exercise being carried out by three government agencies and four tourist industry bodies. The aim of the exercise is to identify new areas for tourism to take pressure off existing areas (the Daintree in particular) and to provide for future growth in demand. Policies and practices are also being addressed. The approach being taken is to assess the tourism potential of areas via a series of 'product reviews' to gauge the suitability of areas in terms of attractions, access etc. This approach is being complemented by information from land managers on environmental constraints on use of these areas for tourism (Nevard, T. 1995, pers. comm.). At the time of writing, the Draft Ecotourism Strategy is yet to be released.

4.4 Conclusions

The Wet Tropics area was included on the World Heritage List in recognition of its unique and biologically diverse natural environment and its outstanding natural beauty. Listing of an area is not sufficient to guarantee its conservation. The Wet Tropics WHA is subject to human induced threats arising both inside and outside the area. Features of the environment and the beauty of the area attract visitors and the number of visitors is increasing. Visitors potentially pose a threat to parts of the Wet Tropics WHA. This human influence has the potential to reach deep into the WHA. The opportunity to visit is also beneficial in that it increases the enjoyment of visitors and possibly their support for conservation management. Tourism also brings regional economic benefits, which probably contribute to the high regional support for the Wet Tropics WHA.

It is clear that ongoing, appropriately funded, active management is necessary to maintain the viability of the natural environment of the Wet Tropics WHA. The focus of this study is on that management required specifically to accommodate visitor use with minimal impacts. The challenge here is to develop a model of sustainable tourism for this protected area, and this is the subject of the remainder of this study.

CHAPTER 5
CONCEPTS AND TECHNIQUES

This chapter sets out the concepts and techniques which will be applied to the issues being addressed in this thesis. To repeat the statement of the aims of this thesis set out in Chapter 1 — the thesis addresses questions about realising sustainable development in relation to tourism in protected areas. It is particularly concerned with the role that economics could have in:

1. operationalising the concept of sustainable tourism in protected areas;
2. the design of policy instruments for the attainment of such objectives; and
3. providing managers with detailed empirical guidelines.

These questions are addressed in the particular context of the Wet Tropics WHA, and the material presented in Chapters 2, 3 and 4 provided essential background. In Chapter 2, the dilemma of tourism in natural environments was set out; in Chapter 3 the concepts of sustainable development and sustainable tourism as developed in the literature were considered; and information for the case study of tourism in the Wet Tropics WHA was presented in Chapter 4.

This chapter is the beginning of the part of the thesis that extends the information and approaches drawn from the literature into new approaches to the question of sustainable tourism in protected areas via: a proposed operational definition of 'sustainable tourism in protected areas'; an ecological economics model of tourism in protected areas; and an empirical analysis of tourism in the Wet Tropics WHA. In this chapter, the concepts to be applied in analysis in the remainder of the thesis are introduced and the techniques of valuation and analysis to be used are set out.

In Section 5.1, an operational definition of 'sustainable tourism in protected areas', developed for this thesis, is presented and discussed. In Section 5.2, an economic model is developed to illustrate the tourism–environment–management interactions with respect to tourism in protected areas. This model places tourism in protected areas in an ecological economics framework. An adaptation of the model for an empirical analysis of tourism in the Wet Tropics WHA is also presented in Section 5.2. This provides direction on what information is required for applying the model. This model is to be applied in Chapter 9. In Section 5.3, the approaches to data generation in Chapters 6, 7 and 8 are described.

5.1 Operationalising the concept of Sustainable Tourism in Protected Areas

The aim of this section is to present a working definition of 'sustainable tourism in protected areas' for use in the rest of this thesis. Published definitions of sustainable tourism were discussed in Chapter 3. Most authors recognised a distinction between sustainable use of natural environment resources for tourism and sustainable flows of benefits from tourism, the need to incorporate both concepts of sustainability into a common approach, and a difficulty in doing so. The working definition developed here is based on conclusions drawn on the relevant issues discussed in the previous chapters.

One of the difficulties in deriving a definition of sustainable tourism is the need to make a determination of whether sustainability requires the maintenance of natural capital or whether it can incorporate substitution of manufactured capital. If the possibility of substitution is accepted, as under the 'weak sustainability' rule, natural environments can be transformed into built environments and theme parks, and tourism may still be consistent with sustainability. The definition of sustainable tourism proposed here is for sustainable tourism <u>in protected areas</u>. In Chapter 3, it was established that protected areas are closely associated with protection of critical natural capital and that the 'strong sustainability' rule was the appropriate approach to adopt for protected areas. To meet this guideline, it is necessary that critical natural capital be maintained. Just exactly what that means for any protected area must be determined on a case by case basis, by adopting approaches such as setting limits of acceptable change, with a focus on ecological limits. As suggested in Chapter 3, this approach means there may be some substitution of manufactured capital for natural capital, for example in clearing small areas and building boardwalks, provided critical natural capital is not threatened.

If environmental impacts due to direct use are not avoided and are allowed to accumulate, thresholds may be reached where limits of acceptable change for critical natural capital are threatened. 'Adequate management' can be defined as management which prevents these limits being reached. Adequate management can employ both preventative approaches and repair of impacts. It follows that if expenditure on management is not sufficient to provide 'adequate management', it cannot be assumed that critical natural capital is being maintained.

With regard to the concept of a sustainable flow of benefits of tourism, the definitions of sustainable tourism put forward in the literature do not clearly indicate how these benefits should be measured. There are various indicators of volume and value of tourism that are adopted to describe benefits of tourism, for example visitor numbers and visitor expenditure. It was argued previously that many of these are not good indicators of the net value to society of tourism.

It was proposed in Chapter 3 that the appropriate economic measures of benefit are the surpluses accruing to consumers and producers utilising a resource such as a protected area. It was also illustrated that the direct use of a natural environment resource may result in the loss of the flow of other benefits if environmental damage occurs, or that costs may be incurred in preventing damage. Therefore the benefits of use measured by surpluses must be balanced by any costs of use — to derive net benefits (which may be positive or negative). The argument is made therefore, that the best indicator of benefits of tourism is the 'net economic benefit' measure. Sustainability of, or increases in, positive net economic benefits is therefore a relevant quantitative target for sustainable tourism.

For the purposes of this study, 'sustainable tourism in protected areas' is therefore interpreted as the ecologically sustainable use of protected areas so as to provide a sustainable, at least non-declining, flow of positive net economic benefits of tourism.

The two *criteria* for sustainable tourism proposed therefore are:
(i) maintain critical natural capital; and
(ii) provide a non-declining stream of positive net economic benefits

In addition, an essential necessary *condition* for meeting these criteria over time is proposed:

maintain investment in adequate management.

It is necessary for sustainable tourism that each of these criteria and conditions be met, but each on its own is not sufficient.

One of the aims of this thesis is to explore the role of economics in operationalising the concept of sustainable tourism in protected areas. It is argued here that the criteria and conditions for sustainable tourism in protected areas proposed above operationalise the concept and that economics plays a number of roles here. The concept is operationalised in that quantifiable criteria and conditions are set, and performance against these criteria and conditions can be measured.

The condition of maintaining critical natural capital must be interpreted for each protected area in terms of quantifiable limits of acceptable environmental change set uniquely for the environment of the area. This task is clearly outside economics. It is unrealistic to expect tourism to make no impact at all on the natural environment. The task of management is to determine the limits of acceptable change that will allow tourism use without threatening the critical natural capital, including essential ecological processes of an area, biodiversity values and the natural environment characteristics that together make up attractive landscapes. The precautionary principle can be employed in setting limits of acceptable change. These limits become the 'safe minimum standards' for economic analysis. There will of course be practical difficulties in measurement of performance against targets associated with maintenance of critical natural capital.

If there is an additional sensitivity to potential social or cultural impacts of tourism in a protected area, limits on tourism to prevent adverse impacts can be built into the safe minimum standards. Although limits to prevent unacceptable social and cultural impacts are not generally mentioned specifically in the following discussion, reference to environmental impacts and limits set to maintain critical natural capital, should be understood to incorporate social and cultural impacts and limits set for social and cultural reasons.

Performance against criterion (ii) is measurable, in theory at least. This is measurable using a neoclassical approach and is also consistent with an ecological economics approach, because environmental constraints have been set via criterion (i). Net economic benefits are measured as economic benefits minus economic costs. The means of calculating these values are discussed in the next section. There are practical limitations to valuing benefits and costs and these are also discussed later.

Performance against the condition of investment in adequate management is measurable in theory. The target of adequate investment in management can be quantified by measuring the amount of money that would be needed to be spent on management to achieve use that does not exceed limits of acceptable change. The actual amount of money being spent in management of a protected area can be compared with this target.

So, the claim can be made tentatively that the concept of sustainable tourism in protected areas can be operationalised via measurable criteria and conditions, that economic approaches have a central role, but only if the economic approaches can incorporate the externally set constraints required to guarantee maintenance of critical natural capital. This approach may be classified as 'ecological economics'.

Further roles of economics in regard to management for sustainable tourism include optimising the investment in management and raising revenue for management. There is generally a trade-off possible between increasing volumes of tourism and greater investment in management required to accommodate more tourism, without endangering critical natural capital, and economic analysis can assist in finding the optimum amount of investment.

The discussion in Chapter 3 introduced the concept of investment of rents arising from the use of renewable resources, following the Hartwick rule for non-renewable resources. The criteria for investment in adequate management is a related issue. It is not necessarily the case however that the two amounts — rents earned, and investment required to maintain particular conditions — are the same. What is relevant is investigation of whether sufficient rents can be captured to fund 'adequate management'.

There remains the question of whether and how the conditions can be effectively operationalised in a practical sense, given the need to be able to set and monitor limits of acceptable change and given the importance of non-market values. These issues will be investigated via the empirical analysis of the Wet Tropics WHA.

A related question is whether a simpler approach that does not attempt to measure net benefits but concentrates of the issue of adequate investment in management to meet criterion (i) is useful for providing empirical guidelines to managers. Such an approach would not tell us anything about whether the flow of economic benefits from tourism is sustainable but would focus on maintaining natural capital. This approach could be termed 'sustainable use' or 'ecologically sustainable use'. This will also be explored in the case study.

5.2. An Economic Model of Tourism in Protected Areas

This section presents a model of tourism in protected areas which may be used in a normative role to develop policy for management of tourism. The model addresses maximising the net benefits of protected areas given the values arising from tourism and other uses of protected areas and the need to make trade-offs amongst these. This model is presented as a standard neoclassical approach and also with modifications necessary to pursue sustainability.

Economic analysis and tools can be applied to the question of 'What is the best level of tourism and recreational use of a protected area?' In this thesis it is recognised that in theory there can be several answers to this question depending upon the economic approach taken. The neoclassical economics approach to resource allocation is a normative use of economics aimed at maximising society's benefits — using a specific way of measuring benefits and costs. It is argued here that in order to pursue sustainable development in relation to tourism and recreation use of natural environments, the practices of neoclassical economics need to be modified. This is the subject of the next section. First, a model for maximising the benefits of use of a protected area using a standard neoclassical economics approach is presented.

5.2.1 A neoclassical approach to maximising the benefits arising from protected areas

If we were to consider the best use of an area of currently intact natural environment using a benefit cost analysis (BCA) approach, the aim would be to maximise the Net Present Value (NPV) of the use of the resources of the area in question. If no decision has been made on how to use the area, the analysis would need to proceed in two stages. In the first stage, it would be necessary to decide on feasible options — for example conversion to agriculture, logging for commercial timber, declaration as a protected area for conservation — and to value use in each of them. The second stage would be to compare options.

If use as a protected area is one of the options chosen for valuation in the first stage, it would be necessary to estimate the combination of allowed direct uses and indirect use values that would maximise net benefits arising from the protected area. Because a certain amount of direct use is generally considered consistent within a protected area, there are many options as to the combinations of use and management that may generate net benefits. The challenge is to find that combination which maximises net benefits. That exercise is the subject of the model presented shortly.

The second stage in a BCA would be to compare the net present value arising from use as a protected area with the net present value arising from any reasonable alternative uses of the land, chosen in stage one. The net present value of these alternatives would become the 'opportunity costs' of the protected area option. If no constraints have been placed on land use options, the use with the greatest predicted net present value would be chosen.

If the area of natural environment is <u>already</u> declared as a protected area (for example as is the Wet Tropics WHA), the BCA exercise becomes one of seeking out the combination of direct and indirect uses that confers the greatest net present value in this more constrained situation.

The following discussion focuses on calculation of the net present value arising from uses of the protected area. The uses include all those direct uses which are considered to be consistent with protected area status. As discussed in Chapter 2, the appropriate direct uses will vary with the class of protected area chosen. For the purposes of this discussion it is assumed that commercial tourism and recreation are the only permitted direct uses. The other major use of the protected area is assumed to be 'passive' use of non-market goods and services.

The Net Present Value (NPV) of net economic benefits arising from use of a protected area can be described by the following function:

$$NPV = \sum_{t=0}^{N} \{(CS_{Tt} + PS_{Tt}) + (CS_{Rt}) + PUV_t - MC_t\} \; 1/(1+r)^t \qquad [1]$$

where

CS_T is the consumers' surplus from tourism
PS_T is the producers' surplus of tourist service operators
CS_R is the consumers' surplus from private recreation
PUV are passive use values
MC are management costs.
r is the discount rate

Benefits of direct uses are measured in terms of any consumers' surplus and producers' surplus arising from the various direct uses allowed in the protected area. The consumers' surplus is the benefit derived by tourists from consuming a good or service, net of the cost of purchase. Producers' surplus arises if the costs of production are less than the price obtained for tourism services over some of the quantity of goods supplied.

Where there are commercial producers involved in delivering goods and services to consumers, both the production and consumption activities may deliver surpluses. In the case of private recreation, the visitors supply their own 'means of production' (Walsh 1986) and so only consumers' surplus is relevant for this activity.

Passive use values are the services from natural environments that do not arise from direct use. As discussed in Chapter 3, these include amenity services enjoyed from afar and life support services. The size of passive use values will be affected by any impacts of the permitted direct uses on the integrity of the natural environment and on the level of management inputs to contain impacts and restore values. Passive use values may change over time even if environmental conditions remain the same, as they are values placed by beneficiaries. These values may change with, for example, tastes, information, population growth and increasing scarcity of natural environments. The act of visiting a protected area may result in the visitors having increased existence, bequest and option values for that area, during their visit and in the future.

Management costs are the costs of those activities supplied outside the production processes of the various sectors, usually by government, in order to maintain some or all of the direct use and passive use values of the protected area.

For any combination of direct uses, management input and resulting passive use values, there will be a NPV of net economic benefits which is the discounted sum of net economic benefit values over time. The economically efficient pattern of uses is that which maximises the NPV.

There are several difficulties with the practical application of this model. It is difficult to establish the absolute value of passive use values at any time. The goods and services consumed by passive users include many of a public good or impure public good nature. The value of a public good is established by summing individual preferences vertically. It is often difficult however to elicit these preferences because no markets exist, and if they did, differential pricing would need to be adopted to account accurately for the different preferences of individuals. It is more usual to consider *changes* in the level of passive use values with a *change* in any other variable in the function. The methods which have been developed for estimating non-market or passive use values all consider the value of a change in the quality or quantity of environmental goods or services.

To apply the model in a dynamic sense, it is necessary to account for changes in the level of benefits flowing from direct and passive uses over time. To do this thoroughly, it would be necessary to incorporate several relationships between elements of the system. These relationships have been identified from the information in previous chapters. The relevant relationships are as follows, and none of them are necessarily linear:

a. the impact of visitors on the environment (impacts are likely to increase with increases in visitor presence — numbers and activities);
b. the impact of environmental damage on demand for visits (if impact is obvious to visitors, demand is likely to decrease with an increase in impacts, but displacement of environmentally sensitive visitors with less sensitive visitors may dampen any decrease);
c. the impact of visitors on visitors (termed the 'crowding effect', increases in visitor numbers and infrastructure may eventually lead to a decrease in visitor numbers, following the Butler cycle);
d. the capacity for expenditure on management to ameliorate environmental damage (increases in expenditure lead to decreases in damage, but thresholds may be reached where irreversible impacts can not be prevented);

e. the capacity for expenditure on management to ameliorate crowding effects (increases in expenditure can lead to decreases in perceived crowding, but thresholds may be reached where crowding can not be prevented);
f. the capacity for expenditure on management to increase benefits to visitors (by providing infrastructure and personnel that may increase the experience of individuals);
g. the capacity to raise funds for management from visitors (if funds are earmarked, an increase in visitor numbers will lead to an increase in revenue for management); and
h. the impact of fees on visitor numbers (increases in fees above low levels will generally lead to a reduction in demand).

The information requirements to model each of these separate relationships and then integrate them are high. In particular, modelling the environmental impacts of tourism would be a complex undertaking, given that 'tourism' is generally composed of a number of activities in a number of sites in a protected area.

However, the value of going to the trouble of modelling all these relationships using a standard neoclassical approach is questionable, if the aim of the exercise is to move towards sustainable tourism. If the neoclassical model is used, maximisation of the NPV for the protected area option will require trade-offs to be made between the possible direct uses of resources and passive use values. Within this approach, trade-offs will be required between the different levels of management investment and visitor benefits.

The neoclassical model is based on consumer sovereignty. Maximising the NPV of the sum of surpluses to individual consumers and producers arising from the various direct and passive uses of a protected area may result in direct uses which are not sustainable over time and in the degradation of critical natural capital. This will not be consistent with the 'strong sustainability' rule. The pattern of use may be consistent with the 'weak sustainability' rule if the rents are invested in other socially desirable capital, but will not even be consistent with weak sustainability if the earnings are spent on consumption goods. There is no guarantee therefore that maximum NPV will be consistent with maintenance of critical natural capital.

Measuring passive use values as the sum of individual values for natural environments will not guarantee that maintenance of the same level of value will be consistent with constant environmental quantity or quality. If the passive use value per unit of natural environment rises because of increasing population or increasing scarcity of natural areas, a declining quantity or quality of natural environment, even with a loss of critical natural capital, could deliver the same total economic values over time.

5.2.2 A model for sustainable tourism in protected areas

The most effective way to guarantee maintenance of critical natural capital is to impose constraints such that it must not be depleted by direct uses permitted. This is a form of 'safe minimum standards' approach to environmental management. This requires a modification of the neoclassical model as the target is set outside the model rather than internally. The approach then becomes one of 'constrained optimisation' of net economic benefits. The constraints are physical limits and regulations, rather than constraints on economic values. For example, constraints may include physical limits on areas open to tourism, limits on types of activities, regulations on how activities are to be conducted, and limits of acceptable environmental change set for particular sites.

An important aspect of the constrained model is a focus on the opportunity to invest in management to increase visitor benefits and to offset potential reductions in natural capital by the various direct uses. It is often possible to increase the level of direct uses that can occur with no lasting environmental impact by increasing the level of management in the form of prevention of impacts or rehabilitation (for example, following Dixon et al 1993). As long as impacts are not technically irreversible, the application of sufficient management funds can mean that impacts do not accumulate into future years. There is an efficient level of management beyond which the costs exceed the benefits, and there are thresholds beyond which impacts cannot be prevented. The link between use levels and investment in management is a point at which intervention to maintain critical natural capital can be made.

A model for sustainable tourism is developed from the basic model in Equation [1], as follows.

The surpluses ($CS_T + PS_T + CS_R$) are denoted as surpluses in use, SU. Passive use value is the measure of all non-use interests in the area. The sustainable management problem is represented as:

$$\text{Max NPV} = \sum_{t=0}^{N} \{SU_t (V_t) + PUV_t (V_t, M_t, E_t) - C_t (M_t)\} \; 1/(1+r)^t \qquad [2]$$

Subject to: $PUV_t \geq PUV_{t-1}$

where

- V is the visitation rate
- M is the management effort
- E is exogenous influences on PUV, for given V and M
- C is management costs

It is assumed that SU increases with V. As regards PUV, we are assuming that there is a tendency for it to decrease with increasing V, due to environmental impact of visitors (but it might also tend to increase if visitors derive increased PUV). Also with respect to PUV, impact can be ameliorated by management effort, and that for given V and M, PUV may vary with effects exogenous to the protected area, as noted above. It is assumed that management costs increase with effort M. According to this formulation, surpluses in use net of management costs are maximised, subject to non-declining PUV.

Now while [2] sets out the essential nature of the sustainable management problem, it is not operational. This is due to problems associated with assessing PUV as a function of the control variables V and M. In any case, given E in PUV_t (V_t, M_t, E_t), constant PUV is not necessarily the same as maintaining critical natural capital as understood as the purpose of the creation and management of protected areas, as discussed above. A more operational specification is:

$$\text{Max NPV} = \sum_{t=0}^{N} \{SU_t(V_t) - MC_{Ot}(V_t)\}\ 1/(1+r)^t \qquad [3]$$

where MC_O is the management cost of offsetting visitor based environmental impact in the protected area, assumed to be increasing with the visitation rate. MC_O is the amount of expenditure on management required to meet the condition of 'maintaining adequate investment in management'. Equation [3] in principle is operational in that costs of offsetting visitor impacts could be empirically related to visitor numbers, as could the variation of total use surplus. There are practical difficulties in generating empirical estimates of the variables, as will be discussed in subsequent chapters.

In order to meet criterion (ii), the results of surpluses minus management costs, SU_t-MC_{Ot}, in each year need to be positive and non-declining. The problem could be specified as:

$$\text{Max NPV} = \sum_{t=0}^{N} \{SU_t(V_t) - MC_{Ot}(V_t)\}\ 1/(1+r)^t \qquad [4]$$

Subject to: $SU_t > MC_{Ot}$

and $(SU - MC_O)_t \geq (SU - MC_O)_{t-1}$

In Chapter 9, this basic approach will be implemented in terms of considering, under different scenarios, the *conditional* NPV, denoted as NPV_C, associated with tourist and recreational use. NPV_C is the NPV that would result for sustainable tourism, *conditional* upon MC_O being invested in management. NPV_C is defined as:

$$NPV_C = \sum_{t=0}^{N} \{SU_t - MC_{Ot}\}\ 1/(1+r)^t \qquad [5]$$

But, the condition of investment in adequate management will be met only if governments ensure that allocations to management of protected areas are adequate. It is relevant to look at actual expenditure on management of protected areas to see if actual management budgets, MB, are equal to the required MC_O that is a necessary condition for sustainable tourism. It is possible that there will be a shortfall, S, of actual expenditure in relation to that necessary for sustainable tourism in the protected area, such that:

$$S = MC_O - MB \qquad [6]$$

If there is a shortfall, the condition of investment in adequate management will not have been met. The value of S tells us how much additional expenditure on management is required to meet the condition.

5.2.3 Approaches for analysis

It is the purpose of this section to outline the empirical analysis that is to be undertaken in the rest of this thesis to provide information for consideration of the questions addressed in this thesis.

In 5.1, the proposed criteria and conditions for sustainable tourism in protected areas were presented and it was pointed out that although the components of the criteria and conditions could be measured in principle, the practicality of measuring elements, and therefore being able to make the definition operational, needs to be tested in an empirical application. The elements that need to be tested through economic analysis are the ability to measure net economic benefits and to determine how much management effort is adequate. (The ability to set and maintain conditions to meet criterion (i) are not being tested quantitatively in this thesis).

The empirical analysis is undertaken in Chapter 9, using information gathered and analysed for the Wet Tropics WHA as reported in Chapters 6 to 8. The steps followed in the analysis in Chapter 9 are described briefly here to provide a rationale for how the rest of the study proceeds.

STEP 1

Adapting Equation [5] for the Wet Tropics WHA.

This model is modified for application in the Wet Tropics WHA. No consumers' surplus accruing to overseas tourists is included (see Section 5.3 for a discussion of the reason for this). No distinction is made between tourism and recreation, rather, consumers' surplus is included separately for Australian tourists and local North Queensland residents.

$$NPV_C = \sum_{t=0}^{N} \{(CS_{At} + CS_{Lt} + PS_{Tt}) - MC_{OWt}\}\ 1/(1+r)^t \qquad [7]$$

Where,

- CS_A is the consumers' surplus accruing to Australian tourists;
- CS_L is the consumers' surplus accruing to local North Queensland residents;
- PS_T is the producers' surplus accruing to tour operators in the Wet Tropics WHA;
- MC_{OW} is the expenditure required for adequate management of the Wet Tropics WHA.

Equation [6] is adapted to become:

$$S_W = MC_{OW} - MB_W \qquad [8]$$

Where

- S_W is any shortfall in funding for adequate management of the Wet Tropics WHA;
- MB_W is the actual management budget for the Wet Tropics WHA;

STEP 2

Quantitative values for the elements of the equations are estimated from data collected for the study, in the following way:

- CS_A calculated via the Travel Cost Method (TCM) (Chapter 8);
- CS_L not able to be estimated (see 5.3);
- PS_T not able to be estimated (see 5.3);
- MC_{OW} based on total costs of preventing or repairing damage, based on expert assessment (Chapter 6);
- MB_W via analysis of historical and proposed future management budgets (Chapter 6).

STEP 3

Analysis to find net economic benefits in the 'current' year (1994) is set up on an EXCEL spreadsheet. This is expanded to cover several years into the future — using the current year data to provide a 'baseline case'. The ability to discount is introduced and the *conditional* NPV is able to be calculated. It is possible to identify if there is a shortfall in management effort in any year(s). Sensitivity analysis to different values for some variables is possible.

STEP 4
Various scenarios for the future are investigated based on changes to the variables including:

- projected growth in visitor numbers to the Cairns Region and projected local population growth, leading to growth in visitor-days to the Wet Tropics WHA;
- a modification of that growth based on possible 'crowding effects' of increased visitor numbers;
- a change (decrease) in management budgets based on forward agreements by the Commonwealth and Queensland governments;
- different scenarios representing possible management responses to growth in visitor numbers.

STEP 5
The impact of the introduction of entry fees on visitor numbers is modelled, based on price elasticity of demand information, and implications for revenue raising and rationing use are investigated.

5.3 Information for the empirical analysis

Most of the data required for the case study of the Wet Tropics WHA had to be either collected from original sources and analysed, or assembled from published sources and further manipulated. In Chapters 6, 7 and 8, a number of tasks undertaken for the collection and analysis of data are described. These data are utilised in the modelling exercise in Chapter 9. The contents and rationale for the information presented in these chapters is discussed briefly in order to place the next three chapters into context.

Chapter 6 includes sections on environmental impacts of tourism and on management, particularly funding of management. In the first part of the chapter, consideration of the potential environmental impact of tourism in the Wet Tropics WHA, which was introduced in Chapter 4, is extended. In Chapter 4, it became clear that there is little useful information available on actual or potential environmental impacts of tourism in the Wet Tropics WHA in published sources, reflecting a paucity of targeted research on these issues. It was decided for the purposes of this study, to undertake a survey of scientists and managers familiar with the Wet Tropics WHA and with tourism use of the area. Their opinions were sought on the current and future levels of impacts and threats and their recommendations for avoiding impacts. The method and results of the survey are reported in Section 6.1. The information obtained is used to make an assessment of the status of current environmental impacts of tourism in the Wet Tropics WHA, that is used, in Chapter 9, to make a qualitative assessment of the situation in respect of criterion (i) for sustainable tourism. Information collected from scientists and managers is also used to assess the requirements for adequate management, developed further in Section 6.3.

In Section 6.2, the results are reported of analysis of historical data on expenditure on management of the Wet Tropics WHA, undertaken to extract expenditure on management of tourism. This information is used directly in the modelling exercise in Chapter 9. It is also used as a base on which to build an assessment of what expenditure is required to ensure, as far as possible, that adequate management is applied to avoid irreversible and cumulative environmental impacts of tourism currently and in the future. Supplementary data used to build up this assessment is drawn from the Draft Wet Tropics Plan, data assembled for the Wet Tropics WHA Ecotourism Strategy and expert opinion. The results of this assessment of requirements for adequate management are reported in Section 6.3 and used in the model in Chapter 9.

A survey of visitors to the Wet Tropics WHA was undertaken for this study. The methods and results are reported in Chapter 7 and Appendix E. The main aim of the survey was to collect economic data for use in the Travel Cost Method (TCM) reported in Chapter 8. In addition, data was collected on the demographics of visitors and their opinions on a number of aspects of their visits to the Wet Tropics WHA, and this information is interpreted in this chapter. The modelling and discussion in Chapter 9 draws upon information presented in Chapter 7, particularly in relation to attitudes to environmental quality and crowding effects. In the survey, questions were asked of overseas visitors on their willingness to pay entry fees, and reasons why they supported or disagreed with entry fees to pay for park management. The results of these survey questions are reported in Chapter 7. This information is used in Chapter 9 in making an assessment of the potential impact on this group of visitors of the introduction of entry fees.

Empirical analyses to estimate consumers' surplus and the price elasticity of demand for visits to the Wet Tropics WHA are reported in Chapter 8. These measures are essential inputs to the model used in Chapter 9. The consumers' surplus measure is used directly in the model in Chapter 9. The price elasticity of demand measure is used in Chapter 9 to assess the potential impacts on visitor numbers and revenue raised of introducing entry fees. These parameters were estimated using the TCM. In addition to seeking results via the TCM for use in further analysis, the approach in Chapter 8 explores aspects of the TCM. Some conclusions are drawn as to how the results of TCM should be interpreted, and as to the reliability of TCM based parameter estimates.

The consumers' surplus estimated in Chapter 8 is the consumers' surplus accruing to Australian tourists as a result of direct visits to the Wet Tropics WHA. It is relevant to discuss here both why the consumers' surplus for this group only was calculated, and why it pertains to direct visits only.

It is necessary in welfare analysis to define the population of relevance for the analysis. It is usual to adopt national boundaries for such analysis. In this study, national boundaries have been adopted for the measurement of consumers' surplus and producers' surplus, that is, we are measuring only direct benefits of visiting to Australians and producers' surplus accruing to Australian businesses. Thus consumers' surplus accruing to visitors from overseas is not relevant to the assessment of benefits to visitors to the Wet Tropics WHA. The relevant estimates of producers' surplus are any surpluses accruing to operators in the Wet Tropics WHA providing trips to visitors from overseas, to Australian tourists and to local residents.

Practical difficulties of applying TCM to the population of visits from overseas are a secondary reason for not undertaking a TCM for this group. It will become obvious from the analysis reported in Chapter 8 that application of TCM to overseas visitors would be of dubious value given the small number of overseas visitors and relative to the large populations in overseas 'distance zones'. Other Australian practitioners (for example, Stoeckl 1994) have not included overseas visitors when using the TCM. However application of the TCM to international visitors has been reported in the context of visitors to African Game Parks (Mungatana & Navrud 1994).

It was intended to undertake a separate TCM for local residents of North Queensland using the data set of the *1993 WTVUS* (Manidis Roberts et al 1994). The variables on which information was collected appeared to be sufficient to apply TCM to local residents, but not tourists from other parts of Australia. Therefore, a survey of Australian and overseas tourist was undertaken for this study, but local residents were not surveyed. When the data set from the *1993 WTVUS* became available for analysis (after the conduct of the visitors survey), it was discovered that travel patterns by local residents were not amenable to use of the TCM, at least in its traditional mode. The survey revealed that for any site in the Wet Tropics WHA, the majority of local resident visitors originated from the nearest town or settlement. In addition, for any town or city origin point, the majority of visits were made to the nearest rainforest site. Therefore there was no opportunity to use the distance zone approach on which TCM is based. Estimates of the measures of consumers' surplus or price elasticity of demand were therefore not obtained specifically for local residents. It would be interesting to pursue a means of applying TCM or a similar approach to the pattern of visits made by local residents, but this is a matter for more research and is beyond the scope of this study. An estimate of consumers' surplus for local residents is made in Chapter 9, based on the results for Australian tourists.

The consumers' surplus measures sought and reported in this study are surpluses arising from the opportunity to visit the Wet Tropics WHA directly. These are direct use values. They are not intended to include surpluses arising from the enjoyment of existence, bequest and option values, which it is believed accrue to a much larger group of people that those who directly visit. An economics interpretation of protected areas is that they provide for the continuing 'supply' of passive use values. As long as criterion (i) is upheld, passive use values might be expected to remain constant, or to rise as discussed above. The approach taken in this study of adopting safe minimum standards, expressed as criterion (i), is consistent with the intent of management of the Wet Tropics WHA. The intent of management is to allow, and perhaps optimise, that level of tourism that is consistent with the primary objective of conservation. It therefore is not necessary to place a dollar measure on the value of conservation to produce a continuing stream of passive use values. The use of the contingent valuation method (CVM) would be the appropriate approach if passive use values were to be measured, but as they are not, this methodology was not employed.

The remaining value to be measured for inclusion in the model is producers' surplus accruing to tourist operators dependant upon the Wet Tropics WHA. The first stage in measuring producers' surplus is to define which operators should be included, those working in the Wet Tropics WHA or a broader group whose business depends fully or partially on visitors to the Wet Tropics WHA. The second stage is to derive empirical estimates of producers' surplus per visitor-day, for use in the model. The task of deriving empirical estimates of producers' surplus accruing to the different types of operators working directly in the Wet Tropics WHA was difficult given the time and resource available for this study and so a zero value is used in the model in Chapter 9. A discussion of the concept of producers' surplus arising from tourism in the Wet Tropics WHA is reported in Appendix F.

Having set up the approach to economic analysis in this chapter, the empirical part of this study proceeds in the following chapters.

CHAPTER 6
ENVIRONMENTAL IMPACT AND MANAGEMENT

The aim of this chapter is to present information collected on environmental impacts of tourism in the Wet Tropics WHA and current management of impacts, and to present an assessment of what might be required for 'adequate' management in the future.

The results of the literature review on environmental impacts of tourism in the Wet Tropics WHA were reported in Chapter 4. The literature search revealed scant published information on this issue, which was surprising given that tourism is now the main direct use of the area. The information available was certainly not sufficient to make an assessment of the current status of tourism impacts, if any exist. In order to investigate the matter further, the author undertook a survey of scientists and managers with expertise and experience in the Wet Tropics WHA, to seek their opinions on environmental impacts of tourism and their management. The methodology and results of the survey are reported in Section 6.1.

The funding to date of management of the Wet Tropics WHA was analysed to separate out expenditure on management of tourism. The findings are reported in Section 6.2.

An assessment of what might be required for 'adequate' management of tourism now and in the future was developed based on the interviews with scientists and managers, analysis of future plans for management and further discussions with management agencies. Projections of future expenditure required to achieve 'adequate' management are based on historical funding data and information from management agencies. Results are reported in Section 6.3. In Section 6.4, conclusions from this chapter are presented.

6.1 CURRENT AND POTENTIAL FUTURE ENVIRONMENTAL IMPACTS AND MANAGEMENT OF TOURISM

6.1.1 Survey of scientists and managers

Tourism in the Wet Tropics WHA consists of a range of activities which occur at different intensities, at a range of sites which have different ecological properties and different degrees of hardening. Any scientific assessment of the total impacts of tourism in the Wet Tropics WHA would need to take into account tourism at all these locations and therefore would be a complex undertaking. There is no such assessment existing for the Wet Tropics WHA. There is very little published information on scientific research relating tourism presence to environmental indicators at any location in the Wet Tropics WHA. There are few published observations for the Wet Tropics WHA by recognised experts on environmental impacts of tourism.

There are however a number of scientists with expertise in ecology, botany, zoology and geography undertaking research on aspects of the environment of the Wet Tropics WHA. Some of these people are undertaking research specifically on human use - environment interactions and have published their results. Other scientists have a good knowledge of the natural environment and their opinions on the possible impacts of tourism, observations on where impacts may be occurring and opinions on how to prevent impacts, are valuable.

The three main management agencies, WTMA, QDEH and QDPI-FS, as well as some Local Government Authorities, are taking actions meant to avoid, minimise or repair impacts of tourism. Such actions include planning, management of commercial tour operations, design and construction of infrastructure and maintenance of sites. People involved in this type of work have a knowledge of potential impacts of tourism, what they are doing to try to avoid impacts and their success or otherwise. This knowledge is rarely documented in published works. The condition of sites is currently 'monitored' via observation or crude indicators rather than rigorous scientific monitoring. The results of the informal monitoring that does occur are not in the public domain.

It was decided that the best way to tap into the knowledge of the scientists and managers was to conduct personal interviews. A survey of scientists and managers was designed to effect this task. The information sought from the respondents to the survey was both fact and opinion. The results should be interpreted in the light of this approach, that is, much of the information is in the form of opinions.

The aims of the survey were to:

- seek the opinions of respondents on the current significance of environmental impacts of tourism at the scale of the Wet Tropics WHA;
- identify any specific impacts of tourism the respondents could nominate, by location, species, activity etc.;
- seek the opinions of respondents on whether any irreversible impacts had occurred, or were in the process of occurring;
- seek the opinions of respondents on the potential future impacts of tourism, with growth in visitor numbers;
- identify management actions that are in place to avoid, minimise or repair impacts and seek comments on the adequacy of management;
- seek comment on management actions that might be needed in the future;

- seek comments on the adequacy of research and monitoring of the impacts of tourism, and;
- identify any published scientific research on the impacts of tourism and/or its management not already identified, or any unpublished research due for release.

Survey methodology

The approach chosen for the survey was to interview a number of individuals expected to be knowledgeable about the subject. The selection was made to include officers of the management agencies in positions dealing with tourism and its management, scientists working directly on human - environment interactions, and heads of research organisations. Scientists qualified in ecology, botany, zoology and geography were interviewed. This was not an exhaustive survey of all people who have an interest in tourism or its management in the Wet Tropics WHA. The aim was to concentrate on science and management. Interviews were conducted with 15 people. Their names and positions are reported in Table 6.1. A small number of other people contacted with a request for an interview were not available.

The interviews were originally intended to be based on a structured set of common questions aimed at collecting information to meet the aims of the survey. A survey form was designed to facilitate this. The questions were all designed to be open-ended. The approach of using the survey form was abandoned soon after interviews commenced. Respondents were often not prepared to answer questions outside their areas of expertise and some felt uncomfortable with the range of questions proposed. Interviews were therefore conducted with the researcher asking questions, following the common questions devised, but without obviously using a survey form. The majority of time in each interview was spent concentrating on the area of expertise of the respondent. Interviews lasted around an hour to an hour and a half. All interviews were conducted by the researcher. All responses were recorded in writing at the time. The approach taken complies with the type of interview technique described by Carr (1994) as 'semi-structured'.

The author undertook to keep reporting of the views expressed anonymous. This approach was chosen to encourage people to speak frankly. It allowed employees of management agencies to express their views without having them attributed to the agency and allowed scientists to give informed speculation about questions that have not been subjected to scientific testing.

Table 6.1: Scientists and managers interviewed on impacts of tourism in the Wet Tropics WHA

Expert	Position	Organisation	Field of expertise
Mr Max Chappell	Manager of Planning	Wet Tropics Management Authority	Regional planning
Dr Steven Goosem	Senior Principal Scientist	Wet Tropics Management Authority	Ecology, Plant ecology
Dr Nicki Goudberg	Consultant		Ecology of mammals
Dr Andrew Graham	Principal Scientist	CSIRO, Tropical Forest Research Centre	Rainforest ecology, recreation impacts
Mr Lee Hess	Recreation Planning	Queensland Department of Primary Industries Forest Service	Tourism and recreation planning and management
Dr Mike Hopkins	Head of Office	CSIRO, Tropical Forest Research Centre	Rainforest ecology
Professor Jiro Kikkawa	Director	Cooperative Research Centre for Tropical Rainforest Ecology and Management	Ecology, Ornithology
Mr Les Moore	Research Scientist	CSIRO, Tropical Forest Research Centre	Ecology of rainforest animals
Mr Tim Nevard	Coordinator	Ecotourism Strategy Task Force	Urban and regional planning.
Dr Tony Norton	Research Fellow	Centre for Resource and Environmental Studies, Australian National University	Management of ecosystems
Mr Mike Prociv	Project Officer, Commercial Permits	Queensland Department of Environment and Heritage	Tourism and recreation planning and management
Dr Steve Turton	Lecturer in Geography	Department of Tropical Environments and Management, James Cook University	Rainforest dynamics, recreation impacts
Mr Gary Werren	Consultant		Rainforest ecology
Mr Doug Wilson	District Manager, Wet Tropics	Queensland Department of Environment and Heritage	Conservation management
Mr Peter Valentine	Senior Lecturer in Geography	Department of Tropical Environments and Management, James Cook University	Recreation impacts and management

Survey findings

Interviews were conducted to concentrate on the area of expertise of the individual being interviewed. This report of the survey findings has been structured under a number of headings. Not all respondents were asked about each topic, or in a number of cases had no comment to make on the topic. The summaries below therefore do not represent the views of all 15 respondents. The number of respondents represented is indicated for each topic. It is possible that respondents whose views were not obtained on a topic might disagree with the thrust of the summaries.

The reporting is not in terms of averages. In many cases a point made by only one respondent is reported. In some cases, a consensus of opinions occurred and this is reported. Where there was obvious disagreement amongst respondents on an issue, this is noted. The greatest area for disagreement was over the effectiveness of management approaches taken by different land management agencies.

To preface the summaries of responses, it is worth noting that all respondents were familiar with tourism in the Wet Tropics WHA. They were aware that the direct physical extent of tourism use of the area is a small percentage of the area. All respondents were aware of current management of tourism and all expected management at some level in the future. All respondents considered that the extent of impacts of tourism depended on the level and effectiveness of management.

A number of respondents talked about direct and indirect impacts. The use of these terms was not necessarily consistent across respondents. The majority of respondents who used the term 'direct' were referring to the impacts of construction of facilities and the daily presence of tourists being transported within the Wet Tropics WHA and participating in activities including walking, rafting and spotlighting, at hardened and non-hardened sites. Illegal activities undertaken for recreation were also included as direct impacts. Introduction of weeds and disease, or at least an increased risk of this, was included as a direct impact. Indirect impacts mentioned included the flow-on ecological impacts of direct impacts; for example the ecological impact of loss of cassowaries through road kills, or the impacts on aquatic fauna through erosion. A number of respondents included the range of impacts on the Wet Tropics WHA by off-site developments which can be attributed to tourism, as indirect impacts of tourism.

A number of respondents were very concerned about the amenity aspects of current tourism use and potential growth in visitor numbers. In their view, the amenity of areas has been reduced by the presence of tourists and tourism facilities and they expected that loss of amenity would continue to occur with growth in visitor numbers.

Opinions on the current significance of the environmental impacts of tourism on the scale of the Wet Tropics WHA. *(12 responses)*

There was acknowledgment by all respondents that tourism is one of a number of processes potentially threatening changes to the natural environment of the Wet Tropics WHA. Tourism impacts were not seen by any of the respondents to particularly stand out from the range of threatening processes identified for the area. No significant impacts such as species loss or loss of a habitat type were attributed to tourism in particular, with the possible exception of the Lake Eacham rainbow fish (see below).

Only six respondents gave clear opinions on the scale of current tourism impacts. Four of these were of the view that, on the scale of the Wet Tropics WHA, the direct impacts of tourism are minor. The impacts of tourism were seen as minor in comparison with natural sources of change and other sources of impact; logging in the past and influences from outside the Wet Tropics WHA. The other two respondents considered that tourism was causing cumulative impacts that might well become significant in the future.

Respondents from management agencies did not offer an opinion on overall significance of tourism impacts but expressed opinions that impacts could be significant, if not for management undertaken in the past and currently.

Information about specific impacts of tourism (13 responses)

When asked about specific impacts of tourism, some respondents talked about impacts while others focused on management to prevent or repair impacts. Information on the latter has been grouped under a heading on management.

Tourism has direct impacts in the form of clearing for roads, car parks, tracks, day use sites and camping areas. Given that this is not generally thought significant on the scale of the Wet Tropics WHA, the question is 'Does clearing directly threaten rare and threatened species or habitats?' The presence of numerous endemic species, some with small total populations, means clearing can potentially have significant impacts. Clearing of vegetation for the construction of visitor facilities is known in at least one instance to have included destruction of 9 of 21 known plants of an endemic species (the species was later found to have a wider distribution). A case of a 'near miss' where a rare plant species was found to be located next to a cleared area was reported.

Illegal collecting of specimens of rare flora occurs in the Wet Tropics WHA. Species targeted are small plants or seedlings of trees. They include tassel ferns, orchids, epiphytes, hoyas, ant plants and idiospernum seedlings. It is believed that rare species are deliberately targeted by serious collectors but other plants are taken opportunistically by visitors. It was suggested that the access made available for tourism has been utilised by illegal collectors. One respondent observed that the species targeted would not generally have major flow-on ecological impacts, with the exception of the ant plant which is host to the Apollo Jewel butterfly.

Impacts on fauna generally raised greater concern amongst respondents. Vertebrate fauna may be disturbed by human presence but it is difficult to observe fauna to monitor what the impacts of tourism are. The Wet Tropics WHA contains a number of rare species of fauna which are vulnerable to a range of threats so any impacts of tourism add to pressures on individuals, local populations and species.

One specific instance of a species made extinct in the wild has been attributed to tourism. The Lake Eacham rainbow fish was once endemic to Lake Eacham (which is in the Wet Tropics WHA) and is now only represented by a captive population at a research station. The introduction of predator fish species to Lake Eacham, reportedly to add interest to the lake for the enjoyment of visitors, caused the extinction in the wild. The fish in captivity have lost all aversive behaviour and it is believed that reintroduction to the lake would not be successful.

There is concern about the effects of tourism on fauna directly targeted for wildlife viewing. There are a small number of specialist commercial tours which seek out fauna, to be observed by day or night, the latter often using spot lights. Declines in populations of golden bower birds, in areas where tour groups have been observing bowers and mating displays by male birds, have been reported. It is thought that the presence of humans prevents successful mating. Golden bower birds are endemic to the Wet Tropics WHA and are now listed as threatened. Guidelines for tour operations have been developed to minimise disturbance to breeding birds.

Nocturnal spotlighting of arboreal mammals is undertaken by small tour groups. The impacts of spotlighting have not been researched. Concern was expressed by a number of respondents on the potential impact of spotlighting. One possible impact suggested is expansion of the area inhabited by some species of arboreal mammals at the expense of others which are more sensitive to human presence. Guidelines on tour practices are imposed by QDPI-FS.

Cassowaries are vulnerable in the rainforests inside and outside the Wet Tropics WHA, due to a range of influences including clearing, fragmentation and road kills. Respondents were of the view that most road kills were due to local traffic, not tourism. No respondent gave an assessment of any impacts of tourism specifically. Indirect impacts through clearing, including for tourism facilities, outside the Wet Tropics WHA is a major threat to the cassowary population.

Other impacts arising from tourism activities nominated by respondents included:
- aircraft noise disturbing birds and bats;
- horse riding tours introducing weeds;
- river bank erosion associated with rafting and wildlife cruises;
- bush camping using firewood and introducing pollution to waterways; and
- mountain bikes causing track erosion

Impacts associated with facilities included:
- seepage of human waste from septic tanks into waterways;
- poor track construction leading to erosion;
- badly located facilities placing pressure on vulnerable sites; and
- import of soil and untreated wood for construction increasing the risk of introduction of weeds, pests and diseases.

A number of recreational activities are banned in the Wet Tropics WHA in order to prevent unacceptable environmental impact but respondents reported they continue to occur illegally in places. These include collecting flora and fauna, off-road driving in vehicles and on motor bikes, pig shooting and taking dogs into the area.

Opinions on irreversible impacts *(9 responses)*

Some respondents were asked if they considered that irreversible impacts were occurring due to tourism in the Wet Tropics WHA. This question prompted a discussion of what change might be classified as irreversible. A number of respondents were of the opinion that the expansion of tourism and installation of facilities was itself an irreversible process and that the presence of facilities in turn attracts yet more visitors. Some of this concern was clearly for loss of amenity values, in addition to concerns about environmental impacts of continual growth in visitor numbers. Managers amongst the respondents pointed out that if necessary, facilities could be removed and areas rehabilitated. Boardwalks in particular are designed to minimise trampling impacts and can be pulled out.

The possibilities of reversing local losses of populations of flora and fauna were of concern to respondents. It was accepted that cleared areas could be revegetated quite successfully. One respondent stated that if the right trees are put in the right combination in the right place, the ball is set rolling to re-establish ecological processes. It was recognised that this is not restoration of what was there before, as every area has a unique assemblage of flora (and associated fauna). One respondent put it that it is a philosophical issue whether this is 'reversal'. In the case of rare and threatened flora, it was pointed out by a number of respondents that it is technically possible to clone plant tissue from living specimens and therefore retain a diverse gene pool. This of course requires action before the original plants are lost.

Re establishment of populations of fauna where local extinction is threatened or occurs is more problematic. Captive breeding is an option. In the few cases where it has been tried for Wet Tropics WHA species it has been successful for some species (cassowaries) and not for others (frog species). Successful reintroduction of animals depends upon eliminating the processes that caused extinction in the first place and captive bred individuals having appropriate behaviour for survival in the wild. Long term survival of populations may be hampered by a reduced gene pool as a result of captive breeding . The process is expensive and uncertain. One respondent argued that funds would be more effectively spent on conserving populations in situ.

One respondent was of the view that any disturbance is irreversible and that it is important to retain some areas not visited to provide reference areas for scientific research and a precautionary approach to conservation.

Opinions on potential future significance of environmental impacts of tourism - with growth in tourism *(12 responses)*

All respondents considered that tourism has the potential to cause impacts and considered management the most important determinant of what future impacts might be. All respondents expected management to occur in the future, but some were more optimistic than others that management would be adequate. There are two dimensions of adequate management, management at a site level and management to set the overall location, number of sites and total area of the Wet Tropics WHA which will be available for tourism.

Some respondents were not concerned about potential future significant impacts of tourism because they were of the opinion that impacts of tourism are not now and are not likely to be significant. Reasons for this view included the opinion that tourism impacts are not significant compared with other sources of environmental change in the Wet Tropics WHA. Other respondents were of the opinion that management would successfully set appropriate limits and keep to these limits.

A larger number of respondents were concerned that even with management of the current type, significant impacts could occur in the future. Reasons given were that management targets the direct impacts of tourism but we know little about indirect impacts and how to manage them. Indirect impacts of tourism, including from off site tourism sources, were considered by a number of respondents to be widespread and to be degrading the environment of the area. Pressure to upgrade and widen roads was a potential direct impact of concern to a number of respondents.

A number of respondents were concerned that planning for tourism is not based on ecological principles. For example, one respondent pointed out that the location of sites visited is determined by the existing road network. If a clean slate approach were able to be taken, this respondent would place the Cape Tribulation area into high priority conservation, not available for tourism. The tendency for tourism to be attracted to ecologically special areas was noted by a number of respondents. This could lead to potential clashes with conservation interests in the future. A number of respondents nominated the mountain summit zones as areas of particular ecological concern. These areas are likely to be attractive to tourism due to views and interest in rare habitats.

In view of the concern about current impacts of spotlighting and wildlife viewing, the potential impact of growth in this activity was of concern to many respondents. Anything that adds to pressure on cassowary populations was of concern to many respondents.

There were conflicting views about the desirability of increasing the number of sites available to visitors. A considerable effort is currently underway via the development of an Ecotourism Strategy to identify new sites to take the pressure off existing sites (particularly north of the Daintree River) and to accommodate expected growth. This exercise has the support of management agencies and the tourism industry. The majority of the managers interviewed were of the view that this is the best approach to accommodate growth while minimising impacts through careful site selection and provision of facilities. Other respondents were concerned that expansion of tourism adds to the cumulative impacts of tourism, and may threaten sensitive sites. Some were of the view that the provision of additional facilities generates further growth in demand.

No definitive idea of an appropriate upper limit to the total area of the Wet Tropics WHA that should be available for tourism was given by any respondent.

Identify management actions that are in place to avoid/minimise/repair impacts, are they adequate? *(13 responses)*

Many of the management actions in place were so familiar to respondents and seem so logical that they did not comment upon them. Management responses in place are presented in the next section.

Questions on management tended to bring out respondents' opinions on problems with management, or information on latest developments. The management agencies came under criticism from some of the respondents. Criticism ranged from specific issues to frustration with a seeming lack of coordination between the three agencies, WTMA, QDEH and QDPI-FS.

A number of respondents mentioned that hardening of sites, particularly via boardwalks is a positive move in management. The large amount of capital works over recent years was generally seen as positive in minimising environmental impacts. There were some criticisms of the capital works program. A number of respondents were of the opinion that facilities were over engineered, wasting money that could be better spent on other aspects of management. The Maardja boardwalk in the Cape Tribulation area was praised by a number of respondents for its quality, but some of these same people thought it located in too sensitive an area.

Although there has been a large injection of funds into the Wet Tropics WHA for capital works, funding for other management was considered inadequate by a number of respondents, including managers from one of the management agencies. These managers were of the view that tourism growth in recent years had outstripped their capacity to respond effectively. The capital works program has provided a much needed catch-up in facility upgrading and expansion, but funds for maintenance are not considered adequate. A number of respondents were of the opinion that there are too few field staff. Lack of funding for overtime means field staffing on the weekends, when local residents visit the area, is low. A lack of staff for planning and policy development is one source of delay in developing management plans. A number of respondents expressed a concern that funding in the future, following completion of the capital works program, is likely to reduce.

Management planning to determine limits to tourism use on an area wide basis and at sites was supported by all respondents. Frustration was expressed by many at the delay of more than one year in the release of the Draft Wet Tropics Plan[1]. Draft area plans

[1] The Draft Wet Tropics Plan was not released at the time of the interviews. It was released for public comment in October 1995.

developed for National Parks have been held up pending release of the Wet Tropics Plan, so there is no basis for setting limits in National Parks. In contrast, QDPI-FS have decided on limits to use of sites under their jurisdiction, based on a Recreational Opportunity Spectrum approach, and are managing to these limits. Some respondents see management planning as lacking a sufficient ecological base, as discussed earlier.

The development of an Ecotourism Strategy was seen as a positive move to address a gap in planning for tourism in the Wet Tropics WHA.

In response to concerns about the impact of wildlife viewing on the wildlife, limits on visitor numbers and guidelines for viewing have been developed. A number of respondents, while welcoming the response, were concerned at the lack of research to develop scientifically based responses. They point out that very little is known about these animal populations, impacts of human presence or effectiveness of management.

Opinions on research[2] and monitoring[3] for management (11 responses)

Research and monitoring was one aspect of management of tourism identified as not being actively pursued in terms of the contribution that could be made to management of tourism to minimise impacts. As reported above, there is very little published research on this issue. The interviews revealed that there were a few studies in progress or planned to address; trampling effects on tracks, golden bower bird populations and the sensitivity of arboreal mammals to human presence. QDPI-FS undertakes rudimentary monitoring of sites by observation. There was no evidence of monitoring by QDEH.

One respondent who was the head of a research organisation commented by way of background that there is very little research anywhere on impacts of tourism in rainforests, very little research in Australia on the impacts of tourism and very little research on impacts of tourism in the Wet Tropics WHA. A number of scientists emphasised the importance of understanding ecological processes in the rainforest before the impacts of particular activities, such as those associated with tourism can be interpreted. The focus of research by the CSIRO, the Rainforest Cooperative Research Centre, Universities and research funded by the WTMA is on identifying the components of the rainforest system and understanding ecological processes.

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2 Research can include experimental treatments to represent actual human use, comparison of an area with known use levels against a baseline and research into effectiveness of methods for data collection and analysis.

3 Monitoring requires regular collection of information on defined indicators.

Managers expressed frustration at a lack of research on whether management practices are working. Managers are interested in using the limits of acceptable change (LAC) approach in site management but had no information on what indicators of change to select and how to measure them. It was emphasised by scientists that before monitoring could be effective, research is required into what to monitor and methodologies for monitoring.

Priorities for research nominated included; fauna targeted by wildlife viewing, indirect impacts of tourism and effectiveness of management practices. One respondent argued that in order to conserve endangered species the urgency was for action now, based on present knowledge of threats, rather than more research.

Opinions on management actions needed in the future *(13 responses)*

A list of all the management actions suggested was compiled from the interviews. This is in no order of priority:

- implement management planning;
- finalise and implement an Ecotourism Strategy;
- make tourism planning more ecologically sensitive;
- direct tourists to less sensitive and hardened sites where this is compatible with their enjoyment, specifically develop facilities at alternative sites to take growth pressure off the Daintree/Cape Tribulation area;
- provide adequate funds for development of new facilities;
- provide adequate funds for maintenance of facilities;
- provide adequate funds for management planning;
- provide adequate funds for field staff;
- develop limits of acceptable change criteria for sites;
- undertake targeted research on impacts of tourism;
- implement a monitoring program for sites;
- maintain limits against pressure for change;
- increase education and enforcement to reduce illegal activities;
- develop conditions for wildlife viewing in the light of research; and
- apply a true precautionary approach where tourism expansion is dependent on demonstration that impacts are acceptable.

Observations on survey findings

It is not possible to present a consensus view on any of the topics covered in the survey because not all 15 respondents gave a view on each topic, and there were a range of opinions expressed on some of the topics. Nevertheless it is possible to take an overview of the responses. The following is my interpretation of the responses to the survey.

No respondents were greatly alarmed that tourism was currently threatening the integrity of the natural environment of the Wet Tropics WHA as a whole. One group of respondents was reasonably relaxed with what they knew of the current impacts of tourism, given steps being taken to manage impacts. The other respondents were concerned about specific impacts, general indirect and cumulative impacts and/or a lack of knowledge about impacts. Given the predictions for continuing growth in visitor numbers, some respondents were still relaxed about our ability to contain impacts to acceptable levels. The remainder of respondents were concerned about implications for the integrity of the Wet Tropics WHA, or at least particular locations and ecosystems within it. Some respondents nominated parts of the Wet Tropics WHA where they thought tourism should be prohibited or current use reduced.

All respondents acknowledged the role of management in determining how impacting tourism will be now and in the future. No respondents were of the opinion that tourism is so benign that it doesn't require management. The respondents' views on what was required for adequate management and their faith that it would occur, influenced their views on threats posed by tourism. Even those respondents who were relaxed about future growth in visitor numbers were so on the proviso that management would be in place and adequate.

Several respondents spoke about the challenge of keeping management up with the demands of growth in tourism. The recent large expenditure on capital works was seen as a catch-up exercise to meet the demands of growth over the last decade. There was concern that the catch-up required on other facets of management has not yet occurred, for example the delays in implementing planning. This concern led to concern for the future with predicted growth in visitor numbers and a reduction in funding for management. Several respondents noted that QDEH in particular is not 'on top' of the growth that has occurred in tourism.

From amongst the responses to the survey, several areas where current management was seen to be lacking were identified. The timeliness of management planning was seen to be a problem with delays in the development and implementation of the Wet Tropics Plan and management plans. Funding for elements of management apart from capital works was criticised by a number of respondents as being too low to allow effective management which keeps pace with growth in visitor numbers. The lack of research and monitoring of the impacts of tourism was seen as a problem by many respondents.

Managers in particular would like to adopt a limits of acceptable change approach to site management but do not have the information or resources to do so.

The responses to the survey broadly indicate that there is a necessity to improve on current management to have a chance of attaining sustainable tourism, for visitor numbers at the time of the survey, and in the face of growth in demand.

Finally, some points which are the researcher's interpretation of some issues are included. One respondent only made the following point about use of the precautionary principle in a clear manner but it encompasses views less clearly stated by some others. Application of the precautionary principle would see expansion of tourism only if it is shown by research or monitoring that expected tourism impacts are acceptable. For example, in the case of the golden bower birds where numbers are crudely observed to be in decline, strict application of the precautionary principle would see a cessation of permission to visit bowers until research has established whether there is a problem and how to avoid it (it may be necessary to conduct visits to some bowers as part of the research). The action claimed to be precautionary by one management agency has been to develop guidelines to limit access to bower sites, but this has not been accompanied by a monitoring program. This is better than the other management agency has done but is not the same thing as strict application of the precautionary principle.

No overall view as to limits to tourism at the Wet Tropics WHA scale or at the site scale was elicited from any respondent, with the exception of one.. This one respondent thought there was already too much tourism as amenity had been lost, but he said he did not have enough information to judge the significance of biophysical impacts. All other respondents took the approach that limits depended on the management in place. They all implicitly supported the process of ongoing planning to determine limits based on biophysical information and the views of interested parties.

The insights gained from the survey of scientists and managers are used in developing a model of what might be adequate management of tourism for the Wet Tropics WHA and this is presented in Section 6.3.

6.2 Funding of visitor management in the Wet Tropics WHA

The model of sustainable tourism in protected areas requires information on expenditure on managing tourism and recreation, in terms of both the actual expenditure on management and expenditure required to achieve what might be described as 'adequate management'.

In this section, the historical expenditure on management of tourism and recreation, hereafter termed 'visitor management', in the Wet Tropics WHA is described[4]. The published reports of the WTMA do not separately identify expenditure associated with visitor management. An exercise was undertaken to extract information on this expenditure from the unpublished records of funding of individual projects, held by the WTMA. Because of the joint funding arrangements, the WTMA keeps complete records of expenditure by the WTMA, QDEH (now DoE) and QDPI-FS (now DNR).

The exercise involved firstly identifying what categories of expenditure should be attributed to visitor management in the Wet Tropics WHA and secondly, separating out expenditure in the identified categories from the records of the WTMA. The methodology used and detailed results are described in Appendix E.

The categories of expenditure included were:

- construction of infrastructure for visitors, including access roads, visitor facilities, visitor interpretive centres, interpretive and directions signs;
- maintenance of infrastructure for visitors;
- staffing related to providing services for visitors;
- research directly related to visitor management;
- a proportion of management planning; and
- a proportion of corporate support overheads.

The proportion of expenditure on management of the Wet Tropics WHA that can be attributed to visitor management was about one third of all management expenditure (between 32% and 37%) for most years, but climbed to 52% in 1991-92. Total expenditure on visitor management is shown in Table 6.2.

Over the period 1990-91 to 1994-95, a total of $10.2m was spent on construction and maintenance of facilities for visitors. Of this amount, $5.1 m was spent on capital works and $5.1m was spent on maintenance of facilities, (see Table 6.3). Services covered by recurrent funding, included staff, vehicles and fuel, management planning, research and administration. The total amount spent on such services, excluding construction and maintenance of infrastructure, is shown in Table 6.4.

[4] Unless otherwise referenced, the information in this section was derived from the files of the WTMA. I am indebted to the WTMA for allowing access to the files.

Table 6.2: Total expenditure on visitor management in the Wet Tropics WHA, 1990-91 to 1994-95

	1990-91 $'000	1991-92 $'000	1992-93 $'000	1993-94 $'000	1994-95 $'000
Visitor man. Recurrent cash	783	3 338	1 836	3 067	1 652
Visitor man. Recurrent in-kind	925	1 910	1 594	1 189	809
Visitor man. Capital	0	959	998	1 575	1 795
Visitor man. Total	1 708	6 207	4 428	5 830	4 255
Visitor man. % of WTWHA	37%	52%	33%	36%	32%

Source: constructed from data held by the Wet Tropics Management Authority

Table 6.3: Expenditure on construction and maintenance of visitor facilities in the Wet Tropics WHA, 1990-91 to 1994-95

	1990-91 $'000	1991-92 $'000	1992-93 $'000	1993-94 $'000	1994-95 $'000	Total $'000
Capital works Visitor Facilities	0	757	688	783	526	2 754
Capital works Road Upgrades	0	0	240	395	348	983
Capital works Visitor Centres	0	55	0	487	862	1 404
Recurrent cash Infrastructure maintenance	35	1 639	830	1 576	772	4 853
Recurrent cash WH signs	0	14	0	158	37	209
Total	35	2 465	1 758	3 399	2 545	10 203

Source: Constructed from data held by the Wet Tropics Management Authority

Table 6.4: Expenditure on visitor management (excluding infrastructure) in the Wet Tropics WHA, 1990-91 to 1994-95

	1990-91 $'000	1991-92 $'000	1992-93 $'000	1993-94 $'000	1994-95 $'000	Total $'000
Expenditure excluding infrastructure	1 672	3 742	2 670	2 431	1 710	12 225

Source: Constructed from data held by the Wet Tropics Management Authority

The expenditure on construction and maintenance of visitor infrastructure represented a program to upgrade facilities to cope with increased visitor numbers. Construction projects were also dispersed throughout the Wet Tropics WHA in an attempt to provide employment and facilities in areas where the community was disadvantaged by the cessation of logging. Examples include the upgrade of the road to Wallaman Falls in the south and construction of the Ravenshoe Visitors Centre on the Atherton Tablelands. Expenditure on maintenance of visitor facilities was spread throughout the visitor sites in the Wet Tropics WHA. Maintenance funds were spent by both the QDEH and QDPI-FS in the northern and southern regions of the Wet Tropics WHA on works such as walking track maintenance, access road maintenance and facility repair. As will be demonstrated in Section 6.3, this expenditure has not completed the work assessed as being needed on visitor infrastructure.

Visitor facilities including campsites, lookouts, toilets, tracks and carparks were constructed in at least 28 locations in the Wet Tropics WHA. The most expensive project was development of a camping site and day use area at the Goldsbrough Valley at a cost of over $300 000. Redevelopment of a number of camping and day use sites was completed. Typical costs for facilities were $50 000 to $60 000 for toilet blocks using composting toilets, $30 000 for carpark sealing, and $60 000 to $90 000 for parking and signage at major lookout points. An example of the cost of boardwalks are several currently planned for Cape Tribulation with budgets of around $200 000 (these are outside the Wet Tropics WHA, funded by the Daintree Rescue Package) (WTMA 1995d).

A program was undertaken to install visitor centres in and around the Wet Tropics WHA. The 17 sites were selected to service the greatest number of visitors and so include airports and popular road stops adjacent to the Wet Tropics WHA. The visitor centres range from display panels installed in existing buildings to purpose built information centres. The most ambitious project was a purpose built visitor centre constructed at Ravenshoe, at a cost of $264 900. Smaller installations consisting of several panels ranged in cost from $20 000 to $30 000. The visitor centre program represents a significant increase in the interpretative information available to the public.

There was no explicit expenditure on monitoring that could be related directly to visitor management in the Wet Tropics WHA. The QDPI-FS had a program of limited monitoring of site quality but not including monitoring of ecological indicators (DPI-FS 1994). The WTMA funded a small number of research projects in 1993-94 relating directly to visitor management, at a cost of $17 000 (CRC-TREM 1994). A possible alternative source of funding of research and monitoring for the Wet Tropics WHA is the Cooperative Research Centre for Tropical Rainforest Ecology and Management. However perusal of the research projects and consultation with the Director in 1995 revealed no completed research directly related to management of tourism and/or recreation but that a small number of projects were ongoing or commencing (Kikkawa J. 1995, pers. comm.).

The modelling exercise in Chapter 9 requires building a baseline scenario which projects conditions in 1994 forward for 10 years, and building some alternative scenarios. The actual expenditure or forward budget for visitor management is one variable in the model. For the baseline scenario, one choice is to chose an average of actual expenditure in 1993-94 ($5.829m) and 1994-95 ($4.254m) with the result being $5.041m. Alternatively an average of the expenditure over the four years to 1994-95 could be taken, in order to account for the 'lumpy' nature of expenditure on capital works over that period. The four year average is shown in Table 6.5. The average of $5.180m was chosen to represent expenditure in 1994.

Table 6.5: Total and average expenditure on visitor management 1991-92 to 1994-95, by funding type

	Total for 4 years $'000	Average per year $'000
Recurrent cash	9 893	2 473
Recurrent in-kind	5 501	1 375
Capital	5 326	1 332
Total	20 720	5 180

Source: constructed from data held by the Wet Tropics Management Authority

Conversion to a per visitor-day figure involved dividing the annual average expenditure by the number of visitor-days. The estimated number of visitor-days is 3.4m (see Chapter 4), and sensitivity analysis has also been undertaken with half that number. The results, and the contributions of recurrent and capital costs, are shown in Table 6.6.

Table 6.6: Current annual average cost of visitor management, per visitor-day

	Per visitor-day 3.4m vd $	Per visitor-day 1.7m vd $
Recurrent	1.13	2.26
Capital	0.39	0.78
Total	1.52	3.04

Source: constructed from data held by the Wet Tropics Management Authority

For the purposes of the baseline scenario in Chapter 9, the figure used for management budget (MB), is the historical four year average expenditure on visitor management of $5.18m, which translates into $1.52 per visitor-day, assuming 3.4m visitor-days.

The forward budgets for 1995-96 and 1996-97 represent a cut in funding for management of the Wet Tropics WHA, and therefore a cut in funds available for visitor management, assuming that expenditure ratios are maintained. Alternative scenarios developed in Chapter 9, incorporating likely future budgets for visitor management, would need to account for the trend for decreased funding from government. The relationship between budgets for all Wet Tropics WHA management and visitor management, assuming that visitor management continues to be funded at one third of the total budget, is shown in Table 6.7. The figures for 1994-95 are actual expenditure and for 1995-95 and 1996-97 are forward budgets. It should be noted that the Queensland government's 'in kind contribution has to date been higher than that indicated in the forward budget, so forward budgets may underestimate actual expenditure'.

The Commonwealth and Queensland Governments have been unable to settle on a new three year agreement for funding, although the stated intention is to develop such an agreement. In the absence of a forward agreement, it may be reasonable to project the 1996-97 level of funding forward for future years. This is done in one scenario modelled in Chapter 9.

Table 6.7: Projected budgets for visitor management

	1994-95 $'000	1995-96 $'000	1996-97 $'000
Wet Tropics WHA management	12 072	10 414	6 151
Visitor management	4 255	3 471	2 050

Source: constructed from data held by the Wet Tropics Management Authority

The new approach of reduced funding from consolidated revenue will <u>not</u> in the short term be offset with revenue raised from users. In September 1996, the Queensland Government announced that park use fees for all Queensland National Parks would be introduced from 1 March 1997. This decision was reversed in December 1996. The system proposed was for revenue raised to accrue to the DoE for distribution according to priorities determined by the Department. The implications for funding of the Wet Tropics WHA were difficult to predict. There were a number of unknowns in terms of:

- how much revenue would be raised from visitors to the Wet Tropics WHA;
- how much of this revenue would be allocated to the Wet Tropics WHA; and
- whether contributions from consolidated revenue would be further cut.

The impact of introducing fees is modelled in Chapter 9 and the issue of the potential for funding visitor management from revenue raised is discussed further in that chapter.

6.3 An assessment of funding for adequate management, now and in the future

The aim of this section is to make an estimate of the expenditure required for management of tourism and recreation in the Wet Tropics WHA that can meet the definition of 'adequate management' in the context of the overall definition of sustainable tourism in protected areas. In Chapter 5, it was proposed that adequate management is management that prevents limits of acceptable change being reached, with an emphasis on ecological limits. It is perhaps not conducive to good management to try to separate out visitor management from the overall management task for meeting the goals of the Wet Tropics WHA, however the emphasis here is on the contribution to overall management funding that should be made because of the presence of visitors in the Wet Tropics WHA.

Adequate management is not simply a matter of funding - it must include employing effective approaches, as discussed in Chapter 2 and discussed briefly here with respect to the Wet Tropics WHA. But to employ effective approaches, adequate funding is required. Adequate management could include a number of strategies. Management planning to specify which areas are and are not available for visitor use is an important starting point. Specifying limits of acceptable change for visitor sites and associated areas or systems that may potentially be impacted by visitor presence, is vital to the approach of maintaining critical natural capital. This would require planning and research to set limits, and monitoring of performance against those limits. Adequate management would encompass preventative measures including the provision and maintenance of infrastructure to direct the presence of visitors to specified areas and minimise impact in those areas. Other strategies including providing information to give visitors an appreciation of the value of the area and education on minimising their impact may be useful. Adequate management may also include rehabilitation of sites and the implementation of species recovery programs. There is no evidence that tourism and recreation are the sole or major cause of species becoming threatened in the Wet Tropics WHA, however as human presence (including outside the Wet Tropics WHA) is contributing to threats to species, some contribution to prevention and rehabilitation measures through visitor management is warranted.

An important aspect of adequate management would be the adoption of principles of adaptive management, including the ability to close sites or discontinue activities if it appears that limits of acceptable change are being reached. It is important in adaptive management to also review the limits set, periodically or in the light of findings from research and monitoring. The ability to close sites or discontinue activities that are popular and profitable for the commercial tour industry requires a degree of authority to be vested in management agencies and possibly political will on the part of Ministers. This process will be easier to implement if it is a stated clear intention of management to act this way if necessary. In particular, any system of issuing permits to commercial operators to visit sites must have provision for withdrawal of permission by the management agency. Agencies are often reluctant to do this as it implies that payment of compensation may be requested. It would be possible however to develop a system that includes auctioning the rights to permits and retention of some of the funds raised from auction against the possibility that compensation would be required. There is no such system operating in protected areas in Australia.

Ironically, the ability of management agencies to prohibit, limit or discontinue use that they suspect may be threatening limits of acceptable change (or if they are concerned that limits that were set in the past are too generous) may be challenged if there is some research and monitoring effort, but scientific evidence is not conclusive. This type of problem has been recognised internationally and is addressed by the 'precautionary principle' which suggests that lack of scientific evidence is not a reason to not take a precautionary approach. In Australia, protected area management agencies may be tied up in defending their precautionary type decisions in the Administrative Appeals Tribunal or in court[5]. The ability of management agencies to effectively invoke the precautionary principle is an issue that goes beyond the Wet Tropics WHA.

The question of whether there should be upper limits on the annual number of visitors to the Wet Tropics WHA cannot be answered here. The overall management approach, in terms of areas that should be off-limits to visitors and areas that should be available for people to visit, will be set in the Wet Tropics Plan. Development of the Plan is a result of integration of scientific information and public opinion on what is the desirable overall balance between preservation and use. The delays in development of the initial Wet Tropics Plan are partly due to trying to reach a consensus on this balance. The final form of the Plan is not available at the time of writing, but is likely to place the vast majority of the area of the Wet Tropics WHA off-limits to all but self reliant visitors. The ecological limits to visitor numbers at individual sites will depend upon the nature of the site itself (presence or absence of rare or threatened species, soil type, hydrology, vegetation type etc), the type of activities undertaken by visitors and provision of infrastructure to minimise ecological impacts.

There are a number of sites in the Wet Tropics WHA where management agencies have limited or rationed visitor use. There are limits placed on the number and frequency of

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[5] For example, the Great Barrier Reef Marine Park Authority has defended several decisions in the Administrative Appeals Tribunal, at considerable cost to the agency. All of the cases have been dropped by proponents before being determined.

visits to sites for spotlighting nocturnal marsupials. At the Curtain Fig Tree, tour operators are limited in the time they can spend at the site, and parking facilities are deliberately kept to the current size to limit independent visitors. This is a relatively small site and crowding rather than ecological damage is the reason for the limits (the provision of board walks has prevented potentially fatal damage to the tree of trampling on the root area).

The precinct north of the Daintree River is one of the most popular and also one of the most ecologically important and vulnerable parts of the Wet Tropics WHA. The moratorium on increasing the permitted capacity of tour operators was placed in recognition that current use was perceived by many (including the then Minister for the Environment) to be high. Significant infrastructure has been put in place to minimise ecological impacts, including sealing the road and construction of boardwalks and toilets. The issue for this area is not only of preventing ecological impacts but also of determining and maintaining the appropriate recreational setting. This must be an issue for public debate and it is intended to approach this by developing an Area Plan for the area.

In the meantime, in anticipation that the setting preferred for the Daintree area will be predominantly natural, managers and tour operators are looking to take pressure off the area and direct growth into other areas inside and outside the Wet Tropics WHA. One vehicle for that is the development of an Ecotourism Strategy for the forested areas of the region. The Ecotourism Strategy project is a joint project of the WTMA, DoE, DNR and tour operators, in consultation with other stakeholders including Aboriginal communities. An assessment was conducted of all sites with visitor access and/or infrastructure within the Wet Tropics WHA and in forested areas outside the WHA, and of potential visitor sites within and outside the Wet Tropics WHA. The assessment included an inventory of existing access, facilities, interpretive information and directional signage. Recommendations were then made as to the preferred future recreational setting and visitor use of each site, in the overall context of all opportunities available. An assessment of the infrastructure requirements, if any, was then made. The results of the Ecotourism Strategy have not yet been made public. Preliminary information from the assessment of site requirements was made available for use in this study and is used to develop a future management strategy.

Current management of the Wet Tropics WHA can be assessed as less than adequate on a number of counts. Respondents to the survey of scientists and managers were concerned with the lack of research and monitoring on the impacts of tourism. The assessment of sites carried out for the Ecotourism Strategy found a number of sites degraded from use, in particular those with no facilities such as made walking tracks.

Upgrading of some existing high use sites is also recommended. Staff of land management agencies interviewed generally voiced concern at not having enough staff or funds for an adequate presence in the Wet Tropics WHA. In particular, managers commented that the immediate pressure placed on resources by visitors to the Wet Tropics WHA including the need to maintain visitor sites, meant that other activities, such as monitoring and eradication of weeds and feral animals, were not given the priority that managers thought they deserved.

The respondents to the survey of scientists and managers identified a need for continued management of the area if growth in visitor numbers is to be accommodated without unacceptable impacts.

The assessment here of requirements for funding for adequate management is organised in several steps. The first step is to develop a description of adequate management for the baseline scenario. This requires an assessment of what would be required to bring current visitor management up to a level that could be described as 'adequate' according to the following criteria:

- provide and maintain visitor infrastructure to minimise the environmental impact of visitor presence;
- provide interpretive and educational information at sites to encourage responsible use;
- conduct a regular site monitoring program;
- conduct research directed to minimising visitor impacts;
- provide adequate field presence for all aspects of visitor management;
- provide management planning for visitor sites; and
- provide administrative support for these activities.

The focus of these criteria is on minimising environmental impact, or maintaining critical natural capital. The survey of visitors reported in Chapter 7 revealed that crowding is not currently an issue for the vast majority of visitors to the Wet Tropics WHA, so adequate management of the current level of visitors need not address crowding specifically.

In step one, existing management is supplemented by:

- upgrading of sites and facilities as required;
- increase in field presence as required; and
- introduction of a research and monitoring program for visitor management.

Step two is to develop strategies for 'adequate' future visitor management that take account of projections that visitor numbers will increase, and perhaps double over the period from 1994 to 2003. Two future visitor management strategies are developed.

Strategy 1.

- Visitor presence is confined to existing sites - these sites are upgraded as required, the research and monitoring program is expanded as required and other management activities are increased as required.

Strategy 2.

- Additional sites[6] are opened up to visitors - existing sites are upgraded as required and access and facilities are provided to new sites, the research and monitoring program is expanded as required and other management activities are increased as required.

These management strategies were developed by the author, informed by the raw data for the Ecotourism Strategy. As the Ecotourism Strategy has not been released, there is no documented interpretation on whether the estimates of infrastructure requirements are based on proposed maximum visitor numbers for each site, and what these might be. Several assumptions were made therefore in developing management strategies 1 and 2. It is assumed that management strategy 2 would accommodate the projected medium and high growth rates of visitor numbers to the year 2003. It is not possible to say whether the strategy would more than accommodate a doubling of visitor numbers. It is also assumed that if these higher levels of growth are to be accommodated within management strategy 1, it could mean crowding effects would set in. A limit may need to be placed on visitor numbers to prevent environmental damage if management strategy 1 were to be followed by the management agencies. Possible impacts of crowding and environmental limits are simulated in Chapter 9.

Step three is to assess what extra management facilities and activities would be required to meet adequate management under these two strategies, and to calculate what funding additional to the projected actual funding would be required.

The actual management budget is assumed to be as represented in Table 6.8, based on the average expenditure to 1994, the budgets for 1995-96 and 1996-97 (taken as calender years) and projecting the 1996-97 budget of $2.050m forward.

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[6] It is also possible that increased visitor numbers could be diverted to sites outside the Wet Tropics WHA. However, this would also require the provision of adequate management, so it is assumed that strategy 2 covers the costs of either diverting visitors to sites outside the Wet Tropics WHA or to additional sites within the Wet Tropics WHA. Only the latter option is discussed here.

Table 6.8: Projected actual management budget 1994 to 2003

	1994 $'000	1995 $'000	1996 $'000	1997 $'000	1998 $'000	1999 $'000	2000 $'000	2001 $'000	2002 $'000	2003 $'000
Budget	5 180	3 471	2 050	2 050	2 050	2 050	2 050	2 050	2 050	2 050

The following is the assessment of what additional funding is required to achieve adequate management in all the years from 1994. The assessment includes capital works, research and monitoring and all other management activities, and is brought together in a single table at the end of the section.

Capital works

Information used in this section has been drawn from the raw data for the Ecotourism Strategy[7]. All interpretations are my own and should not be interpreted as representing draft or final conclusions of the Strategy. Only sites within the Wet Tropics WHA have been included in here.

The capital works program of the first half of the 1990's provided upgraded and new infrastructure in many sites. This needs to be at least maintained. An assessment of maintenance costs of 5% to 10% of new/replacement cost per annum has been suggested for use in the Ecotourism Strategy.

The assessment of currently visited sites undertaken for the Ecotourism Strategy identified that many of these sites needed upgrading or the provision of new infrastructure to prevent further degradation, given current levels of use. In addition, some sites not currently in use were identified as potential sites to accommodate increased visitor numbers.

In Table 6.9, the current status of sites and status if the Ecotourism Strategy were fully implemented is summarised. The works required for full implementation of the Ecotourism Strategy are described in Table 6.10.

Table 6.9: Status of visitor sites within the Wet Tropics WHA

	Current status of sites	After full implementation of the Ecotourism Strategy
Sites with no facilities	40	16
Sites with low key facilities	3	9
Sites with facilities	62	80

Source: unpublished data from the Wet Tropics Ecotourism Strategy

[7] The author is grateful for the opportunity to use this raw data.

Table 6.10: Site development suggestions for Ecotourism Strategy

Site development suggestions	Number of sites
Retain with no existing facilities	16
Retain with low key facilities*	1
Existing facilities** adequate	32
Upgrade from low key facilities to facilities	2
Upgrade existing facilities	30
Develop new low key facilities, currently none	8
Develop new facilities, currently none	16
Undetermined	5
Total sites	110

* 'low key' facilities include some vehicle control, bollards, location signage.
** 'facilities' include all other infrastructure in any combination.
Source: unpublished data from the Wet Tropics Ecotourism Strategy

In addition, the raw data for the Ecotourism Strategy includes an assessment of the quality or presence of; access from the nearest road to sites, interpretation signs at sites and direction signs from roads, and suggestions for road upgrades and new signs. Road upgrades are suggested in 6 cases, provision of interpretation signs on site for 51 sites and direction signs for 29 sites. It is important to note that for a number of sites, it is suggested that no directions signs be provided, in order to retain the low key nature of use.

The replacement value of existing sites has been very conservatively estimated at $10.525m[8] (not including access roads, interpretation displays or location signs). The higher maintenance cost estimate of 10% per annum is used in this exercise, partly because it is known that the estimate of capital value is conservative and also because this is more likely to provide adequate management. This translates into an annual maintenance cost of $1 052 500 per annum.

The cost of upgrades and new sites has been estimated at a total of $5.976m, plus an additional 25% for planning, assessment and approvals, giving a total of $7.259m. Adding the cost of road upgrades, interpretive signs and direction signs gives a total of $8.290m. Should all the additional facilities be constructed, the annual maintenance cost for all existing and new facilities would be a minimum of $1.753m.

The raw data for the Ecotourism Strategy has been developed with a view to accommodating current visitor numbers and reducing damage at sites where this is occurring, and accommodating up to a doubling of visitor numbers.

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[8] This estimate for most sites is based on using a new replacement value for the minimum size of each type of facility at the site, eg 4 cubicle toilet block, 10 space car park, but does not take into account how many toilet blocks or car park spaces etc are on site.

The baseline requirement for adequate management is assessed to include sufficient funding for capital works to upgrade high use sites as identified in the raw data for the Ecotourism Strategy and to maintain existing and upgraded sites. The sites identified as requiring upgrading are; Cape Tribulation, Noah Beach north, Marrdja Boardwalk, Mossman Gorge, Barron River Power Station site, Lake Barrine, Curtain Fig, Lake Eacham, Mt Hypipame, Josephine Falls, Henrietta Creek, Tully Gorge Camp, Tully Falls, and Wallaman Falls. The cost of upgrading these sites is estimated conservatively at $1.614m. Assuming this work was accomplished over three years, the average cost per year would be $537 000. For the baseline case, it is acknowledged that capital works were undertaken in 1994 and 1995, so the additional funding is assumed to be needed from 1996.

Future management strategy 1 is assumed to require upgrading of facilities at all 30 sites where upgrades are suggested, and provision of access roads, interpretive signs and direction signs as required at all these sites. The capital costs are $4.796m. It is assumed this is implemented over five years from 1996, at a cost of $959 200 per year.

Future management strategy 2 is assumed to involve the full implementation of the suggested Ecotourism Strategy. The capital costs are $8.289m. It is assumed this is implemented over five years from 1996, at a cost of $1.657m per year.

The annual requirements for capital for new works and maintenance are shown in Table 6.11.

The raw data for the Ecotourism Strategy does nor address general maintenance of roads used by visitors, and this leads to an underestimate of the total capital works that would be required for visitor management. An issue that should be addressed in the context of adequate visitor management is the condition of the unsealed road from Cape Tribulation to Bloomfield, and the environmental impact of erosion from that road. This issue was not addressed by the Ecotourism Strategy. The road is used for tourism and recreation and for transport by local residents. An assessment has been made for the WTMA of the cost of erosion mitigation. The cost of undertaking engineering works to minimise erosion from the Cape Tribulation to Bloomfield road and reduce the environmental impact through revegetation and weed reduction in some areas, but not seal the road, has been estimated at $3.2 million with $200 000 thereafter for annual maintenance (NRA 1994). Assuming that half of the use of the road is for tourism and recreation, the cost attributable to management of tourism is therefore half of the assessed mitigation cost. The cost of upgrading this road, over three years, is included in the baseline and both future management strategies.

Table 6.11: Assessment of additional funding required for adequate funding for capital works

	1994 $'000	1995 $'000	1996 $'000	1997 $'000	1998 $'000	1999 $'000	2000 $'000	2001 $'000	2002 $'000	2003 $'000
Baseline New works	0	0	537	537	537					
Baseline Maint.	0	0	1052	1106	1160	1214	1214	1214	1214	1214
CT-B road	0	0	800	800	100	100	100	100	100	100
Baseline Total	0	0	2390	2243	1797	1314	1314	1314	1314	1314
Strategy 1 New works	0	0	959	959	959	959	959			
Strategy 1 Maint.	0	0	1052	1148	1244	1340	1436	1530	1530	1530
CT-B road	0	0	800	800	100	100	100	100	100	100
Strategy 1 Total	0	0	2811	2907	2303	2399	2495	1630	1630	1630
Strategy 2 New works	0	0	1 657	1 657	1 657	1 657	1 657			
Strategy 2 Maint.	0	0	1052	1218	1384	1550	1714	1880	1880	1880
CT-B road	0	0	800	800	100	100	100	100	100	100
Strategy 2 Total	0	0	3509	3675	3141	3307	3471	1980	1980	1980

Research and monitoring

The WTMA has funded a limited amount of research on the impacts and management of tourism and recreation in the Wet Tropics WHA, but this is not sufficient to address questions about impacts of current visitor use. The lack of a targeted research and monitoring program to address visitor use of the Wet Tropics WHA is a current inadequacy in management.

A proposed program could include an ecological research component to; develop monitoring methodologies, interpret results of monitoring, conduct manipulative research into impacts of particular activities, conduct longitudinal research, and interpret the results of other ecological research in terms of implications for visitor management. A dedicated field team could conduct regular monitoring of sites and other attributes. This research would address criterion (i) of the criteria for sustainable tourism. It may be complemented by research into social and cultural aspects of tourism in the Wet Tropics WHA to address criterion (i). In addition, research into psychological and economic aspects of tourism and recreation would be necessary to address criterion (ii).

An indicative budget for the research and monitoring program is shown in Table 6.12. To be 'adequate' the program would have commenced at least by 1994. The baseline monitoring budget considered adequate for the current level of visitors is shown in the first row of the Table. It is based on spending the first two years developing the approach for the monitoring program and commencing monitoring in the third year. The monitoring program could employ a Director and researcher, with two field staff joining half way through the second year for training[9]. The field staff would be a permanent monitoring team. The proposed monitoring program could be assessed by an expert workshop in the second year and results assessed by expert workshops every five years.

Table 6.12: Assessment of additional funding required for adequate funding for research and monitoring

	1994 $'000	1995 $'000	1996 $'000	1997 $'000	1998 $'000	1999 $'000	2000 $'000	2001 $'000	2002 $'000	2003 $'000
Baseline Monitoring	400	512	525	525	525	525	625	525	525	525
Baseline Research	200	200	200	200	200	200	200	200	200	200
Baseline Total	600	712	725	725	725	725	825	725	725	725
Strategy 1 Monitoring	400	512	525	525	525	525	625	525	525	525
Strategy 1 Research	300	300	300	300	300	300	300	300	300	300
Strategy 1 Total	700	812	825	825	825	825	925	825	825	825
Strategy 2 Monitoring	400	625	750	750	750	750	850	750	750	750
Strategy 2 Research	300	300	300	300	300	300	300	300	300	300
Strategy 2 Total	700	925	1050	1050	1050	1050	1150	1050	1050	1050

The amount of research that could be suggested for visitor management in the Wet Tropics WHA could be unlimited, at least in the first few years where there is justification in undertaking research to catch up on the lack of effort to date. A pragmatic approach has been taken here, limiting the research funds to $200 000 per year for the current level of visitors.

For future management strategy 1, the expenditure on research has been increased to $300 000 per year to research issues of more intensive site use. An additional monitoring effort would be required to cover the extra visitor sites introduced in future management strategy 2. It is estimated that an extra two field staff would be employed.

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[9] Costs are calculated as salaries with a multiplier of 2.5 to cover overheads, accommodation and vehicles. The salaries suggested are; Director $70 000, researcher $50 000, senior field officer $50 000 and assistant field officer $40 000. An initial capital grant of $100 000 is included for office establishment and equipment. The cost of an expert workshop is assessed at $100 000.

Management activities

The historical expenditure on visitor management, that is not construction or maintenance of infrastructure, was reported in Section 6.2. The actual expenditure in 1994-95 was $1.709m. This category of expenditure includes staff in the field, vehicles and fuel, equipment, interpretive materials and activities, management planning, a small amount of research and administration. Interviews with land managers identified general concern that there were too few rangers in Parks and that limited funding meant that priority was placed on immediate rather than long term needs[10]. Managers were however reluctant to nominate what might be adequate presence in Parks or adequate levels of funding for other management activities. The reduction in the budget in 1996-97 in particular is likely to exacerbate the perceived problems of insufficient funding for management. Currently, infrastructure maintenance and research are funded from the recurrent budget, represented by the $2.050m available for 1996-97. If additional funding for capital works and research and monitoring were provided as suggested above, this would make all of $2.050m available for other management costs. This translates to $0.60 per visitor day at 3.4m visitor-days.

In the absence of good information on what might be adequate expenditure on other management activities, it is assumed for the baseline case that the current level of funding up until 1995-96 is adequate and the 1996-97 amount of $2.050m is also adequate.

If visitor numbers increase, there is likely to be a need for greater ranger presence in the field in the Wet Tropics WHA, with all the associated costs. If visitor numbers are concentrated in existing sites, as in strategy 1, the needs will be for higher maintenance of sites (more regular rubbish disposal, more monitoring of camping, more weekend presence etc). Alternatively, if the number of sites with facilities are increased, as in strategy 2, more rangers will needed to be stationed in, or regularly visit more sites.

In the absence of good information on what might be adequate future expenditure on other management activities, it is assumed for the two strategies, (i) that funding in 1994-95 and 1995-96 is adequate and (ii) that from 1996-97 onwards (indicated as 1996 in the model), the costs of other management activities are equal and that they increase linearly with visitor numbers. A nominal amount of $1 per visitor-day has been assumed. Costs are estimated in the model in Chapter 9 according to the number of visitor-days being modelled. The additional costs for adequate management are the costs assessed per visitor-day minus the $2.050m assumed budgeted. An example is

[10] Examples given of results of funding restrictions included; the need to chose between providing toilet paper in Parks and other conservation management activities, and not having rangers present in the Parks on the weekends.

given in the Table 6.13, based on 3.4m visitor-days in 1994, growing at the medium projected growth rate (see Chapter 9 for an explanation of growth rate projections).

Table 6.13: Assessment of additional funding required for adequate management, other management activities, (example assuming 3.4 million visitor-days in 1994, growing at the medium projected growth rate)

	1994 $'000	1995 $'000	1996 $'000	1997 $'000	1998 $'000	1999 $'000	2000 $'000	2001 $'000	2002 $'000	2003 $'000
Other man. Baseline	0	0	0	0	0	0	0	0	0	0
Other man. Strategy 1	0	0	1828	2035	2300	2571	2868	3194	3554	3950
Other man. Strategy 2	0	0	1828	2035	2300	2571	2868	3194	3554	3950

Total additional funding for adequate management

The total additional funding requirements to achieve adequate management, based on the assumptions made above, are shown in Table 6.14. It is worth noting that the estimate is of the same order as expenditure on visitor management in the first half of the 1990s (see Table 6.2). The recommended distribution of funds is somewhat different with some dedicated to research and monitoring.

Table 6.14: Assessment of total additional funding required for adequate management, (example assuming 3.4 million visitor-days in 1994, growing at the medium projected growth rate)

	1994 $'000	1995 $'000	1996 $'000	1997 $'000	1998 $'000	1999 $'000	2000 $'000	2001 $'000	2002 $'000	2003 $'000
Baseline Total	600	712	3115	3168	2522	2039	2139	2039	2039	2039
Strategy 1 Total	700	812	5464	5785	5428	5795	6288	5649	6009	6405
Strategy 2 Total	700	925	6387	6778	6491	6928	7489	6224	6584	6980

6.4 Conclusions

This chapter included the results of two different investigations – the survey of scientists and managers and the analysis of expenditure on visitor management. The results of both these investigations were drawn together in the assessment of funding required for adequate management. The survey of scientists and managers was conducted because there has been insufficient research work to allow any conclusions to be drawn on the impacts of tourism in the Wet Tropics WHA. While some respondents were concerned about specific impacts at present, all respondents were of the view that management would be crucial to any chance of accommodating continuing and expanded visitor use within ecological limits.

The analysis of expenditure on visitor management revealed that generally about one third of the annual budget of the WTMA had been dedicated to this activity. The reduction in funding in the past two years is a cause for concern, as visitor numbers are predicted to continue to grow.

The assessment of adequate future funding incorporated information from the two investigations plus raw data from the Ecotourism Strategy. It was fortunate that the raw data was available. However, as no final report has been released, the interpretation of the raw data by the expert group involved in the development of the Ecotourism Strategy was not available. The assessment in Section 6.3 is therefore solely the opinion of the author. It was assessed that the funding required for adequate management is in the order of that provided in the first half of the 1990s, with a dedicated amount to be spent on research and monitoring, and total funding increasing in line with increases in visitor numbers. The amounts projected for different management strategies and visitor growth rates are used in the analysis in Chapter 9.

CHAPTER 7
VISITORS TO THE WET TROPICS WHA

A source of original data for this study is a survey conducted of visitors to the Wet Tropics WHA. The survey was conducted primarily in order to collect expenditure and willingness to pay data for the economic analysis using the travel cost method (TCM). Other information necessary for the economic analysis was the means of travel to North Queensland and demographic and attitudinal data used in the travel cost analysis. Other characteristics of visitors were sought to generally describe the sample of visitors surveyed and compare the sample with other data sources to evaluate the representativeness of the sample obtained. Another important use of the data collected was to interpret perceptions of current visitors towards crowding or environmental damage, in reference to the question of whether visitor perceptions may or may not act to limit use to sustainable levels.

It was necessary to conduct this survey as none of the other sources of data available on visitors to the Wet Tropics WHA or to North Queensland provided the information necessary for the economic analysis planned. The survey was limited to Australian tourists and visitors from overseas. Local residents who visit the Wet Tropics WHA were not included in this survey. This was because it was thought there was sufficient data in the data base of the *1993 WTVUS* (Manidis Roberts et al 1994) to apply travel cost analysis to that group of visitors.

The methodology employed for this survey is described briefly and evaluated in Section 7.1. More detail on methodology is included in Appendix E, along with copies of the questionnaires used. Selected results are presented in Section 7.2, but again more detail is included in Appendix E, which reports demographic and related characteristics of the survey sample (and compares these results with results from other survey where possible). The attitudes of visitors to crowding and environmental impacts is discussed in Section 7.2. Visitors from overseas were asked about their willingness to pay entry fees to the Wet Tropics WHA and the results are presented in this section. Further analysis of economic and demographic data was undertaken for the application of the TCM, which is the subject of Chapter 8. Conclusions are presented in Section 7.3.

7.1 Conduct of the Visitor Survey

After consulting existing sources of data available on visitors to North Queensland and the Wet Tropics WHA, it became evident that a survey was required to provide the data needed for economic analysis. Details of the survey design and methodology are given in Appendix E and summarised here. The questionnaires used are reproduced in the Appendix.

The survey targeted Australian tourists and tourists from overseas, not local resident visitors. It was explained in Chapter 5 that it was thought that there would be sufficient information on visits by local residents in the *1993 WTVUS* to allow a travel cost analysis, and so resources were not devoted to collecting additional data on this group.

The survey design focused on collecting information for economic analysis, as well as demographic data required for travel cost analysis, and information on visitors' attitudes to their experience of visiting the Wet Tropics WHA. The range of questions asked was developed based largely on other surveys conducted for analysis using the TCM. The sampling strategy was developed based on the results of other surveys which cast light on issues such as seasonality and locations visited. Reconnaissance in North Queensland identified the need to take different approaches to surveying independent visitors and visitors on commercial tours. The former group were interviewed face to face at locations in the Wet Tropics WHA. Visitors on commercial tours were surveyed by distributing questionnaires with reply paid envelopes, at the commencement of tours. The survey was piloted and both the questionnaire and survey strategy were amended before being administered.

Interviews and distribution of questionnairs were conducted over the period August to October 1994. The research undertaken during the survey design indicated it was not necessary to survey in more than one season and that this period was optimal. Targets were set for the number of valid interviews and returns and, although not met for some sub-groups, the overall number of valid responses provided a satisfactory data set. The response rates for the sub-groups surveyed are listed in Table 7.1. Although the response rate for Australian visitors on tours was low at 37%, this is still acceptable for a survey without follow up (Blamey 1995).

Table 7.1: Survey response rate

	Survey Method	Responses coded	Response rate
Australian independent visitors	Personal interview	339	80%+
Australian visitors on tours	Self-administered, mail back	232	37%
Overseas independent visitors	Personal interview	159	80%+
Overseas visitors on tours	Self-administered, mail back	387	64%

The data were all coded by the researcher and analysed using SPSS. The responses on a number of key variables were compared with results of other, published, surveys. These comparisons are reported in Appendix E. It has been concluded that the sample achieved in this survey is adequate in terms of what is known about the population of visitors to the Wet Tropics WHA and it is reasonable to use the results of this survey to estimate characteristics of the population, without the need to weight results for any variables.

7.2 RESULTS AND DISCUSSION

7.2.1 Characteristics of Visitors to Wet Tropics WHA

The sample of visitors to the Wet Tropics WHA (excluding locals) was evenly divided between visitors from overseas and visitors from Australia, (see Table 7.2). This result was obtained by chance, not by setting targets for equal numbers.

Table 7.2: Origin of visitors

Origin	Number responses	Percentage
Australia	563	50.1
Overseas	560	49.9

N = 1123

Visitors from Europe and the UK/Ireland made up the largest proportion of visitors from overseas included in the sample, (see Table 7.3).

Table 7.3: Country of origin of visitors from overseas

Country	Sample Percentage of overseas visitors
New Zealand	8.6
UK/ Ireland	26.8
Other Europe	28.0
Japan	19.0
Other Asia	2.0
North America	12.5
Africa	1.2
Middle East	0.8
Pacific	0.6

N = 560

The origin of Australian visitors in the sample is described in Table 7.4. The distribution roughly follows state population sizes.

Table 7.4: State of origin of Australian tourists

State	No. Respondents	Percentage of respondents	Percentage distribution of Australian population*
NSW	166	29.5	34.0
Victoria	150	26.6	25.1
Queensland	98	17.4	17.6
South Australia	57	10.1	8.3
Western Australia	55	9.8	9.4
Tasmania	13	2.3	2.6
Northern Territory	6	1.1	1.0
ACT	18	3.2	1.6

N = 563

*Source: Australian Bureau of Statistics, 1991 population census, unpublished tables.

The survey achieved an equivalent balance between male and female respondents for Australian and overseas visitors, and the balance reflected that of the population, (see Table 7.5).

Table 7.5: Gender of respondents

	Percentage of respondents		
	Australian visitors	Overseas visitors	All visitors
Male	47.2	47.8	47.5
Female	52.8	52.2	52.5

N = 1103

The results in Tables 7.2 to 7.5 indicate the sample is likely to give a reasonable representation of the population of visitors. Further comparison of sample results with those from other surveys is given in Appendix E.

7.2.2 Reasons for visiting North Queensland

Respondents were asked to list up to three reasons for visiting North Queensland. This was asked as an open-ended question in order to gauge the extent to which rainforest or the Wet Tropics WHA was mentioned, without prompting. The amalgamated results are reported in Table 7.6, where the percentages add to more than 100% because of the multiple answers. Forty-five per cent of respondents nominated rainforest as one of the three most important reasons for visiting North Queensland. This response is interesting in that all people interviewed were actually visiting the rainforest, whether or not they nominated it as an important attraction. The only attraction nominated by more people was the Great Barrier Reef. There were other responses that referred to aspects of the natural environment that were too general to attribute to any particular feature.

Table 7.6: Reasons for visiting North Queensland, total sample

Attraction	Percentage of respondents
Great Barrier Reef	55.3
Rainforest*	45.6
Climate	33.1
Natural environment	21.7
Visit friends and relatives	11.3
Visit named locations in NQ	10.1
Outdoor activities	9.5
New experience	8.5
Holiday, relax	7.5
On way around Australia	6.2
Temporary work	3.4
Enjoyed previous visit	3.3
Culture, lifestyle	3.2
Other	3.9

N = 1099

*Includes responses of 'rainforest', 'Cape Tribulation', 'Daintree' and 'World Heritage Area'.

The open-ended question was followed by a closed response question to try to ascertain more closely how important the rainforest was in respondents' decision to visit North Queensland. When asked specifically about rainforest, 80.7% of respondents said that it was either the most important, or one of a number of important attractions to North Queensland. This is much higher than the response to the open-ended questions, and suggests that respondents may have been prompted by the closed question. Only 11.6% of all visitors nominated rainforest as the most important reason for visiting North Queensland.

Table 7.7: Importance of opportunity to visit rainforest as an attraction to North Queensland

Importance of rainforest	Australian visitors	Overseas visitors	All visitors
Most important attraction	13.7	9.5	11.6
One of a number of important attractions	72.5	65.6	69.1
Not particularly important	8.0	9.3	8.6
Had not planned to visit the rainforest before coming to NQ	5.7	15.7	10.6

N = 1110

As might be expected, the proportion of overseas visitors who rated the rainforest as important in their decision to visit Australia was smaller than the proportion who nominated it as important in their decision to visit North Queensland, once they were in Australia, (compare Tables 7.7 and 7.8). That 62.6% of visitors from overseas nominated rainforest as an important attraction, or the most important attraction, to Australia is interesting and shows quite a high awareness of Australia's natural environment attractions, (see Table 7.8). Again it is possible that some respondents were prompted by the closed response question.

Table 7.8: Importance of opportunity to visit rainforest as an attraction to Australia

Importance of rainforest	Percentage of overseas visitors
Most important attraction	5.3
One of a number of important attractions	57.3
Not particularly important	18.5
Had not planned to visit the rainforest before coming to NQ	18.9

N = 546

By comparison, for the *1993 WTVUS*, independent visitors in the dry season were asked to nominate attractions to the region and the top three responses were the Great Barrier Reef (57.7%), rainforest (56.6%) and touring/sightseeing (37.8%).

Respondents were asked this question: 'Have you visited the rainforest before on a previous holiday/trip to North Queensland?' Three quarters of all respondents had not visited before. Even 60% of Australians had not visited before.

Table 7.9: Have respondents visited Wet Tropics WHA rainforest before, on a previous trip to North Queensland

	Percentage of respondents		
	Australian visitors	Overseas visitors	All visitors
First visit(s) on this trip	60.6	88.5	74.4
Visited before	39.4	11.5	25.6

N = 1096

A series of questions was asked about the number of days that respondents planned to be away from home on their entire trip, how many days were planned for North Queensland and how many days they had already spent visiting rainforest and planned to visit rainforest in North Queensland (used as a proxy for the Wet Tropics WHA). These responses were edited to produce the tables below. A variable for total days visiting rainforest was compiled by adding 'days visited so far' and 'days planned'. The proportion of 'days visited so far' of 'total days visiting rainforest' was 73.9%. The proportion of 'days in North Queensland so far' of 'total days intended to be in North Queensland' was 57.5%. Given these results, the possibility that the respondents might overestimate 'days planned to visit rainforest' was considered not to be a problem.

For all visitors, the majority of visits to North Queensland were of two weeks or less duration, (see Table 7.10). The mean number of days spent visiting rainforest was 3.5 days and the mode was 2 days, (see Table 7.11).

Table 7.10: Days visiting North Queensland this holiday.

Number of days	Percentage of respondents	Cumulative percentage
1 to 3	6.3	6.3
4 to 7	41.7	48.0
8 to 14	35.0	83.0
15 to 21	7.8	90.8
22 to 180	9.2	100

Mean = 12.4	Median = 8.0	Mode = 7.0

N = 1103

Table 7.11: Days visiting rainforest in NQ this holiday, 'day trips so far' plus 'planned day trips'

Number of days	Percentage of respondents	Cumulative percentage
1	24.4	24.4
2	28.1	52.5
3	18.0	70.5
4	8.6	79.1
5	6.5	85.6
6	3.9	89.5
7	3.0	92.5
8 to 14	5.0	97.5
15 to 72	2.5	100

Mean = 3.5	Median = 2.0	Mode = 2.0

N = 1100

Visits by respondents can be grouped into a few broad patterns. For Australians, 56% had North Queensland as their sole destination. Eighty-five percent of these respondents flew. These trips were mostly for two weeks or less. Visitors in this group averaged 3.1 day visits to rainforest. The other pattern of visits by Australians was a visit to North Queensland as part of a longer trip for several weeks to several months away from home, usually by private car. The average number of day visits to rainforest for this group was 5.1.

Visitors from overseas also divided easily into two groups. Those on shorter duration trips, and backpackers taking extended visits. The cut-off date for inclusion in the survey was one year. Visitors from overseas staying up to a month in Australia averaged 2.3 day visits to rainforest while those staying longer averaged 4.8 day visits.

Days spent visiting the rainforest made up less than half of all days spent in North Queensland, for the majority of respondents, (see Table 7.12).

Table 7.12: Days visiting rainforest in NQ this holiday, as a percentage of all days visiting NQ

Percentage of days	Percentage of respondents
1 to 25	32.8
26 to 50	43.9
51 to 75	18.7
76 to 100	4.6

N = 1090

7.2.3 Day trip to the Wet Tropics WHA

As can be seen from Table 7.13, the majority of people surveyed (83.2%) had stayed the previous night in Cairns or Port Douglas. Both these coastal locations, while tropical with rainforest views and rainforest close by, cannot really be said to be 'in the rainforest'. Travel to the rainforest is a matter of a trip to one or more sites in the Wet Tropics WHA. Trips may be taken independently or on a commercial tour. The means of access to the rainforest by respondents is shown in Table 7.14. Some accommodation establishments on the Atherton Tablelands, north of the Daintree River, at Cape Tribulation, around Daintree town, at Mission Beach and on the outskirts of Cairns offer close proximity to rainforest. It is possible to walk into the Wet Tropics WHA from some of these sites. This option was not taken by many of the visitors interviewed at popular sites in the Wet Tropics WHA, (see Table 7.15).

Table 7.13: Town stayed in last night

Town	Percentage of respondents
Cairns	69.9
Port Douglas	13.3
Towns on Atherton Tablelands	5.7
Cape Tribulation/ north of Daintree River	4.3
Mossman/ Daintree	2.2
Mission Beach	1.3
Cooktown	0.8
Innisfail	0.5
Gordonvale	0.3
Townsville	0.1
Ingham	0.1
Outside North Queensland	1.6

N= 1021

Table 7.14: Access to the Wet Tropics WHA

	Australian visitors %	Overseas visitors %	All visitors %
Independent	30.1	14.1	44.3
Commercial tour	19.9	35.7	55.6

N = 1123

Table 7.15: Access to the Wet Tropics WHA, independent visitors

	Australian visitors %	Overseas visitors %	All visitors %
Private car	49.6	24.5	41.6
Hire car	45.1	61.6	50.5
Motorcycle	1.8	1.9	1.8
Walk	1.5	7.5	3.4
Bicycle, bus	2.1	4.4	2.6

N = 497

The most popular activities for the tourists surveyed, with over 50% participation, were scenic driving, scenic viewing and walking and photography. Altogether, 81.2% of respondents reported taking a walk, with shorter walks most popular. This may be a function of tour itineraries and facilities at sites, many of which have only short walking tracks, rather than a preference of visitors, (see Table 7.16).

Table 7.16: Activities undertaken on today's trip

Activity	Percentage of respondents participating
Scenic viewing	80.2
Scenic driving	74.4
Photography	62.3
Walking, less than half hour	36.8
Picnic, BBQ	33.5
River or lake cruise	32.3
Swimming	29.9
Nature study	29.1
Walking, half to one hour	25.6
Walking, over one hour	18.8
Train ride	17.6
Rafting or kayaking	*17.3

N = 1001, all self reporting

*N = 195, based on number of respondents on rafting trips

7.2.4 Satisfaction with visits to the Wet Tropics WHA

Respondents were asked: 'Have you enjoyed your visit to rainforest sites today?'. This was a closed response question. A show card with possible responses was used in the face to face interviews. The results, shown in Tables 7.17 and 7.18, indicate a positive experience for the vast majority of respondents. More Australian visitors were 'extremely satisfied' than overseas visitors, who made up the difference with the percentage reporting that they were 'satisfied'. Results were similar for independent visitors and visitors on tour, with slightly more visitors on tour being 'satisfied' rather than 'very satisfied'. Similar results were reported in the *1993 WTVUS* where independent visitors, in the dry season only, reported 42.4% extremely satisfied, 38.9% very satisfied and 16.9% satisfied.

Table 7.17: Satisfaction with today's trip to rainforest sites, by origin of visitor

	Percentage of respondents		
	Australian visitors	Overseas visitors	All visitors
Extremely satisfied	47.6	40.9	44.4
Very satisfied	37.8	37.0	37.4
Satisfied	13.2	19.9	16.4
No opinion	1.4	1.4	1.4
Unsatisfied	0.0	0.8	0.4

N = 1066

Table 7.18: Satisfaction with today's trip to rainforest sites, by access

	Percentage of respondents		
	Independent visitors	**Visitors on tour**	**All visitors**
Extremely satisfied	45.3	43.6	44.4
Very satisfied	39.2	35.9	37.4
Satisfied	13.4	19.0	16.4
No opinion	1.6	1.2	1.4
Unsatisfied	0.4	0.3	0.4

N = 1066

Respondents were asked an open-ended question : 'Thinking about rainforest sites, what were the aspects that most added to the satisfaction derived from your visit?' The question was designed to focus on rainforest sites rather than other aspects of the day trip, and seems to have largely succeeded in this. Up to three answers were recorded and these were coded into the categories shown in Table 7.19. All responses that centred on flora and fauna and features of the natural environment and its beauty were classified together under 'natural environment'. The natural environment was the source of satisfaction of the largest number of respondents. The response 'the experience of being there' may be expressing a similar sentiment. A number of respondents specifically cited the protection of the rainforest as National Park/World Heritage Area as adding to their satisfaction. The provision of facilities and information and activities undertaken were less important to the visitors' satisfaction than the rainforest itself. Good facilities were mentioned by 15% of respondents and good information by 5.3% of respondents. Aspects of a commercial tour most added to the satisfaction of 15.4% of respondents.

Table 7.19: Features that most added to satisfaction with visit to rainforest today

	Percentage of respondents nominating feature
Natural environment	49.8
Protection of rainforest	18.2
Enjoyed commercial tour	15.4
Good facilities	15.0
Experience of being there	11.2
Nothing in particular	8.8
Good information	5.3
Outdoor activities	5.1
Few tourism impacts	3.2
Other	0.4

N = 1036

Results from the same question asked in the *1993 WTVUS* show very similar responses. The coding used is different but by grouping of categories, similarities emerge. The top five responses to the *1993 WTVUS* are reproduced in Table 7.20. If 'natural environment', 'natural beauty' and 'view/scenery' are grouped, as they would be for this present survey, these are nominated by 48.4% of respondents. 'Peace and tranquillity' can be roughly equated with 'experience of being there' reported in this survey and 'lack of development' can be equated with 'protection of rainforest'. On these assumptions, the balance of responses is very similar. It is clear from both surveys that the natural environment is the major source of satisfaction for visitors.

Table 7.20: *1993 WTVUS*, Aspects adding to satisfaction

Aspects adding to satisfaction	Total (Independent, dry season only)
Natural environment	25.0
Peace and tranquillity	15.9
Lack of development	13.8
Natural beauty	12.9
View/Scenery	10.5
Total valid cases	1639

Multiple responses allowed.
Source: Manidis Roberts et al 1994, p. 12

Respondents were then asked: 'What were the aspects of rainforest sites that most detracted from your visit?' Up to three answers were recorded. The most popular response was that nothing detracted, which is consistent with the high level of satisfaction reported, (see Table 7.21). Even so, a number of visitors who reported satisfaction did comment on aspects that detracted from their satisfaction. The equal most reported aspect was tourism impacts and crowding. This is discussed in more detail below. Altogether around 15% of respondents found aspects of the natural environment disappointing; including an inability to see wildlife, the presence of biting insects, the weather on the day and the environment not as expected. Aspects of management in the Wet Tropics WHA including poor facilities and information and poor management in general was mentioned by 14.6% of respondents. Development on private land adjacent to the Wet Tropics WHA and aspects of commercial tours detracted from the satisfaction of some respondents.

Table 7.21: Features that most detracted from satisfaction with visit to rainforest today

	Percentage of respondents nominating feature
Nothing detracted	48.4
Tourism impacts and crowding	15.0
Natural environment disappointing*	14.6
Poor facilities	5.9
Aspects of commercial tour	4.7
Poor information	4.4
Poor management	4.1
Development on private land	4.1
Other	3.5

N = 1040

*Not being able to see wildlife, biting insects, bad weather today, not as expected.

The *1993 WTVUS* included the same question about aspects detracting from satisfaction but the results are reported differently, making comparisons difficult. The report of the *1993 WTVUS* does not enumerate how many respondents gave a response of 'nothing detracted'. The top five responses are given in Table 7.22, reproduced from the *1993 WTVUS.* Each aspect was mentioned by less than 10% of respondents. Inadequate facilities were nominated by at least 16.6% of respondents, keeping in mind that other responses outside the top five may have included other facilities considered inadequate. This was similar to the results of this present survey. Interestingly, crowding was mentioned by only 4.6% of visitors. This is discussed in more detail below.

Table 7.22: *1993 WTVUS*, Aspects detracting from satisfaction

Aspects detracting from satisfaction	Total (Independent, dry season only)
Inadequate bins	7.4
Inadequate car parking	5.0
Crowded	4.6
Other visitors' behaviour	4.4
Inadequate walking tracks	4.2
Total valid cases	1481

Multiple responses allowed.

Source: Manidis Roberts et al 1994, p. 12

The last question of the survey asked: 'Finally, do you have any comments you wish to make about the rainforest or its management?' It is a standard practice in surveying to include an open-ended question such as this at the end of a survey, for several reasons. It allows the researcher to pick up information on issues that may not have been allowed for in the structured questionnaire. This may be useful for interpreting the results of the survey and in planning future research. It also extends to respondents the opportunity to air any opinions they might have about the subject, that have not surfaced in the structured part of the questionnaire. This is a courteous gesture, given the effort respondents have put into answering the questionnaire, and may increase the response rate of self-administered surveys (Dilman 1978).

Up to three comments were recorded and were coded into the categories in Table 7.23. The response rate to the question was quite high at 97.6% but the greatest number of respondents (35.7%) chose to say they had 'no comment' to make. The comments made were a mixture of observations on positive and negative aspects of the rainforest or its management, and neutral advice. The most commonly offered advice, given by 22.2% of respondents, was to preserve the rainforests as it is now, with no changes. This included pleas for no further loss of rainforest and no further development of tourism facilities in the rainforest. The management of the rainforest was praised by about 20% of respondents and criticised by 5.4% of respondents. More respondents than those who praised these aspects specifically, considered that facilities and information should be improved. Only a small number of respondents commented unprompted on the issue of tourism. Two per cent of respondents commented that there could be more tourism and an equal number commented that there should be less.

In summary, the responses are consistent with the high level of satisfaction expressed earlier in the survey. The high level of satisfaction with the rainforest as it is 'now' is consistent with the findings of other surveys of tourists, as is discussed below.

Table 7.23: Comments on the rainforest and its management, Wet Tropics WHA

	Percentage of respondents
No comment	35.7
Preserve as it is now	22.2
Good management	20.8
Improve facilities	8.4
Improve information	7.4
Improve management	5.4
Add land to WHA	2.8
Good commercial tour	2.5
More tourism possible	2.3
Too much tourism now	2.0
Concerned about adjacent clearing	1.7
Good facilities	1.7
Good information	1.0
Poor commercial tour	0.8
Other	1.4

N = 1097

7.2.5 Attitudes to crowding and environmental impacts of tourism

It was an aim of the visitor survey to seek information from respondents on whether they were experiencing any negative effects of crowding or impacts of tourism on the natural environment. It is well established in the literature on tourism research that longitudinal studies are the best way to track attitudes to change in recreational settings. This is because as recreational settings change, so do the groups of people who chose to visit. Those who prefer wilderness will avoid more developed settings. To an extent, the visitors are self selecting, provided they have enough information on what to expect. High levels of dissatisfaction with recreational settings may be due to misleading information as well as to crowding or environmental impacts. These issues have been discussed in Chapter 2.

Given that this was to be a one-off survey, the investigation of negative effects was confined to gauging the general level of satisfaction and seeking information on what added to or detracted from satisfaction, to see if crowding or environmental impact emerged as issues. It was decided not to try to focus in on these issues, but rather to look at where they lay in the overall perspective of respondents. As can be expected from other tourism surveys, a high level of satisfaction was recorded. This is an indication that the expectations and experiences of visitors were well matched. It does not necessarily mean that they did not experience some degree of crowding or notice environmental impacts - they could have expected these.

A small percentage of respondents (3.2%) specifically commented positively on experiencing few tourism impacts. The question about what detracted from satisfaction had a response rate of 92.6%, and 48.4% of respondents said that 'nothing' detracted from their satisfaction. Altogether 15% of respondents cited tourism impacts and crowding as detracting from their satisfaction. A more detailed split up of the responses included in this grouping is shown in Table 7.24. The most nominated response was that there were too many tourists and/or facilities. It is not really obvious from this response or the others given, if respondents were more affected by crowding and evidence of tourism, or perceived environmental impacts. The report of the *1993 WTVUS* lists 'crowding' amongst the top five detractions from satisfaction, but only nominated by a small 4.6% of respondents. It is not known whether other environmental impacts of tourism were nominated by respondents to that survey.

Table 7.24: Responses citing crowding or tourism impacts as detracting from satisfaction

	Percentage of respondents
Too many tourists/facilities	8.8
Presence of litter and graffiti	3.4
Objectionable and noisy behaviour of others	0.9
Daintree and Cape Tribulation too busy	0.8
Opposed to Skyrail development	0.4
Respondents concerned their presence may damage environment	0.3
Impacts of tourism on the environment observed	0.2
Presence of scenic railway	0.1
Exhaust pollution thinning vegetation	0.1
Sealed roads	0.2
Private cars and tourists uncontrolled	0.1
Opposed to roads in rainforest	0.1
Presence of large vehicles and buses	0.1
Concerned about tourism impacts	0.1

N = 1040

The comments made as a response to the general invitation for comments on the rainforest and its management reflect the balance of views obtained from the satisfaction questions. The majority of respondents either had 'no comment', or were supportive of the present management, or wanted the area preserved as it is now. This indicates a general satisfaction of how things are now. Only a small 2% of respondents commented that there was too much tourism now. This must be interpreted in the context that respondents previously had an opportunity to comment on this issue and 15% had noted some dissatisfaction with tourism impacts. The general tone of comments included in 'preserve as it is now' indicated a concern that the potential existed for the area to be threatened by increases in impacts, from tourism or other land development, but that the current level of protection was appropriate.

It is relevant to look at how these results correspond with the concern of managers and other commentators about the current level of crowding and environmental impact and potential for the future. There are three questions here. The first is: How important is the natural environment to the experience of tourists? The second question is: Is there currently a problem being experienced by tourists with crowding and environmental impacts in the Wet Tropics WHA? The third question is: Are tourists concerned about future impacts?

There is sufficient information from the survey to indicate that the natural environment is of great importance to the satisfaction derived by visitors to the Wet Tropics WHA. It can be hypothesised that diminution of the natural environment would reduce the satisfaction of the cohort of visitors, current and potential, who share tastes with the sample of visitors surveyed. This hypothesis could only be tested via broader and longer term studies than the one undertaken here.

The finding relevant to the second question is that a proportion of visitors surveyed did comment that they experienced a diminution of satisfaction due to the level of crowding and impacts existing at the time of their visit. At 15%, the proportion is a minority, but could possibly signal a disquiet that may grow with increasing visitor numbers. It is not possible from a one-off survey to make any judgement on whether this is a standard response for the area or whether dissatisfaction is growing or declining.

Information relevant to the third question is that a larger number of respondents than are currently experiencing a diminution in satisfaction made comments that can be interpreted as concern for future impacts without management aimed at preserving the area 'as it is'. Information was not sought to allow any distinction to be made between crowding or alteration to the natural environment in terms of which issue might be noticed earlier or contribute most to diminution of satisfaction.

7.2.6 Overseas visitors, Willingness to pay entry fees

Visitors from overseas were asked a set of questions to explore their willingness to pay entry fees to the Wet Tropics WHA. Most respondents from overseas (91.7%) answered at least one question in this set, but some individual questions had lower response rates. The response rate for independent visitors who were interviewed face to face was 98%. The non-respondents were virtually all amongst those who returned self-administered questionnaires. We can only speculate whether objection to the fees question caused overseas visitors not to return questionnaires. It is interesting to note, however, that the response rate for the self-administered questionnaire was 64% for overseas visitors while it was only 37% for Australian visitors, and no question on fees was included in the questionnaire for Australians.

Respondents were first asked to answer the question: 'Suppose there was a fee for visiting rainforest sites, to pay for park management. How much would you be willing to pay for each day, with access to as many sites as you wanted?'

The distribution of responses, including responses of $0, is shown on Table 7.25. This table also shows the declining cumulative percentage, which indicates what percentage of all respondents would enter under increasing entry fees.

Table 7.25: Distribution of entry fees nominated

	Include $0 - %	Cumulative - %
$0	13.0	100.0
$1 to $5	33.9	87.0
$6 to 10	30.9	53.1
$11 to 15	4.5	22.8
$16 to 20	10.5	17.7
Over $20	7.2	7.2

N = 514

The highest fee nominated was $350 but only 7.2% of respondents nominated an amount greater than $20. A conservative approach was taken, excluding all amounts above $20. The results are shown on Table 7.26. The lowest mean fee resulting is $7.50. The mode is $10. The modal value of $10 was nominated by 29.6% of respondents including those who nominated $0, and 34.4% of respondents excluding those who nominated $0.

Table 7.26: Mean, median and mode, excluding all responses above $20

	% of N	Mean	Median	Mode	Minimum	Maximum
Include $0*	92.8	7.54	5.00	10.00	0.00	20.00
Exclude $0**	79.8	8.78	10.00	10.00	1.00	20.00

*N = 514, Missing values = 46, Values above $20 = 37
**N = 514, Missing values = 46, $0 value = 67, Values above $20 = 37

Respondents were then asked whether they agreed there should be a fee, and were also asked for their reasons. Sixty-one per cent of respondents agreed that there should be an entry fee, (see Table 7.27). The correspondence between the entry fee nominated and whether respondents agreed there should be a fee is shown in Table 7.29. Interestingly, 28% of the respondents did not agree with a fee and yet nominated an amount for a fee when asked, (see Table 7.28).

Table 7.27: Agree there should be a fee

	Percentage of respondents
Yes	61.4
No	38.6

N = 511

Table 7.28: Agree there should be a fee, by amount nominated

	Agree with fee	
	Yes	No
$0 fee nominated	1.4% of N	10.3%
fee $0> nominated	60.3%	28.0%

N = 496

The mean, median and mode of fees nominated by the group of respondents who disagreed with a fee but nominated an amount they were willing to pay when asked are shown in Table 7.29. The results in terms of mean, median and mode are similar to the results for the whole sample. The percentage of these respondents who nominated the modal fee of $10 was 28.9%. The implication may be that only the approximately 10% of respondents who disagreed with a fee, and nominated $0 when asked, would really oppose a fee if one were introduced.

Table 7.29: Responses of 28% of respondents who didn't agree with a fee but nominated a fee greater than $0

	Mean	Median	Mode	Minimum	Maximum
Exclude fees above $20	7.63	5.00	10.00	1.00	20.00

N = 139

The reasons offered for agreeing with, or disagreeing with, entry fees are listed in Tables 7.30 and 7.31. Of those who agreed with entry fees, the majority appreciated the practical issues of paying for management. A philosophy that nature should be free to everyone was the most common reason for objections to entry fees.

Table 7.30: Reasons for agreeing with fees

Reason	Percentage
To preserve and protect as it is	41.9
To pay for upkeep of existing facilities	26.7
To provide additional facilities	10.6
To control/reduce visitor numbers	5.1
Agree but prefer weekly pass	3.4
To buy land to add to WHA	3.0
Visitors respect area more if pay	3.0
Other areas charge fees	2.5
Other	3.8

N = 236

Table 7.31: Reasons for disagreeing with fees

Reason	Percentage
Access to nature should be free for everyone	39.1
Australia benefits from tourism so government should look after natural heritage	13.2
Tour cost already high, tour companies should pay	8.6
Travelling on a budget	7.3
Fees would discourage visits	6.0
Have donation boxes instead	4.6
Already paid in cost of tour, ferry	4.6
Would promote encroachment on rainforest	4.0
Visitors respect area more if free	3.3
Nature does not need management	2.6
Other	6.6

N = 151

7.3 Conclusions

The survey conducted for this study proved to be successful in providing data that can be used with reasonable confidence in describing characteristics of Australian tourists and overseas tourist visitors to the Wet Tropics WHA. The results of the survey showed a high level of satisfaction with visits to the area and only a minor proportion of visitors bothered by crowding or environmental impacts. This finding must be qualified to reflect the proposition that one-off surveys are not sufficient to gauge trends in satisfaction. Visitors displayed a high level of support for current management of the Wet Tropics WHA. The majority of overseas visitors indicated they are willing to pay an entry fee if revenue raised is to be spent on management, and the modal fee nominated was $10. Information presented in this chapter is drawn on in Chapter 9. The main aim of the survey however was to collect information for economic analysis and this is presented in the next chapter.

CHAPTER 8
CONSUMERS' SURPLUS AND PRICE ELASTICITY OF DEMAND

This chapter presents results of economic analysis to produce estimates of the consumers' surplus and the price elasticity of demand for visits to the Wet Tropics WHA. This information is required as an input to the modelling exercise to determine net benefits of tourism in the Wet Tropics WHA, which is the subject of Chapter 9. The methodology used is the Travel Cost Method (TCM).

It has been explained, in Chapter 3, that the consumers' surplus is the relevant economic measure of benefits to tourists of access to protected areas It is the amount people are willing to pay, in addition to what they have to pay, to gain the personal benefits of directly visiting protected areas. People who visit an area may also hold existence and bequest values for the area, for which they are willing to pay. The TCM adopted in this analysis is aimed at eliciting only the benefits of visiting. A hypothetical market approach such as CVM would need to be used to elicit any additional non-use values. This is not undertaken here as it is assumed that the non-use values are protected via protected area status and management. At least, that is the stated intention of management.

The price elasticity of demand in respect of entry fees is the percentage change (decrease) in demand predicted with a one per cent change (increase) in entry fees. This indicator is used to predict the number of visitors expected under different levels of fees and the amount of revenue that may be raised to pay for management. It is necessary to know the price elasticity of demand for entry fees if managers wish to set fees to a level that would ration visitor numbers to a desired level, for management purposes.

The TCM is widely used for measuring the benefits of access to natural areas of tourism and recreation, in the absence of market measures of these benefits. The aim in this study was to undertake the analysis employing state of the art practice in the TCM. The analysis in this chapter is conducted in a manner which explores aspects of the TCM which have recently been subject to critical comment (Randall 1994).

A TCM analysis was conducted for Australian tourists visiting the Wet Tropics WHA. The reasons for selecting only this group of tourists for inclusion in the TCM were discussed in Chapter 5. The data for the TCM analysis were collected via the survey of visitors to the Wet Tropics WHA. The methodology employed in this survey, and results with respect to visitor characteristics, were described in Chapter 7.

This chapter commences in Section 8.1 with a discussion of the TCM in terms of the basis of the approach, history of use and limitations. The steps required for undertaking the analysis are outlined.

In Section 8.2, brief reference is made to a TCM analysis for visits to North Queensland, further details of which are presented in Appendix G. This analysis for visits to North Queensland was undertaken as a precursor to the main TCM analysis of visitors to the Wet Tropics WHA, which is presented in Section 8.3. Discussion of the results for travel to the Wet Tropics WHA as well as observations on the TCM approach are presented in Section 8.4.

8.1 The Travel Cost Method

8.1.1 The basis of the approach

The Travel Cost Method was developed to measure the benefits to visitors of access to natural areas for recreation. As most natural areas have no entry fees, or only nominal fees, a market does not usually exist where benefits are able to be observed as prices paid for the services enjoyed. This methodology is a surrogate market approach whereby expenditure in an associated market, in this case the market for travel, is used to estimate the benefits of the service from natural areas. As noted above, the benefits are measured as consumers' surplus and an additional indicator, price elasticity of demand, can be calculated.

There are two major steps to a travel cost analysis . The first is to derive a demand function for visits to a site based on the cost of travel, and any other variables that may help explain visit rates. The second step is to derive a demand function for entry to a site under a range of hypothetical entry fees, based on the assumption that behaviour in relation to costs of entry is the same as behaviour in relation to the costs of travel. This assumption is central to the methodology. The area under the second demand function is the consumers' surplus from visiting the site arising from the number of visits observed. The slope of the second demand function is the price elasticity of demand for entry fees. For the purposes of this study, the first function is termed the 'travel demand function' and the second function is termed the 'entry fee demand function'. The slope of the travel demand function is termed the 'cost elasticity of demand ' as it applies to the cost of travel. The slope of the entry fee demand function is termed the 'price elasticity of demand' as it applies to the price of entry fees.

8.1.2 The history of the TCM

The history of the TCM began in 1949 with an idea put to the US National Parks Service by economist Harold Hotelling (McConnell 1985). The concept was developed by a small number of economists until the mid 1960's when Clawson and Knetch (1966) made the technique more widely known via their book *The Economics of Outdoor Recreation.*

Writing in 1986, Walsh notes 'the travel cost method has been thoroughly tested over more than 25 years and found to be a reasonably accurate way to estimate empirical demand functions and benefits of recreation' (Walsh 1986, p. 223). In a paper written at about the same time, McConnell (1985) points out that the approach of the travel cost method in estimating the benefits of visits to a site as the area under an aggregate demand curve uses an approach that is standard in economics. The majority of effort in development of the method has revolved around empirical estimation of the first demand function for travel to a site. McConnell (1985, p. 687) says '(h)ence much effort has been devoted to reconciling differences between models implied by utility maximising consumers with the need to complete analysis with imperfect data'.

Authors of review articles have noted a large number of applications of the TCM published (Smith 1989) and voluminous literature on the subject (Bockstael 1995) and the apparent success of the TCM approach in generating results consistent with theory (Smith 1993).

The approach used in this study is a traditional approach which uses empirical data collected for recreation visits to a site to generate a travel demand function. The welfare measures so generated are those that would correspond to the loss that would occur if the site were no longer available for recreation.

A major theme in the literature in the last decade is development of alternative approaches to generating travel demand functions. These approaches include the household production approach and random utility models (Smith 1989), which attempt to overcome limitations in observable information on the cost of travel. Bockstael (1995) notes that in recent times applications of travel cost models have been developed to value different amenities at different sites in an attempt to discover how different characteristics of sites add to welfare. This type of application has relevance for planning for the provision of recreation sites. Some of these other approaches are discussed briefly in the following section.

8.1.3 Limitations and responses

The large amount of literature that has been produced on the travel cost method includes review articles, papers testing different means of dealing with individual issues, and papers presenting the results of applications. The use of travel cost as a proxy for entry fees, which is the basic assumption of the method, is widely accepted. The literature reveals few questions about the second demand function based on hypothetical entry fees. Rather, the criticisms of the method and its application, and attempts to improve the method, centre on how best to estimate the initial demand function for travel to a site.

It has recently been pointed out by Randall (1994) that if observations of 'travel price' were available, the construction of a travel demand function would be straightforward and non-controversial, and the results of TCM could be used with confidence as dollar values of welfare arising from visits to a recreation site. Travel price is described by Randall as being unique to each individual because the individual is directly involved in production of the visit and contributing travel time and household resources (vehicles etc), all of which are valued according to income constraints and the opportunity cost of time for that individual. Travel price, however, argues Randall, is 'typically unobservable' (p. 88) and thus travel cost has been developed as an alternative measure of the sacrifice by an individual to travel to a site.

Randall proposes that travel cost is a less desirable measure and that the implications of estimating travel cost are that the results of TCM will vary with the estimates of travel cost used. In this case, he argues, no result can be relied upon as an absolute measure of welfare.

Other authors have described the problem of generating a cost estimate as more of a practical problem of assigning costs with less than full information, and have not seen this issue as limiting as Randall proposes. Various conventions for estimating aspects of travel cost have been proposed in the literature, but debate continues with respect to the best way to estimate costs and construct travel demand functions. The following discussion addresses a number of issues of assigning travel costs and manipulating data, namely: collecting data by sample survey; determining the money costs of travel; valuing the cost of travel time; accounting for multi-destination trips; and using individual observations or zone observations.

Collecting data by sample survey

The point of relevance here is that the data used to conduct TCM is usually collected in a survey of a sample of the population of annual users of a site. As such, the quality of the data is dependant on the quality of the survey. In addition, the ability to scale survey results up to a population estimate depends upon records or estimates of annual visitor numbers being available. Annual visitor number data is usually supplied by the managers of the recreation site. The analyst usually has no control over the quality of this data and may not know how reliable the data is.

Determining the money costs of travel

The money costs of travel may include costs of running a vehicle, purchasing airfares, and/or paying for accommodation along the way to the site visited. The analyst faces several choices in estimating money costs of travel. Visitors may be asked what it cost them to make the trip, or costs may be estimated from information collected from visitors plus information from other sources. The first approach records 'perceived costs' and may not reflect actual costs due to recall error. The alternative approach is to collect information on the origin of the trip, vehicle type and type of accommodation used. The approach that requires least imposition on survey respondents is to collect information on the origin of the trip and then calculate a money cost of travel using maps to calculate distance and using a standard vehicle running cost. While using a standard running cost is common (Stoeckl 1994, Bennett 1995), it is suggested by Englin and Shonkwiler (1995) that it is preferable to collect information on the vehicle type used and award costs on that basis. The true cost of automobile travel depends upon whether the vehicle in question is in everyday use or is kept solely for recreational use. In the former case, the marginal running cost is the appropriate cost while in the latter case, average running cost is more relevant. Information would need to be collected from respondents in order to distinguish costs based on frequency of vehicle use.

Valuing the time cost of travel

Time costs of travel arise due to the opportunity cost of alternative uses of time, especially income earning activities. This will vary amongst individuals depending on their income and whether they are giving up an opportunity to earn income when they are taking the trip. In 1983, Hufschmidt et. al. concluded that 'time is an important variable, and ignoring it can bias the final results' (p. 229), with the implication being that excluding time costs would underestimate the total benefits of travel. Hufschmidt et. al. note no consensus in the literature on what value to give to time and suggest sensitivity analysis to different time values. Englin and Shonkwiler (1995) observe that valuing the opportunity cost of time for TCM is still debated in the literature.

The value placed on travel time will also depend on whether travel is considered a utility or disutility. Walsh (1986) notes that the quality of the scenery and presumably other conditions along the way may vary the utility of travel. The utility of travel may be highest for short trips and at the start of long trips. The value of time may therefore vary between individuals visiting the same site, depending upon their opportunity costs of time and the utility of travel. Where people are on annual holiday and enjoying the travel, there may be no need to include a cost for travel time.

In practice, a rate of one quarter to a third of respondent's wage rate is often used to value travel time (Stoeckl 1994; Englin & Shonkwiler 1995). A distinguishable value for travel time may be tested along with other potential explanatory variables in estimating the travel demand function and the value of time included or excluded depending upon its contribution to the function. Stoeckl (1994) found that the inclusion of time costs did not improve the prediction of the rate of visits to Hinchinbrook Island and a better relationship was achieved by excluding time costs.

Accounting for multiple destination trips

Visits to sites of outdoor recreation may include day trips by nearby residents or trips involving overnight stays during the trip and at the destination. Often the site of interest is one of a number of stops on a trip with multiple destinations. The question then arises of how much of the trip cost of multiple destination trips to attribute to the site of interest.

Hufschmidt et. al. (1983, p. 229) note that the problems of multiple destination trips 'can only be overcome by more extensive data collection'. Walsh (1986) suggests that demand for nationally known sites which may be visited on multiple destination trips may be different to demand for local sites. He reports work from the US that demonstrates that demand for visits to a 'national ' site can be reasonably estimated by 'dividing total direct trip costs by the number of recreation sites visited on the trip' (Walsh 1986, p. 229). An alternative approach is to divide total trip costs by the proportion of days spent at the site which is the subject of analysis. Knapman and Stanley (1991) and Stoeckl (1994) asked respondents to nominate other 'important' destinations on their trip and the number of nights spent at each and then apportioned travel costs on the basis of days at the site being studied as a proportion of all days at important destinations.

Individual observations versus zone observations

The travel demand function may be based on individual observations collected in the sample survey or on these observations amalgamated into groups based on zones of different distance from the recreation site. Zone observations are usually the mean of all observations made for individual travellers or groups from that zone.
While early applications of the TCM utilised concentric distance zones around the site, it is now common for the zones to be based on population groupings of known size and known distance from the site, such as Statistical Divisions.

McConnell writing in 1985 stated that 'the procedure of using individual observations rather than zonal averages has become a common practice' (p. 697). However the zonal approach remains in use. Bennett (1995) notes that the individual observation approach is most appropriate where there are repeat visits by a large proportion of visitors whereas the zonal approach is preferred where the majority of visits are once-off.

Alternative approaches to estimating elements of travel cost

The alternatives to the traditional approach of empirical estimates of the money and time costs of travel are based on estimating values for these costs based on other information gathered from visitors. An approach based on the household production function (HPF) attempts to model demand for leisure activities as a function of available income and time, and to model travel to a particular site as a function of demand for leisure and the attractions for the site. Smith (1989, p. 280) states that '(t)he basic model maintains that an individual's utility is derived from consuming services provided by that person (or his household) combining time, market-purchased commodities, and environmental resources'. In this case, information is needed on income, purchases and preferences of visitors. Random utility models (RUM) focus on estimating the demand for visits to a site as a function of the attractions of the site versus substitute sites (Smith 1989). These models require much more information on substitute sites than does the traditional approach. Randall (1994) suggests that neither of these approaches solves the problems he raises, as these approaches still require information that is not directly observable. Another development of TCM uses a latent variable approach to generate estimates of travel cost given other information on travel behaviour (Englin & Shonkwiler 1995).

8.1.4 Testing Randall's concerns in this study

Given the concerns raised by Randall (1994), it was decided to use the conduct of this study to test his assertion that the use of different cost estimates will lead to different results. Randall notes that the literature already contains studies where it has been shown that the results in terms of welfare estimates, as measured by consumers' surplus, are sensitive to the costs used in the analysis. It was decided to focus here on looking at whether the use of different cost values affects the results in terms of price elasticity of demand in respect of entry fees. This is a relevant question where the main purpose of using TCM is to inform managers of protected areas on the question of levying entry fees to raise revenue for management or to ration use.

8.1.5 Generating the travel demand function

The travel cost method takes as a basic proposition that there will be an inverse relationship between the cost of travel and the number of visits made to the site. It may be that other variables will also affect the rate of visits. Such variables may include socio-economic characteristics of travellers which enable them to travel, such as income and occupation, or variables which may affect their tastes for travelling to natural environments, such as age and education. Variables such as attractiveness of particular sites and the cost of travel to substitutes sites may affect the rate of visits to sites. It is normal in using the TCM to test whether any of these other variables add to the explanatory power of the demand function generated. Travel costs are usually measured as the monetary outlays for transport and services, and may include a value for the opportunity cost of time spent travelling.

The travel demand function thus takes the general form:

$$V_i = f(C_i, \text{other variables}_i) \qquad [1]$$

Where V_i is the number of visits, C_i is monetary travel costs and i indexes zones. The travel demand function is estimated from observations of travel costs to, and number of visits made by, visitors who have travelled different distances from home to the site. As noted in the previous section, the observations on visits may be grouped into a number of zones, or treated in the analysis as individual observations. As the population of interest here is tourists to the North Queensland region, the zonal approach was selected for this study.

Apart from requiring an inverse relationship between costs and rate of visits, there is no theoretically correct form for the travel demand function, ie. the theory does not specify the functional form; linear, linear in logarithms etc.

The demand function is generated by the following steps.

The effect of differing populations in the origin zones is corrected for by turning V_i into V_i/P_i by dividing by the population in zone i (here P_i = population/1000, used for manageability[1]).

Multiple linear regression analysis using Ordinary Least Squares is applied to the observations for zones 1 to n, in order to find the function which best describes the range of zone observations. The linear form of this function is:

$$V_i/P_i = \alpha + \beta_1 C_i + \beta_2 X_{1i} + \beta_3 X_{2i} + \ldots \qquad [2]$$

Where X_1 and X_2 are variables from [1] that add to the explanation of V_i/P_i.

There are several criteria for whether the function achieved by regression analysis gives a satisfactory relationship able to be adopted as the travel demand function. The most basic criteria for TCM is whether the coefficient of travel cost, β_1, is negative and significantly different to zero. The sign for β_1 must be negative to signal an inverse relationship between travel cost and visitor numbers. Also important in selecting which of other variables to include in the function is whether the coefficients for these variables are significantly different to zero.

The approach of hypothesis testing is adopted to determine whether variables should be included in the equation of the demand function. The general form of the test is to pose a null hypothesis that the coefficient of the variable is zero and an alternative hypothesis that the coefficient is not zero (or is significantly different to zero). If the null hypothesis is rejected, the alternative can be accepted (Common 1976).

The test of significance used is the *Student's t test*. This measures the probability of obtaining a particular value for the measure being estimated for different levels of significance and degrees of freedom (Dutta 1975).

For the exercises reported in this Chapter, analysis was undertaken using the multiple linear regression analysis facility of the SPSS system. This facility generates coefficients for all the variables being tested, assesses which coefficients are significantly different from zero and therefore which variables would be included in a demand function, and generates results for a number of statistical tests.

[1] P_i = population /1000 was adopted for manageability, based on numerous examples in the literature. This was not really necessary as SPSS can handle the larger number. Both approaches yield the same results ultimately but the value of α in the travel demand function will vary with the measure of population used.

The actual assessment of significance is undertaken during multiple linear regression analysis within the SPSS package (Norusis / SPSS 1993). This is done by using 'stepwise' examination of variables to see if they should be added to the equation for the travel demand function. A maximum value of probability for selection of variables for entry into the equation was set at the 5% level of significance for the coefficient of the variable. In stepwise selection, variables already in the equation are examined and removed if they exceed a maximum probability, in this case the 10% level of significance. This procedure ensures that if the coefficients of variables are not significantly different to zero, the variables are not selected for inclusion in the equation.[2] For the cost of travel, the test is whether the coefficient is significant and negative[3].

The degree to which the function generated explains the observations of V_i/P_i from all zones is conventionally signified by the R^2 statistic. The relevant measure to use is the Adjusted R^2 which is adjusted for degrees of freedom. The R^2 statistic takes a value of between 0 and 1, with an R^2 of 1 being a perfect fit of the function to all observations. If the relationship between travel cost only and visitors does not result in an R^2 close to 1, adding other variables may improve the explanatory power of the function. Walsh (1986) considers that an R^2 value of around 0.5 is quite acceptable for a travel cost demand function.

If the R^2 remains low after adding other variables, it may be that one or more variables significantly affecting travel behaviour have not been identified and included.

The travel demand function can also be estimated using semilog and double log forms to generate a relationship. The equations take the following forms:

The semilog form is:

$$\ln V_i/P_i = \alpha + \beta_1 C_i + \beta_2 X_{1i} + \beta_3 X_{2i} + \ldots \qquad [3]$$

The double log form is:

$$\ln V_i/P_i = \alpha + \beta_1 \ln C_i + \beta_2 \ln X_{1i} + \beta_3 \ln X_{2i} + \ldots \qquad [4]$$

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[2] The SPSS package employs a two tailed test. This means that the probability of the estimate being in the rejection region is 5% or less and the null hypothesis that the estimate is equal to zero is rejected in favour of the hypothesis that the estimate obtained is significantly different to zero. The two tailed test has been adopted here for the coefficients of all variables except travel cost.

[3] If the β_1 coefficient was not found to be significant using the two-tailed test (for example, $t \geq 2.012$ at the 5% significance level, 40 degrees of freedom), the data were tested using the one-tailed test (for example $t \geq 1.684$ at the 5% significance level, 40 degrees of freedom).

Walsh (1986) observes that the double log form is most often used for regression analysis of outdoor recreation demand. The advantage of the double log form is that the coefficients of the variables generated by regression analysis are the elasticities of the variables (Walsh 1986). Of most interest here is that the double log coefficient of travel cost, β_1, is the constant slope of the demand curve and therefore is the cost elasticity of demand for visits.

The double log form is reported throughout this exercise. Linear and semilog forms for the functions were also tested in preliminary analysis. In some cases where a negative and significant relationship between demand and travel cost, as indicated by the β_1 coefficient, was estimated using a logarithmic form, the linear form failed to estimate such a relationship. In all cases tested, the double log form produced superior results in terms of goodness of fit as measured by R^2.

Having obtained a travel demand function with an acceptable R^2 value, the next step is to use the travel demand function to generate a demand function for entry to the recreation site under a range of hypothetical entry fees.

8.1.6 Generating the entry fee demand function and calculating consumers' surplus

To calculate the number of visits or 'entries to the site' demanded from each zone at a range of entry fees, several steps are taken in the calculation. The overall travel cost is increased by the price of entry using a range of hypothetical fees ($1, $10, etc.). For each fee level, the travel cost is increased by the amount of the fee and the number of visits demanded from each zone is then predicted. This step is illustrated in Equation [5]. This equation incorporates converting from logs to integers and removing the population factor by multiplying by P_i:

$$V_i = \alpha' * ((C_i + F_x)^{\beta_1}) * ((X_{1i})^{\beta_2}) * (P_i) \qquad x = \$0, ..., \$n. \qquad [5]$$

Where α' is the antilog of α, F_x is the entry fee used.

The total visits demanded by the sample at different entry fees ($0 to $n) are calculated as:

$$V_x = \sum_{i=1}^{n} V_i \qquad x = \$0, ..., \$n. \qquad [6]$$

A table of hypothetical entry fees and predicted number of visits is constructed using equations [5] and [6].

The table shows a demand schedule which describes a series of linear segments (which will be represented as some form of curve with a negative slope). This is the schedule for the entry fee demand function.

The entry fee demand function can be estimated by applying linear regression to the data in the schedule. The dependant variable is the number of visits predicted and the independent variable is the entry fee level.

In its linear form, the entry fee demand function takes the following form:

$$V_X = \alpha - \beta F_X \qquad [7]$$

The area under the entry fee demand function represents the consumers' surplus arising from visits to the site, at zero entry fee.

As the exercise thus far has been based on data from the sample survey, it is necessary to convert the results to an estimate of consumers' surplus for the annual population of visitors. Assuming the sample has been found to be an adequate representation of the population, the consumers' surplus can be scaled up by a factor representing the proportion the sample is of the population. Alternatively, the mean consumers' surplus for the sample can be calculated and multiplied by the number of visitors in the population.

The double log form of the entry fee demand function takes the form:

$$\ln V_X = \alpha - \beta \ln F_X \qquad [8]$$

In this case, the β coefficient is the price elasticity of demand for entry fees.

8.2 Travel Cost Analysis for travel to North Queensland

The data set constructed from the visitor survey was first analysed to look at characteristics of travel by Australian tourists to North Queensland. A detailed account and results of the Travel Cost Analysis for visits to North Queensland is presented in Appendix G. This analysis is discussed only briefly here in relation to the direction it provided for the development of the Travel Cost Analysis for visits to the Wet Tropics WHA.

The mode of transport used by respondents to get to North Queensland was examined and it was found that 89% of tourists either drove or flew to North Queensland. It has been recommended that only uniform travel modes be used in TCA (Hanley & Common 1987). For this reason, the 11% of tourists using other travel modes were excluded from further analysis. This left a total of 496 observations for all further analysis. The use of two transport modes was still a potential problem for the analysis and therefore the effect of the transport mode was investigated further via the sub-set analysis described below.

The data set was analysed by developing a number of different travel demand functions for travel to North Queensland. Initially, the dependant variable used was the number of visits to North Queensland recorded for the survey respondents. An attempt was made to derive a travel demand function using all 496 observations where respondents either drove or flew to North Queensland. It was not possible to derive a function with a negative and significant β_1 coefficient for this data set.

To explore further the characteristics of travel to North Queensland, the data were divided into sub-sets according to mode of transport (drive or fly) and according to whether North Queensland was the sole destination on one of a number of destinations on a trip. The latter group of travellers is termed 'meanderers' here. In addition, the data were analysed for all 496 observations using the number of visitor-days spent in North Queensland as the dependant variable. All the sub-sets of the data were also analysed using the dependant variable of visitor-days.

A travel demand function with a negative and significant β_1 coefficient was achieved for all respondents who drove or flew to North Queensland, using visitor-days as the dependant variable. The results of the sub-set analysis (using both versions of dependant variable) showed that there was no obvious advantage in further dividing the observations into sub-sets by transport mode or by sole or multiple destinations. Thus, it was decided to proceed with developing a travel demand function for visits to the Wet Tropics WHA using the 496 observations selected and using visitor-days as the dependant variable.

The travel demand function developed for visitor-days to North Queensland was further analysed to derive an entry fee demand function. The consumers' surplus and price elasticity of demand for 'entry' to North Queensland, were calculated. This further analysis was done in order to explore a possible policy option, which is to target a charge on tourists at the regional level to provide funds for environmental management of the Great Barrier Reef WHA, the Wet Tropics WHA and other natural areas in the region. The results for North Queensland are compared with results for the Wet Tropics WHA, in Section 8.4 of this chapter.

8.3 Travel Cost Analysis for travel to the Wet Tropics WHA

8.3.1 General approach

The aim of the main travel cost analysis exercise was to calculate a price elasticity of demand and consumers' surplus for visits to the Wet Tropics WHA. The population of visitors of interest was Australian tourists to the Wet Tropics WHA.

It was decided to treat the Wet Tropics WHA as one site. There are several reasons for choosing this approach. Information available from the *1993 WTVUS* (Manidis Roberts et al 1994) revealed that people generally visit more than one location within the Wet Tropics WHA in one day. The results of the visitor survey conducted for this study revealed that most tourists visited (or intended to visit) the Wet Tropics WHA more than once during their visit to North Queensland. Therefore it makes some sense to think of the Wet Tropics WHA as one site that visitors will cover during their stay in North Queensland, even if it takes a number of days to visit several locations within the Wet Tropics WHA. It is relevant to treat the Wet Tropics WHA as a single site for the exploration of the potential impacts of an overall entry fee, which is a most likely scenario. Finally, the results of the survey best suited treating the Wet Tropics WHA as one site due to poor responses to the itinerary question[4]. While robust information was gained on the number of days respondents had visited or intended to visit the Wet Tropics WHA, and locations visited on the day of the interview, many respondents did not answer the questions on locations within the Wet Tropics WHA visited on previous days or intended to visit. This poor response prevented analysis of sub-sets of the data for particular locations within the Wet Tropics WHA.

The travel cost analysis for visits to the Wet Tropics WHA takes as the dependent variable visitor-days made to the Wet Tropics WHA. For the sample of visitors interviewed, the dependant variable is the total number of visitor-days made by respondents and people directly accompanying them in their 'group'. The independent

[4] This question is discussed in Appendix E.

variables are the mean travel cost per visitor-day and any other variables tested and found to be significant in describing travel behaviour.

8.3.2 Pattern of visits to the Wet Tropics WHA

The patterns of visits to the Wet Tropics WHA by the 496 respondents in the sample are described in the tables below, (Table 8.1 to Table 8.9).

Table 8.1: Travel to North Queensland (NQ)

Mode of transport to NQ	NQ is sole destination	NQ plus other destinations	Total	Total (percent)
Drive to NQ	29	106	135	24.5
Fly to NQ	272	89	361	64.5
Other and multiple modes	16	47	63	11.0
Total	317	242	559	100.0

Table 8.2: Mode of day trip to the Wet Tropics WHA, by travel to North Queensland

Mode of travel to NQ	Independent day trip	Commercial Tour day trip
Drive to NQ	124	11
Fly to NQ	180	181
Drive and fly total	304	192
Drive and fly (%)	61.2	38.7

Table 8.3: Location stayed last night

Location	Independent	Commercial Tour	Percent of total
Cairns and Beaches	169	150	64.3
Pt Douglas and Mossman	65	33	19.7
Atherton Tablelands	37	1	7.6
Cape Tribulation	8	5	2.6
Cooktown	6	0	1.2
Gordonvale	3	0	0.6
Innisfail	3	0	0.6
Mission Beach	2	3	1.0
Taylors Beach	1	0	0.2
Townsville	1	0	0.2
Outside North Queensland	9	0	1.8
Total	304	192	100.0

Table 8.4: Number of days visiting rainforest

	Independent	Commercial Tour	All day trip modes
Mean	5.19	2.13	4.00
Median	3.00	2.00	3.00
Mode	3.00	2.00	2.00

Table 8.5: Visitors travelling by Independent modes when surveyed - actual and planned travel modes for all their day trips to the Wet Tropics WHA

	Independent	Commercial Tour	All day trip modes
Mean	4.88	0.31	5.19
Median	3.00	0	3.00
Mode	2.00	0	3.00

Table 8.6: Visitors travelling by Commercial Tours when surveyed - actual and planned travel modes for all their day trips to the Wet Tropics WHA

	Independent	Commercial Tour	All day trip modes
Mean	0.43	1.69	2.13
Median	0	2.00	2.00
Mode	0	1.00	2.00

Table 8.7: Number of Australian tourists visiting Wet Tropics WHA represented by the sample

Sample represents	Independent	Commercial Tour	All day trip modes
Respondents	304	192	496
Adult tourists	658	377	1035
Adult and child tourists	809	397	1206
Visitor-days	4198	845	4824

Table 8.8: Size of groups visiting rainforest (mean)

	Independent	Commercial Tour	All day trip modes
People in group (inc. locals)	2.92	2.16	2.63
Australian tourists to NQ	2.66	2.06	2.43

Table 8.9: Locations visited in Wet Tropics WHA on day of survey.

Location	Independent	Commercial Tour	All day trip modes
Cape Tribulation	44	87	131
Daintree River	51	5	56
Kuranda & Atherton Tablelands	209	75	284
Rafting	0	25	25
All sites	3046	1926	4963

Visitors to the Wet Tropics WHA stay outside the WHA and visit on day trips. The majority (64.3%) of respondents stayed in Cairns, and a further 19.7% stayed in Port Douglas and Mossman. Virtually all commercial tours of the Wet Tropics WHA emanate from these centres. On the day they were surveyed, 61.2% of respondents were travelling independently to the Wet Tropics WHA, and 38.7% were on a commercial tour. Independent travellers visited the Wet Tropics WHA by private car, hire car, and other modes including bicycle and walking.

Respondents typically made more than one day trip to the Wet Tropics WHA during their stay in North Queensland The mean number of visitor-days was 4 and the mode was 2. There was little overlap between travel modes to the WHA. The majority of respondents travelling independently on the day of the interview were intending to make all their day trips independently while the majority of those on tour when surveyed were intending to make all their trips by tour.

It is suggested by Bennett (1995) that the presence of congestion confounds the TCM in that the marginal costs of visitor presence increase with congestion. The results of the visitor survey, presented in Chapter 7, suggest that only a small percentage of visitors were experiencing congestion effects at the time of the survey.

8.3.3 Generating the travel demand function

Step one in the travel cost analysis was generating the travel demand function, but using visitor-days (Vd), as the dependant variable (based on Equation [2]).

The linear form of the travel demand function is:

$$Vd_i/P_i = \alpha + \beta_1 C_i + \beta_2 X_{1i} + \beta_3 X_{2i} + \ldots \qquad [9]$$

Data collected in the visitor survey needed to be manipulated and augmented to provide observations for all the variables in relevant forms so that values for the coefficients could be generated via multiple regression analysis.

The subscript i in Equation 9, for zone i, denotes the fact that observations are for zones. For this exercise, the zones were based on Statistical Divisions. The respondents to the visitor survey came from 45 different Statistical Divisions. Observations were grouped by Statistical Division. Populations (P_i) of Statistical Divisions were added to the data set using census data from the Australian Bureau of Statistics (1995). Visitor-days (Vd_i) is the total visitor-days from zone i made by respondents and people in their group. The zones used and the number of respondents and visitor-days from each zone are shown in Appendix H..

Generating a cost for travel to the Wet Tropics WHA

The variable C in Equation 9 is the cost of travel to the Wet Tropics WHA. This is perhaps the most critical variable to measure in the entire travel cost analysis exercise[5]. It is in valuing the cost of travel that assumptions need to be made by the analyst which introduce sources of variation into the analysis.

The cost of travel to the Wet Tropics WHA rainforest in North Queensland was conceptualised as including:

(i) monetary costs of travel to North Queensland;

(ii) time costs of travel to North Queensland — converted to equivalent monetary costs;

(iii) monetary costs of day trips to the rainforest; and

(iv) time costs of day trips to the rainforest — converted to equivalent monetary costs.

As noted above, many previous studies using the TCM have included the cost of time spent travelling, whilst others have not. The approach chosen for this study was to derive travel demand functions using both travel cost without the cost of time, and travel cost with the cost of time. Both values are used separately in deriving travel demand functions in order to see which performs the best in explaining the observed number of visitor-days. The approach to estimating the cost of time is explained below.

The total direct monetary outlays on travel may be sought from respondents, or an estimate may be made by the analyst, based on information provided on distance travelled, mode of transport etc. The latter approach of making an estimate was chosen here, as it was considered that building up the total cost based on individual cost items, using published data on costs, was likely to produce a better estimate of direct outlays than if estimated by respondents. The assumptions made are a source of variation in the analysis. Sensitivity analysis was undertaken to illustrate the implications of different assumptions made in estimating the monetary cost of travel.

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[5] Also critical is the value of the dependant variable, number of visitor-days spent at the site. While this information can be observed for the sample of visitors surveyed, extrapolation of the results to the population of visitors in a year depends upon good visitor records or estimation of visitors by management agencies, and often reliable estimates are not available for protected areas.

The formula used to calculate the cost of travel to the Wet Tropics WHA, per person, per visitor-day, for each zone was:

$C_i = DT_i + (NQ_i / DD_i)$ [10]

Where, DT_i = Day trip to Wet Tropics WHA: mean travel cost per person, per visitor-day, zone i.

Without time cost

$DT_i = (d_i{*}rc_i + d_i{*}pc_i + h_i + t_i)/gdt_i + (al_i/an_i)$ [11]

With time cost

$DT_i = (d_i{*}rc_i + d_i{*}pc_i + h_i + t_i)/gdt_i + (al_i/an_i) + dtt_i$ [12]

And, NQ_i = Travel to North Queensland: mean travel cost per person, per visitor-day, zone i.

Without time cost

$NQ_i = (dh_i{*}dc_i + hc_i + n_i{*}al_i)/g_i + a_i$ [13]

With time cost

$NQ_i = (dh_i{*}dc_i + hc_i + n_i{*}al_i)/g_i + a_i + dt_i + ft_i$ [14]

And, 'DD' is the number of days the respondent spent at a main destination on the trip. This is explained below.
See Table 8.10 for an explanation of the other variables used.

The costs of travel were calculated using a combination of: actual costs collected from each respondent; calculations based on data collected from each respondent; and estimates applied uniformly to the sample. Details of the bases of calculations are given in Appendix H.

The respondents to the survey were one person per group travelling together. Respondents reported on travelling arrangements and costs for their group, as well as the number of people in the group. All travel cost data collected is therefore for groups of known size. This was converted using the formulae above into mean per respondent travel costs. All individual per respondent cost observations were then converted to a mean value for each zone by adding the values for all the observations (respondents) for the zone and dividing by the number of observations (respondents) for the zone.

Table 8.10: Elements of travel cost

Symbol	Description of variable
DT	The travel cost of a day trip to the Wet Tropics WHA
NQ	The cost of travelling to North Queensland
DD	The number of days the respondent spent at a main destination on the trip
d	Driving distance on day trip to Wet Tropics WHA
rc1	Running cost 1 (excludes fuel cost)
rc2	Running cost 2 (excludes fuel cost)
pc	Petrol (or diesel) cost.
h	Hire car cost.
t	Cost of commercial tour.
gdt	Number of adults and children travelling together on day trip.
al	Accommodation costs last night.
an	Number of people sharing accommodation cost.
dtt	Monetary cost of time spent on day trip
dh	Distance driving from home, return
dc1	Driving cost 1 (includes fuel cost)
dc2	Driving cost 2 (includes fuel cost)
hc	Hire car costs
n	Number of nights spent enroute while driving.
g	Number of adults and children in the group travelling to NQ.
a1	Economy class airfares.
a2	Actual airfares.
dt	Monetary cost of time spent driving to NQ.
ft	Monetary cost of time spent flying to NQ.

Opportunity cost of time

There is debate in the TCA literature about how to measure the opportunity cost of time and no one approach is universally agreed upon. There seems to be general agreement in the literature that the opportunity cost of travel for recreation is not the full opportunity cost of paid work time forgone, but some smaller proportion of this. For this study, the opportunity cost of time was calculated at 25% of the hourly wage rate. This was calculated from data collected on annual household income as follows:

hour = ((income / g) / 1773.2)*0.25 [15]

Where, 'hour' is the hourly opportunity cost of time, 'income' is the annual total household income of the respondent, 'g' is the number in the group travelling together to NQ, and 1773.2 is the average number of hours worked per year in Australia. This calculation is based on the method used by Stoeckl (1994).

Day trip travel time 'dtt' was calculated as hour*8, based on commercial tours lasting 8 to 10 hours and assuming private trips would be similar in duration. Flying time to NQ, 'ft', was calculated as hour* number of hours flying time from home airport to Cairns, return. Driving time to NQ, 'dt', was calculated as hour*(dh /87.5), where 87.5 km/hr is the speed travelled to cover 700 km per day (after Stoeckl 1994).

dtt = hour*8 [16]
ft = hour*number of hours flight time (return) [17]
dt = hour*(dh /87.5) [18]

A number of assumptions are evident in the calculation of the opportunity cost of time. These are kept constant and not tested for sensitivity to different assumptions.

Converting to a per visitor-day travel cost

The cost of travel to the Wet Tropics WHA generated as DT is the cost of a day trip and does not need to be further converted. The cost of travel to North Queensland generated as NQ is the cost of the entire return trip. This needed to be converted to a cost component of the per visitor-day cost of visiting the Wet Tropics WHA. The conversion was effected by dividing the total cost by the number of 'destination days' DD. Destination days are days spent at main destinations, that is days spent at sites of interest, not travelling. For visitors whose sole destination was North Queensland, destination days were equal to the number of days spent in North Queensland. However, around 40% of respondents were meanderers who visited other sites in addition to North Queensland. It was assumed that for these people, other main destinations were equally important to North Queensland and so the cost of travel needed to be divided by all days spent at a main destination. The formula used for generating destination days aimed to exclude the time spent driving between main destinations. Flying time was always less than one day and so was not subjected to this correction.

The number of days spent at main destinations was calculated by subtracting the number of days spent driving to North Queensland (or to the airport nearest to home) from total days of the trip. The number of days spent driving was calculated as the return distance from home divided by 700 km, which was the assumed distance travelled each day.

This can be stated as follows:
DD (days spent at a main destination) = days on entire trip - days spent driving [19]
Days spent driving = return distance from home('dh') / 700 km/day. [20]

Options for monetary costs

From Equations 15 and 16, it can be seen that the cost of driving to North Queensland was calculated by multiplying the return distance travelled by the cost of driving. The cost of driving was calculated from information collected in the survey on the model and age of the vehicle used. Costs of running the vehicle and typical fuel costs were based on published data (NRMA 1994a,b; DPIE 1994). In deciding upon a vehicle running cost to use, two main options are available; average vehicle running costs (which include depreciation, interest, registration and insurance, tyres, service and repairs), and marginal running costs (which includes tyres, repairs and maintenance)[6]. The correct cost to use depends upon the overall pattern of use made by the owner of the vehicle. Information on this was not collected in the survey. It was decided to use the two measures and test for sensitivity of the results to the values used.

In the travel cost analysis for North Queensland, two versions of airfares were used. A number of respondents reported zero expenditure on airfares as they were using 'frequent flyer' bonus points. The airfares data which included these zero fares was termed 'actual airfares'. Another data set was constructed where normal economy class airfares were assigned to substitute for zero fares. This was done in the case that by using the actual airfares, a statistically acceptable travel demand function would not be achieved. As satisfactory travel demand functions were obtained using actual airfares, these were adopted for the Wet Tropics WHA exercise.

For the TCM for the Wet Tropics WHA, there were two different monetary travel cost options used for travel to North Queensland component. The use of titles 'Travel cost to NQ 3' and 'Travel cost to NQ 4' were retained for consistency with the North Queensland travel cost analysis, (see Table 8.11).

Table 8.11: Two versions of travel cost to North Queensland

Travel cost to NQ 3	Higher (average) driving cost (dc1) and actual airfares paid
Travel cost to NQ 4	Lower (marginal) driving cost (dc2) and actual airfares paid

Four options were identified for measuring the cost of a day trip to the Wet Tropics WHA, (see Table 8.12). In each case, the cost of travel by private vehicle, hire car or tour was included, depending upon which method of access was used by respondents. In two of these options, the cost of overnight accommodation for one night was included. This cost was included on the basis that it is essential for visitors to spend at least one night in the region in order to make a day trip to the Wet Tropics WHA. The two approaches to private car running costs mirror those used for travel to North Queensland, but in this case, the cost of fuel was included as a separate item, with fuel costs for hire cars.

[6] The NRMA (1994a,b) includes fuel costs in per kilometre 'running costs'. For this study, the term 'running cost' excludes fuel costs and the term 'driving cost' includes running cost plus fuel cost.

Table 8.12: Four versions of day trip only costs

Day trip cost A	Higher (average) private car running cost (rc1), hire car cost, commercial tour cost, as appropriate, plus accommodation
Day trip cost B	Lower (marginal) private car running cost (rc2), hire car cost, commercial tour cost, as appropriate, plus accommodation
Day trip cost C	Higher (average) private car running cost (rc1), hire car cost, commercial tour cost, as appropriate
Day trip cost D	Lower (marginal) private car running cost (rc2), hire car cost, commercial tour cost, as appropriate

When these four cost options were combined with the two options for travel to North Queensland, eight travel cost options were generated, (see Table 8.13).

As each option was formulated without and with time costs, there were 16 data sets generated for which travel demand functions were to be estimated. The mean values over all zones for the variable C are shown in Table 8.14.

Table 8.13: Eight versions of day trip travel costs to Wet Tropics WHA, including travel to North Queensland

Wet Tropics WHA cost A3	Day trip cost A plus travel cost to NQ 3
Wet Tropics WHA cost A4	Day trip cost A plus travel cost to NQ 4
Wet Tropics WHA cost B3	Day trip cost B plus travel cost to NQ 3
Wet Tropics WHA cost B4	Day trip cost B plus travel cost to NQ 4
Wet Tropics WHA cost C3	Day trip cost C plus travel cost to NQ 3
Wet Tropics WHA cost C4	Day trip cost C plus travel cost to NQ 4
Wet Tropics WHA cost D3	Day trip cost D plus travel cost to NQ 3
Wet Tropics WHA cost D4	Day trip cost D plus travel cost to NQ 4

Table 8.14: Mean estimates of day trip costs to Wet Tropics WHA, all Australian visitors (dollars)

	Travel cost without time	Travel cost with time
WTA3	134.67	166.64
WTA4	117.93	149.91
WTB3	122.94	154.92
WTB4	106.21	138.18
WTC3	105.11	137.09
WTC4	88.38	120.36
WTD3	93.39	125.37
WTD4	76.66	108.63

Other variables

Information was collected in the survey on a number of other variables which it was hypothesised might be useful in constructing the demand function. In most cases, this information was collected for the respondent only, on the basis that zone observations would be constructed from the mean values for all respondents from a zone.

Respondents were identified as belonging to one of seven age classes, the mid point of that class was used to allocate a value for age in years. In the survey, income was grouped into nine levels, the mid point of each level was used to allocate an income in dollars. Dummy variables were created for education and occupation. In the first case, education to tertiary level was given the value 1 and all other levels, 0. Work in professional and managerial occupations was given the value 1 with all other occupations, 0.

A number of variables aimed at gauging attractiveness of rainforest were tested in the TCA. Respondents were asked the question: 'How important was the opportunity to visit rainforest in your decision to visit North Queensland?' The responses available were 'the most important attraction', 'one of a number of important attractions', not particularly important' and 'I had not planned to visit the rainforest before coming to North Queensland'. A dummy variable was constructed with the first two answers given the value of 1 and the other two answers given the value of 0. Respondents were asked if they had participated in any of 13 listed activities, walking, photography etc. A score for the number of activities undertaken was compiled. Respondents were asked whether they had visited the area before and a variable was constructed with the value of 1 for 'yes' and 0 for 'no'.

For conversion of dummy variables to log forms, the variables were allocated values of 1 and 10 instead of 0 and 1 and the log was taken of those values.

No variables were constructed to represent the possible influence of substitute sites. A substitute site variable would reflect the price of visiting another site. It was considered that the range of possible substitute sites available to the population of Australian tourists is very wide, including many Australian and overseas destinations. It was not practical to construct accurate price variables for the large number of potential substitute sites.

Hypothesis testing

The hypotheses tested in estimating travel demand functions for visits to the Wet Tropics WHA were:

1. The cost elasticity of demand for visits by Australian tourists to the Wet Tropics WHA is negative and significant[7].
2. The function describing the relationship between visits to the Wet Tropics WHA and monetary costs of travel can be improved by including variables for; opportunity cost of time, socio-economic status, and attractiveness of rainforest[8].

8.3.4 Travel Demand Functions estimated — all visitors to the Wet Tropics WHA

The results of the analyses for all sixteen travel cost options are summarised in Table 8.15. In all cases, satisfactory travel demand functions were obtained where the β_1 coefficients was negative and significant at the 5% level. While in four cases, the Adjusted R^2 values were above 0.5 and therefore quite acceptable, other values were lower and perhaps only marginally acceptable.

Table 8.15: All Australian tourist visitors to Wet Tropics WHA, visitor-days: β_1, and Adjusted R^2. Sample size = 496 records, Number of Zones = 45

	Travel cost without time β_1	Travel cost without time Adjusted R^2	Travel cost with time β_1	Travel cost with time Adjusted R^2
WT A3	-1.450*	0.496	-1.634*	0.471
WT A4	-1.657*	0.525	-1.970*	0.499
WT B3	-1.243*	0.501	-1.499*	0.490
WT B4	-1.818*	0.554	-2.215*	0.531
WT C3	-1.141*	0.355	-1.320*	0.390
WT C4	-1.260*	0.425	-1.684*	0.432
WT D3	-1.048*	0.402	-1.285*	0.436
WT D4	-1.003*	0.428	-1.484*	0.446

*: β_1 ⁻ve and significant at 5% level, two-tailed test.

It has been established that for all the versions of travel cost tested, there is an inverse relationship between the cost of travel and the number of visitor-days spent in the Wet

[7] To test hypotheses 1, the form for the test is:

$$H_O: \beta_1 = 0$$
$$H_A: \beta_1 < 0$$

Where β_1 is the coefficient of the variable travel cost C.

[8] To test hypothesis 2, the following hypothesis was posed for each of the other variables, each time a demand function was generated.

$$H_O: \beta = 0$$
$$H_A: \beta \neq 0$$

Where β is the coefficient of the other variable.

Tropics WHA. These results lead to acceptance of Hypothesis 1. The price elasticities of demand range quite widely from -1.0 to -2.2. The range of size of the β_1 coefficients raises some uncertainty about the likely size of the decrease in demand with an increase in costs.

The R^2 values indicate that the cost of travel plus up to one other variable explains around 35% to 55% of demand. The variable for the average age of respondents from the zone appeared in six of the sixteen travel demand functions estimated. The higher the average age, the less visitor-days were spent in the Wet Tropics WHA. In two other travel demand functions, the variable for 'visited North Queensland before' appeared. Respondents were more likely to visit the Wet Tropics WHA if they had not visited before.

The travel cost producing the travel demand function with the highest R^2 value was WTB4. This travel cost included lower (marginal) driving costs, overnight accommodation and no time costs. The mean cost was $106.21. This travel demand function however predicted only 51% of observed visitor-days. The variable for 'visited North Queensland before' was the only other variable appearing in the travel demand function.

The travel cost WTB4 was chosen on the basis of having the highest R^2 value to be the 'preferred' measure of travel cost. In order to undertake sensitivity analysis, the highest travel cost (WTA3 with time, represented as WTA3t) and the lowest travel cost (WTD4) were also chosen for further analysis. The characteristics of these options are summarised in Table 8.16.

Table 8.16: Travel cost options for further analysis, all visitors to Wet Tropics WHA

	Travel cost	Mean travel cost $	β_1	Adjusted R^2
Preferred estimate	WTB4	106.21	-1.818	0.554
Highest estimate	WTA3t	166.64	-1.634	0.471
Lowest estimate	WTD4	76.66	-1.003	0.428

The travel demand functions obtained that led to acceptance of Hypothesis 1 are shown here, for the preferred, highest and lowest travel cost estimates. The figures in brackets are the *t statistics*. See Appendix H for the travel demand functions obtained with other travel costs.

Preferred travel cost estimate WTB4

WTB4	$\ln Vd_i/P_i =$	7.130	$-\ 1.818 \ln C_i$	$-\ 0.541 \ln B_i$	[21]
		(5.399)	(-6.952)	(-3.056)	

Highest travel cost estimate WTA3t

WTA3t	$\ln Vd_i/P_i =$	11.294	$-\ 1.634 \ln C_i$	$-\ 1.269 \ln A_i$	[22]
		(4.666)	(-5.725)	(-2.216)	

Lowest travel cost estimate WTD4

WTD4	$\ln Vd_i/P_i =$	2.526	$-\ 1.003 \ln C_i$		[23]
		(3.495)	(-5.825)		

Table 8.17: Legend for symbols in equations

$\ln Vd_i/P_i =$	log of number of visitor-days from zone i/ P_i
$P_i =$	Population from zone i / 1000
$\ln C_i =$	log of cost of travel from zone i
$\ln A_i =$	log of average age of respondent in zone i
$\ln B_i =$	log of dummy variable for whether the respondent had visited NQ before, average for zone i

8.3.5 Generating the Entry Fee Demand Function

The equations obtained for the travel demand function were used to calculate a demand schedule for entry to the Wet Tropics WHA in the face of hypothetical entry fees. The method of calculating the schedule of demand under hypothetical entry fees from the travel demand function and calculating consumers' surplus is described in Section 8.1.6. The following calculation, for visitor-days to the Wet Tropics WHA by all visitors, for travel cost WTB4, is included for illustration.

The equation obtained for the travel demand function, without time was:

$\ln Vd_i/P_i = 7.130 - 1.818 \ln C_i - 0.541 \ln B_i$ [24]

Based on Equation [5], the demand for visits from zone i at a range of entry fees was calculated by:

$Vd_i = 1248.88^* ((C_i + F)^{-1.818}) * ((Bi)^{-0.541}) * (P_i)$ $F = \$0, \$1, \ldots \$x.$ [25]

Where 1248.88 is the antilog of 7.130 and F is the entry fee.

The total visits demanded by the sample at different entry fees were calculated, using the formula in Equation [6], and are shown in Table 8.18 and in Figure 8.1.

8.3.6 Calculation of consumers' surplus

There are several alternative approaches to calculating the area under the entry fee demand function, which represents consumers' surplus. The most straightforward approach is to calculate the area under the curve delineated by the actual data shown in Table 8.18 and graphed in Figure 8.1. That was the method selected for this study. The total area under the curve was calculated by taking the area under segments of the schedule and adding these. The other approaches are to fit a linear or double log regression function to the data and find the area under whichever function gives the best estimation of the data.

It is obvious from Table 8.18 and Figure 8.1 that at very high fees only a small percentage of visitors would be willing to pay to enter the Wet Tropics WHA. As the travel demand function was estimated as a double log function, it is actually asymptotic to the Y axis and will never specify a fee at which the quantity of visits demanded will become zero. It is necessary to select a fee that will be used as the maximum 'cut-off fee' for estimating the area under the curve. The data for WTB4 in Table 8.18 suggest that less than one per cent of visitors are willing to pay more than $2000 per day to visit the Wet Tropics WHA. The area under the curve was calculated using cut-off points of $2000, $500 and $100. This illustrates the difference that selection of a cut-off point can make to estimates of consumers' surplus. The survey results suggest that 75% of visitors to the Wet Tropics WHA are willing to pay $100 or less to visit the Wet Tropics WHA. When the $100 cut-off point is used, all visitors willing to pay more are assumed to be willing to pay $100. The total and mean consumers' surplus results for the sample of visitors surveyed are shown in Table 8.19.

The data presented in Table 8.19 includes estimates for the mean consumers' surplus per visitor-day for the sample of Australian tourists surveyed. These mean values were used to estimate the consumers' surplus enjoyed by the population of Australain tourists who visit the Wet Tropics WHA in one year. The number of visitor-days to the Wet Tropics WHA by Australian tourists is estimated in Chapter 4 at 3.4 million per year. As there is some uncertainty about the means of making this estimate (see Chapter 4), sensitivity analysis is undertaken here, using an estimate of half that number of visitor-days, ie. 1.7 million visitor-days, as a possible lower bound of the number of visitor-days. The estimated total annual consumers' surplus (based on 1994 data) is presented in Table 8.20.

Table 8.18 Predicted demand for entry to Wet Tropics World Heritage Area at hypothetical entry fees, all visitors to Wet Tropics WHA

	WTB4		WTA3t		WTD4	
Entry fee (dollars)	Visitor-days predicted	% of visitor-days $0 entry fee	Visitor-days predicted	% of visitor-days $0 entry fee	Visitor-days predicted	% of visitor-days $0 entry fee
0	2487	100	3300	100	3333	100
1	2428	98	3260	99	3261	98
2	2371	95	3220	98	3193	96
5	2215	89	3105	94	3010	90
10	1992	80	2929	89	2756	83
15	1807	72	2769	84	2549	76
20	1650	66	2624	80	2375	71
50	1053	42	1968	60	1709	51
100	613	25	1324	40	1181	35
200	293	12	765	23	735	22
300	175	7	505	15	535	16
400	117	5	363	11	420	13
500	84	3	276	8	346	10
1000	28	1	109	3	184	6
1500	14	1	60	2	125	4
2000	8	<1	39	1	95	3

Figure 8.1 Entry fee demand function WTB4

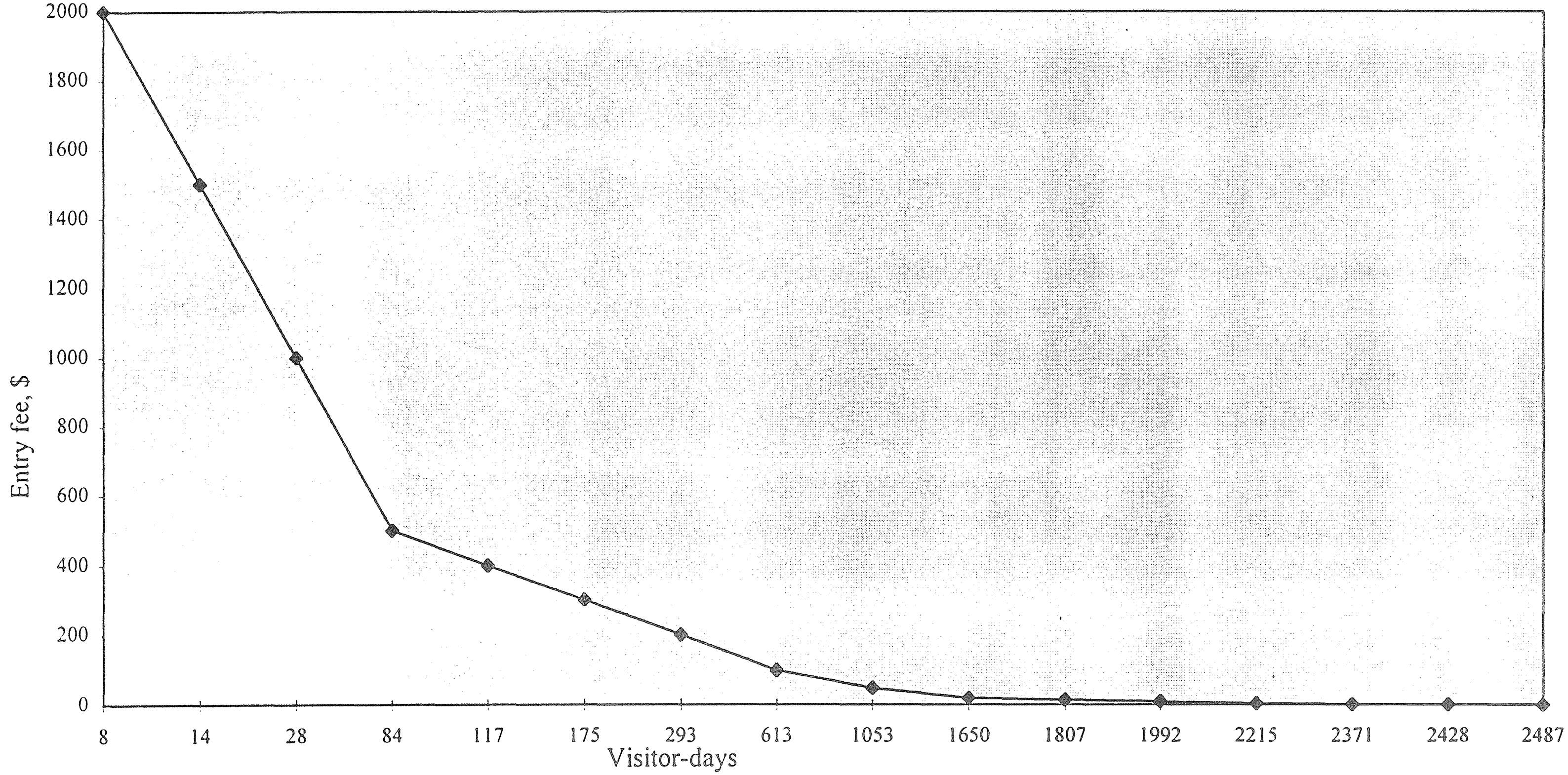

Table 8.19: Results of consumers' surplus estimations for sample of Australian tourists to the Wet Tropics WHA

	WTB4	WTA3t	WTD4
Number of visitor-days represented	2487	3300	3333
$2000 cut-off			
Total for sample	259 939	616 550	699 426
Mean per visitor-day	105	187	210
$500 cut-off			
Total for sample	215 939	453 300	434 676
Mean per visitor-day	87	137	130
$100 cut-off			
Total for sample	122 589	210 000	189 326
Mean per visitor-day	49	64	57

8.3.7 Conversion of consumers' surplus estimates for sample to population estimates

One notable aspect of the results is how greatly they vary with the choice of cut-off point for maximum entry fee considered. The other notable aspect is that these estimates indicate that the benefits of direct visits to the Wet Tropics WHA are indeed large.

Table 8.20: Estimates of annual consumers' surplus for population of Australian tourists to the Wet Tropics WHA, 1994 ($million)

Cut–off value	WTB4 1.7m visitor-days	WTB4 3.4m visitor-days	WTA3t 1.7m visitor-days	WTA3t 3.4m visitor-days	WTD4 1.7m visitor-days	WTD4 3.4m visitor-days
$2000	178.5	357.0	317.9	635.8	357.0	714.0
$500	147.9	295.8	232.9	465.8	221.0	442.0
$100	83.3	166.6	108.8	217.6	96.9	193.8

8.3.8 Calculation of price elasticity of demand

Fitting a regression to the data in Table 8.18 is useful to estimate the price elasticity of demand for entry fees. The double log function was estimated to find the β coefficient of entry fee cost. This is the price elasticity of demand for entry fees, across the range from $0 to $2000. The results, in Table 8.21, show a predictable high R^2 value and elasticity relatively close to unitary. Price elasticities of demand for segments of this function, corresponding to increases in fees are estimated below.

Table 8.21: Double log regression results

	β	Adjusted R^2
WTB4	– 0.755*	0.853
WTA3t	– 0.576*	0.822
WTD4	– 0.482*	0.884

* β ⁻ve and significant at 5% level, two-tailed test.

8.3.9 Testing for multicollinearity

It is relevant when using multiple linear regression to test for the possible effects of multicollinearity (Walsh 1986). Multicollinearity occurs where two or more of the variables are not independent of each other. The treatment in this exercise of time costs as either absent, or as a part of the total travel cost, meant that the possibility of money and time costs being correlated did not arise. As it turned out in this exercise, there were very few cases where there were more than two independent variables in the travel demand functions estimated and multicollinearity was unlikely to be a problem. The test for multicollinearity is to generate correlation coefficients between pairs of independent variables. Tables of correlation coefficients were generated for all the independent variables used in estimation of travel demand functions for visits to North Queensland and visits to the Wet Tropics WHA. In no case was a correlation coefficient greater than 0.8 and this is generally taken to rule out the existence of problems with multicollinearity (Walsh 1986).

8.4 Discussion of results

8.4.1 The effect on results of different travel cost estimates

Consumers' surplus

There was obviously a difference in the consumers' surplus generated with different travel cost estimates. However, the results do not vary in a monotonic fashion, as Randall (1994) suggests they might. The results are not ranked in the same order as the ranking from lowest to highest of the mean travel cost used. This is probably because the travel costs used in this study do not vary in a monotonic fashion. As the travel costs used in this study are uniquely calculated for each observation, based on the actual travel patterns of respondents in the zone, the effect of a change in travel cost will not be uniform across all 45 zones. For example, the effect of increasing travel costs by changing from marginal vehicle running costs to average running costs will only affect the travel costs for those respondents who drove. The resulting travel demand functions that best fit the data will be influenced by the values of individual zone observations. The travel demand functions obtained in turn determine the form of the entry fee demand functions generated and the consumers' surplus and price elasticity of demand estimates.

Another very obvious source of variation in the results is the selection of a cut-off point for the upper fee when calculating consumers' surplus. There is no obvious correct point to choose (though it should not be higher than $2000, which predicts close to 100% of visitor-days.).

At the $2000 point cut-off, the lowest result for consumers' surplus (WTB4) is only 50% of the highest result (WTD4). However the variation reduces as the cut-off point is lowered and at the $100 cut-off point, the lowest result for consumers' surplus (WTB4) is 77% of the highest result (WTA3t).

Price elasticity of demand

In comparing estimates of price elasticity of demand, as measured by the β coefficient of the double log function (see Table 8.21 above), the first observation to make is that the results differ with the travel cost chosen. The lowest estimate of price elasticity of demand (WTD4) is 64% of the highest estimate (WTB4).

Conclusions on Randal's concerns

These results show that the TCM technique does not give results that can be interpreted as absolute measures of benefits enjoyed by visitors to natural environment areas. The results obtained are determined by the data used in the analysis. As the actual price to individuals of travel to a site is difficult to observe, the price has to be estimated via observations on travel costs. There is no agreed theoretically correct way to measure and apportion costs, and decisions have to be taken by the analyst at several points in constructing cost values, including; in choosing measures for the opportunity cost of time, choosing measures of vehicle costs, and accounting for multiple destinations. The analyst has to chose between using as close as possible to actual costs of travel and using averages, for example using vehicle cost based on the actual vehicle used versus using costs for an 'average vehicle'.

In this study, costs of flying and driving were combined and actual costs were used as far as possible. This led to significant variation within the travel cost options generated. The results for consumers' surplus and price elasticity of demand estimated did not reflect the ranking of mean travel costs for the sixteen travel cost options used in the analysis. This is because the 45 observations for each travel cost option did not change uniformly across the different options. Despite this variation, satisfactory travel demand functions were obtained which indicate a relationship does exist between the cost of travel and number of visitor-days demanded. This allowed the generation of consumers' surplus and price elasticity of demand estimates. The results obtained across the three travel cost options selected for further analysis were of the same order of magnitude, which leads to some confidence in using the results obtained. The results can only be interpreted as estimates of the relative size of benefits to tourists of visiting the Wet Tropics WHA, not as absolute measures of welfare.

While the TCM technique may be based on a theoretically sound approach (given acceptance of the assumption that behaviour in respect of entry fees will be the same as behaviour in respect of travel costs) the practical application requires many further assumptions to be made, for which there is no clear theoretical basis, which means that no measure obtained via TCM can be claimed to be absolute.

8.4.2 Choice of values to use in modelling

Consumers' surplus

A major aim of undertaking TCM was to generate estimates of consumers' surplus from visits to the Wet Tropics WHA and a price elasticity of demand for entry fees, for use in modelling net benefits of tourism in the Wet Tropics WHA. The variation in the results associated with different values for travel cost and selection of fee cut-off points leads to understanding that there is no absolute measure generated via this methodology, but all results are estimates. Nevertheless as the results for consumers' surplus are similar across the ranges of travel cost values used, as are the results for price elasticity of demand, which leads to some confidence that the order of magnitude of the estimates is correct. The conservative approach is to select a consumers' surplus estimate from the lowest end of the range. If the $100 cut-off point is used, there is not much difference in mean estimates of consumers' surplus across the different travel cost values. An estimate of $49 per visitor-day would be a conservative choice.

Price elasticity of demand for entry fees

It is not so straightforward to select which estimate of price elasticity of demand to use in further analysis. If there were no change (decrease) in demand with a change (increase) in price, demand would be described as 'inelastic'. A one per cent decrease in demand with a one per cent increase in price is termed 'unitary elasticity' and the price elasticity of demand would be indicated as -1.0. All of the estimates of price elasticity of demand for travel to the Wet Tropics WHA are around -0.5 or less, that is relatively inelastic. If an estimate of -0.5 is used and the actual response to an increase in fees is even less elastic, the result would be that the actual fall in the number of visitors would not be as great as predicted and revenue raised would be higher than predicted. This is probably a preferable direction for error if fees are to be imposed for revenue raising. However, if the objective were to ration use via fees, it would be preferable for any error to be in the other direction. As the exercise in Chapter 9 is more to do with revenue raising, the estimate of price elasticity of demand selected for use in the modelling should be the most elastic of the estimates available.

The modelling exercise in Chapter 9 requires that scenarios be generated for the imposition of a range of different entry fees, where there are now no fees. This requires the use of price elasticity of demand estimates for segments of the entry fee demand function, not the entire function as represented by the β coefficient reported above.

The price elasticities of demand for increases of fees from \$0 to \$1, \$2, \$5, \$10, \$15, and \$20 were estimated for the three travel cost options represented in Table 8.18 by applying a formula to the relevant data in the table. The formula for calculating the elasticity describing the change in demand with a change in entry fees is[9]:

$$\varepsilon_p = ((Q_X - Q_0)/0.5*(Q_X + Q_0)) / ((P_X - P_0) / 0.5*(P_X + P_0)) \qquad [26]$$

Where, Q_0 is the number of visitor-days at the current zero entry fee, Q_X is the number of visitor-days predicted at a hypothetical entry fee, P_0 is the current zero entry fee, and P_X is a hypothetical entry fee.

The results are given in Table 8.22. Consistent with the aim of selecting the most elastic estimates for use in analysis, the estimates for the travel cost WTB4 will be used in the Chapter 9 modelling exercise.

Table 8.22: Price elasticity of demand, entry fees from \$0 to a range of fees

Entry fee increase	WTB4	WTA3	WTD4
\$0 to \$1	–0.012	–0.006	–0.010
\$0 to \$2	–0.023	–0.012	–0.029
\$0 to \$5	–0.057	–0.030	–0.050
\$0 to \$10	–0.110	–0.059	–0.094
\$0 to \$15	–0.158	–0.087	–0.133
\$0 to \$20	–0.202	–0.114	–0.167

9 This formula is taken from Knapman and Stoeckl (1995).

8.4.3 Comparison of results for travel to North Queensland with results for travel to Wet Tropics WHA

Estimates of consumers' surplus (total for the sample and mean) for visits to North Queensland, taken from Appendix G, are given in Tables 8.23 and 8.24 below. The conservative estimate of mean consumers' surplus for a visitor-day for North Queensland is $55 and the for the Wet Tropics WHA it is $49. These are relatively close results. It is not possible to say from these results that a visitor-day to North Queensland is worth more than one to the Wet Tropics WHA, as the difference in results may be a function of the choice of cost used in analysis. In particular the treatment of costs for visitors with multiple destinations necessarily varied for the two sets of analysis.

The price elasticity of demand results vary between –0.4 and –0.7. These are relatively similar when compared with the results for segements of the entry fee demand functions, as presented above.

Table 8.23: Results of consumers' surplus estimations, total and mean for sample, for visitor-days, all visitors to North Queensland, Travel cost 4 with proportional factor (dollars)

	Without time cost	With time cost
Number of visitor-days represented	10 999	11 382
$2000 cut-off		
Total for sample	2 720 502	2 550 321
Mean per visitor-day	247	224
$500 cut-off		
Total for sample	1 486 002	1 462 321
Mean per visitor-day	135	128
$100 cut-off		
Total for sample	601 752	615 171
Mean per visitor-day	55	54

Table 8.24: Double log regression results, all visitors to North Queensland, Travel cost 4 with proportional factor, $2000 cut-off

	β	Adjusted R^2
Without time cost	–0.418	0.913
With time cost	–0.446	0.908

8.4.4 Comparison with results of other studies

It is relevant to consider the results of some recent studies undertaken using the TCM. Four studies have been identified where the results have direct relevance to the current study as they have been conducted for other Australian World Heritage Areas or sites within WHAs. All four studies employed the traditional approach to TCM.

Kakadu National Park

A study of the value of Kakadu National Park to travellers was published in 1991 by Knapman and Stanley. The study included Australian visitors who made up 80% of visitors. People from Jabiru township located within the National Park were not included in these visitor numbers or in the study. Knapman and Stanley do not report the average length of a visit but information from the park managers is that the average stay by private visitors was four days and the average stay by visitors on commercial tours was two days in 1991 (ANPWS 1991). Visitor fees of $5 per visit were charged in 1991.

The consumers' surplus, above payments of entry fees[10], was estimated at $34 005 149. The mean consumers' surplus was therefore $174 per visit for 200 000 actual visits or $140 for 242 135 predicted visits. The estimates are in 1990 dollars.

Hinchinbrook Island National Park

Hinchinbrook Island National Park is located off the Queensland coast, close to Cardwell. It is within the Great Barrier Reef WHA. The results of a study using TCM for visits to Hinchinbrook Island were published in 1994 by Stoeckl. This study only included Australian visitors, who made up an estimated 70% of all visitors. It was estimated that there were 3211 visits by Australians. Stoeckl does not report the average length of stay by visitors but notes that visits are made as day trips or longer stays. There are no entry fees to the island[11].

The consumers' surplus was estimated at between $959 811 and $1 164 735[12]. The mean consumers' surplus per visit was $362. The estimates are in 1992 dollars.

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[10] It was estimated from the model that with current entry fees of $5 per visit, $896 797 would be paid in entry fees at the number of visits predicted by the model, which was 242 135 visitors.

[11] Tour operators on Queensland National Parks pay a per visitor fee of $1.15 or $2.30 per day but the extent to which that is passed on to visitors or made known to visitors is unknown.

[12] The smaller estimate does not include a value for the opportunity cost of travel time while the larger estimate does. The estimate without time costs gave a better R^2 value in the travel demand function.

Price elasticity of demand, Kakadu and Hinchinbrook

Neither of the above studies provided results on price elasticity of demand for entry fees. In a separate paper published by Knapman and Stoeckl (1995), the results of further analysis to calculate the price elasticity of demand for entry fees into both Kakadu and Hinchinbrook were presented. Elasticities were calculated over a range of hypothetical entry fees. It was found that with low fees, the demand was highly inelastic in that the predicted decrease in demand with an increase in fees was very small. The authors also calculated the fee level at which a one per cent increase in fees would result in a one per cent decrease in demand and found this to be quite high, at least $100. Some results of this analysis are presented in Table 8.25.

Table 8.25: Price elasticities of demand for Kakadu and Hinchinbrook

Model	Initial entry fee ($A)	Final entry fee ($A)	Estimated own-price elasticity	Estimated entry fee at which demand becomes elastic ($A)
A (Kakadu)	5	6	−0.014	196.60
B (Kakadu)	5	6	−0.012	225.08
C (Hinchinbrook)	0	1	−0.0015	165.70
D (Hinchinbrook)	0	1	−0.0005	552.84
E (Hinchinbrook)	0	1	−0.0025	99.44

(Knapman & Stoeckl 1995)

Fraser Island World Heritage Area

TCM was applied to estimate recreation values for Fraser Island before it became a WHA. The results of the study by Hundloe et al were published in 1990. The study included all visitors, there is no indication that any of these were not Australian. Two populations of visitors were surveyed, private visitors and those on commercial tours. There were an estimated 100 000 private visitors in 1989-90 who stayed andaverage of five days. There were 90 000 visitors on tours. The length of stay is not reported but a proportion of tours are day trips. There was a visitor fee of $10 per private vehicle at the time. Entry fees, if any, for visitors on commercial tours are not reported.

The estimate of consumers' surplus above entry fees was between $3 million and $6.2 million[13]. Based on a total of 1900 000 visits, the mean consumers' surplus was between $15.70 and $32.63 per visit. No estimates of price elasticity of demand were published.

[13] The $3 million estimate comes from estimating the consumers' surplus for the two groups separately and adding the results. When the survey responses for both groups were added and a single consumers' surplus value estimated, the result was $6.2 million.

Dorigo National Park

Dorrigo National Park in Northern NSW is one of the reserves that make up the Central Eastern Rainforest Reserves (Australia) World Heritage Area. It receives approximately 1600 000 day visits per year. There are no entry fees for the Park.

Bennett (1995) estimated the consumers' surplus for the Park at a mean value of \$34.34 per visit (visitor-day)[14]. This translated into a total of \$5.4 million per annum. The entry fee demand function was estimated in a double log form and thus the price elasticity of demand could be observed - the elasticity estimate was –1.693.

Comparison

The results of the study by Bennett provide the only direct comparison as the mean consumers' surplus was calculated for a visitor-day. Bennett's estimate was \$34.34 (using an \$100, cut-off point), which is lower than the \$49 lower bound estimate for the Wet Tropics WHA, but of a similar magnitude.

In all the other studies, the consumers' surplus is calculated for a visit, and the length of visits is not identified. The values achieved in these other studies range for \$15.70 to \$362, which does raise questions about what the results mean. It is likely that different approaches to using cut-off points for generating estimates has an influence on the results selected for reporting. It would be useful if there could be more standardisation across studies with respect to using visits or visitor-days as the dependant variable (although as in this case, the analyst may have to chose the only option that produces useable travel demand functions) and the use of cut-off points in calculating consumers' surplus.

The price elasticity of demand estimates derived for the Wet Tropics WHA, over the lower range of increases in entry fees show demand is not very elastic for low entry fees. This is a similar result to that of Knapman and Stoeckl for Kakadu and Hinchinbrook Island. This is an important finding in terms of ability to raise revenue without reducing demand in any significant way.

8.4.5 Overall conclusions

The exercise to estimate a mean consumers' surplus and price elasticity of demand for visits to the Wet Tropics WHA was successful. Due to limitations in the TCM, which

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[14] Bennett used a double log function to estimate the travel demand function and therefore the entry fee demand schedule estimated was asymptotic. He used a \$100 cut-off point as the upper limit of fees used to estimate consumers' surplus.

were discussed in this chapter, the results must be qualified as being estimates only, and not absolute measures of welfare. Using the estimated (lower bound) mean consumers' surplus, total consumers' surplus generated with respect to annual visits by Australian tourists to the Wet Tropics WHA was estimated at between $83 and $218 million in 1994. The magnitude of this value justifies efforts to achieve sustainable tourism in the Wet Tropics WHA in the future.

CHAPTER 9
ANALYSIS FOR SUSTAINABLE TOURISM

An approach for analysis of questions of sustainable tourism in a protected area was outlined in Chapter 5. In this chapter, the approach is applied to the Wet Tropics WHA, using the data generated for this case study and reported in Chapters 6 to 8.

The objectives of the empirical analysis derived from the issues to be investigated in this study, set out in Chapter 1. The objectives of the empirical analysis, therefore were:

1. To test the ability to operationalise in practice the concept of sustainable tourism in protected areas, according to the criteria and conditions proposed in Section 5.1, using empirical analysis of tourism in the Wet Tropics WHA;
2. To provide a practical example of the potential for the use of the economic instrument of 'entry fees' for the Wet Tropics WHA; and
3. Based on (1) and (2) to make an assessment of the role of economics in providing managers with empirical guidelines and instruments for promoting sustainable tourism in protected areas.

It is useful to reiterate the proposed criteria and condition for sustainable tourism developed in Chapter 5.

The two *criteria* for sustainable tourism proposed are:
(i) maintain critical natural capital; and
(ii) provide a non-declining stream of positive net economic benefits.

In addition, an essential *condition* for meeting these criteria over time is proposed:

maintain investment in adequate management.

An evaluation of whether tourism in the Wet Tropics WHA is currently sustainable or is likely to be sustainable in the future required consideration of whether the two criteria are being met and whether the management system is set up to guarantee adequate investment in management. A brief assessment of the current situation in respect of meeting criterion (i) is presented in Section 9.1.

A quantitative approach to assessing the current situation in respect of criterion (ii) is presented in Section 9.2. The modelling was also extended to a range of possible future scenarios for tourist numbers and expenditure on management. In Section 9.3, the results of the modelling and a discussion of these are presented.

9.1 Criterion 1: Maintain critical natural capital

This brief assessment of whether criterion (i) is being met is necessarily a qualitative assessment as the scientific data and models do not exist to provide a quantitative assessment, and collecting and analysing such data was not an objective of this study.

There are a number of threats to maintaining critical natural capital in the Wet Tropics WHA. Tourism is amongst these. The survey of scientists and managers reported in Chapter 6 revealed that the majority of respondents thought that tourism was not currently responsible for significant region wide impacts. Some respondents did note particular instances of impacts of tourism at a local level. Respondents were generally concerned that significant impacts may occur in the future as the result of cumulative impacts of visitor presence, and increased visitor numbers. All respondents were of the view that management was necessary to contain impacts. Current funding for management was identified to be inadequate by some respondents and a lack of research and monitoring was noted.

It is not wise to try to make a definitive assessment from the information available of whether criterion (i) is being met. At the time of the survey, it is possible that criterion (i) was generally being met. However if funding of management of the Wet Tropics WHA and therefore funding of visitor management is reduced below that assessed as 'adequate' there is no guarantee that criterion (i) will be met in the future.

9.2 Applying the economic model

An economic model for assessing sustainable tourism in a protected area was developed in Chapter 5. The steps taken in applying the model to the Wet Tropics WHA in this chapter were previewed in Chapter 5.2. For this present chapter, modelling was undertaken according to these steps, using an EXCEL spreadsheet. Detailed results for each scenario modelled are given in Appendix I.

9.2.1 Variables in the model for the Wet Tropics WHA

Model period

The model covers a ten year period from 1994 to 2003. This period approximately coincides with the period for which forward projections of tourism to North Queensland are available and therefore is relevant for forward planning for management of the Wet Tropics WHA. The base year for data for the model is 1994. This year was selected because data on consumers' surplus and price elasticity of demand were collected for 1994. The total number of visitor-days to the Wet Tropics WHA, estimated from the *1993 WTVUS* (Manidis Roberts et al 1994), for 1993-94, was used as an estimate of 1994 visitor numbers. The information available on forward budgets and actual funding of visitor management is for financial years, was estimated for calendar years. The dollar values used were all standardised to 1994 values.

Number of visitor-days (VD)

The number of visitor-days to the Wet Tropics WHA was based on the results of the *1993 WTVUS* (Manidis Roberts et al 1994). That study reported the estimated number of visits to sites in the Wet Tropics WHA in 1993. Those results were adopted for 1994 for the purposes of this model. This estimate was converted to visitor-days using the method described in Section 4.2, of dividing the number of visits to a site by the mean number of sites visited in a day. Estimates of the number of visitor-days made to the Wet Tropics WHA by all visitors and by each sub-group were made on the basis of a mean of 1.4 sites visited per day. The estimates used in this chapter are shown in Table 9.1.

It is possible that there are errors in both the estimates of visits in the *1993 WTVUS* and the conversion to visitor-days undertaken for this study. Therefore, sensitivity analysis using a lower number of visitor-days was also undertaken for the baseline scenario.

Table 9.1: Estimated number of visitor-days to the Wet Tropics WHA

	Estimated number of visitor-days
All visitors	3 400 000
Local residents	1632000
Australian tourists	1054000
Overseas tourists	714 000
Independent visitors	2278000
Visitors on commercial tours	1122000

Consumers' surplus (CS_A, CS_L)

As explained in Chapter 5, net economic benefits of tourism in the Wet Tropics WHA should be calculated with reference to Australia only. The relevant elements of consumers' surplus for this model are consumers' surplus to Australian tourists and to local residents who visit the Wet Tropics WHA. Consumers' surplus to visitors from overseas was not included.

Estimates of consumers' surplus to Australian tourists were generated using the TCM. The estimate of mean consumers' surplus per visitor-day selected for use in the baseline case was $49, (see Section 8.4.2).

While it was intended to estimate a value for consumers' surplus per visitor-day for local residents visiting the Wet Tropics WHA via the TCM, it was found that the pattern of visitor use by local residents was not amenable to analysis using the TCM (at least in its traditional form, see the discussion in Section 5.3). It was assumed that a positive consumers' surplus does accrue to local residents. It was also assumed that the mean consumers' surplus per visitor-day is lower for local residents than for Australian tourists, although there is no evidence that it would be lower.

It would be normal in these circumstances to nominate a conservative value for CS_L for use in the analysis, ie. an amount less than CS_A, and then to undertake a sensitivity analysis. The sensitivity analysis would include an investigation of the effect if CS_L were $0. The results of analysis using only the CS_A value illustrated that the conditional net benefits of tourism are high and that addition of a positive value for CS_L would only add to the positive result. Therefore, the CS_L is given a value of $0 in this analysis. It was important to show how the CS_L value fits into the model, so it was modelled even though a zero value is used. If the results were not so obvious, it would be important to generate a value for CS_L. Using this approach, the gross benefits to visitors of access to the Wet Tropics WHA are underestimated.

The total consumers' surplus (TCS) is calculated as follows:
TCS = (Visitor-days, Australian tourists x $49) + (Visitor-days, local residents x $0)

Producers' surplus (PS_T)

The model calls for inclusion of a value for producers' surplus accruing to the commercial tourist industry dependent on the Wet Tropics WHA. The relevant value is producers' surplus generated via providing commercial tour services to all visitors - overseas tourists, Australian tourists and local residents - who use these services. It was estimated that one third of all visitor-days are made by commercial tour.

A discussion of the concept of producers' surplus, its likely occurrence in relation to the tourist industry associated with the Wet Tropics WHA and how it might be quantified is presented in Appendix F. It was concluded that it was beyond the scope of this study to measure with any accuracy the producers' surplus associated with the range of relevant tour types and other non tour operations. However it was also concluded that there is likely to be a surplus arising, at least for some of the sub-sectors of the industry. The value of producers' surplus was therefore concluded to be positive but unknown.

As for CS_L, the value for producers' surplus was modelled as $0. The same comments apply, if the results of the analysis using only CS_A to measure benefits were not so conclusive, it would be important to include an estimate of PS_T.

The producers' surplus is calculated as follows:
PS_T = (Visitor-days on commercial tours x $0)

Management budget (actual) (MB_W)

The actual management budget is the historical and predicted budget appropriations for visitor management. Historical spending on management of tourism and recreation were calculated and reported in Section 6.2. Forward projections of the 1996-97 budget are used here for estimates of future budgets. It should be noted that in the future, government appropriations may be supplemented by revenue raised from users. The potential revenue from entry fees was included in some of the scenarios modelled. The projected actual management budget, standardised to 1994 dollars is shown in Table 9.2. These values were used for MB_W throughout the modelling undertaken in this chapter.

Table 9.2: Projected actual management budget 1994 to 2003

	1994 $'000	1995 $'000	1996 $'000	1997 $'000	1998 $'000	1999 $'000	2000 $'000	2001 $'000	2002 $'000	2003 $'000
Budget	5 180	3 471	2 050	2 050	2 050	2 050	2 050	2 050	2 050	2 050
1994 dollars	5 180	3 401	1 969	1 969	1 969	1 969	1 969	1 969	1 969	1 969

Management costs of 'adequate management' (MC_{OW})

The management costs of 'adequate management' are the costs it is considered necessary to meet to ensure adequate management for sustainable tourism, according to criterion (i), maintain critical natural capital. These costs were estimated by examining the actual management expenditure and adding funding for any elements not adequately funded in the current budget. The exercise of estimating management costs of adequate management for the baseline year with no visitor growth, and two management strategies incorporating growth in visitor numbers is reported in Section 6.3. The value of MC_{OW} changes with the number of visitor-days and so differs across the model runs. The actual data used in each scenario are shown in Appendix I.

Conditional Net Economic Benefits (NEB_C)

Net economic benefits for each year are calculated *conditional upon* management costs for adequate management being provided. The NEB_C value is therefore the net economic benefit of sustainable tourism in the Wet Tropics WHA. This assumes that the shortfall in funding for management is zero. It is this figure that is to be monitored to determine if criterion (ii) for sustainable tourism, 'provide a non-declining stream of positive net economic benefits', is being met. The criterion will only be met if the NEB_C in <u>each</u> year is positive and the stream is non-declining.

The NEB_C measure is relevant to policy decisions on management of visitor use in the Wet Tropics WHA. If the NEB_C in the baseline year is positive, this signals that the benefits to Australian society of the current level of visitor use outweighs the costs nominated for adequate management, and that providing the funding nominated for adequate management is justified. This measure should also guide policy decisions on how much funding to allocate to management in future years.

The conditional net economic benefit (NEB_C) for any year was calculated as follows:

$$NEB_C = (TCS + PS_T) - MC_{OW}$$

Conditional Net Present Value (NPV_C)

The conditional discounted net present value (NPV_C) of net economic benefits over a number of years was used to bring the benefits and costs of a 'sustainable tourism program' (ten years is modelled here) to a single measure. A discount rate of 8% was used here, following recommendations of the Department of Finance (1991), but sensitivity analysis to different discount rates could also be employed. If the NPV_C is positive, the program is considered *prima facie* to be a desirable use of resources. The NPV_C of one scenario of tourism management can be compared with others to see if any emerge as providing highest net economic benefits. Even if the baseline scenario, for example, gives a positive NPV_C, there may be scenarios that provide even higher positive NPV_Cs.

The NPV_C will not however indicate if the stream of net economic benefits is rising, stable or declining. A positive NPV_C may be achieved even with declining net economic benefits in the years towards the end of the modelling period. Therefore the NEB_C in each year must also be monitored for performance against criterion (ii). Declining NEB_Cs become signals for the possible need for intervention. If the environmental impact of tourism is minimised via constraints to maintain natural capital and adequate funding for management, any declines in NEB_Cs are likely to be due to reductions in amenity (or effects external to the system such as a reduction in tourism overall).

Shortfall in management funding (S_W) or Excess (E_W)

A shortfall in management funding for sustainable tourism occurs if the actual management budget is less than the costs for adequate management. If there is shortfall, the condition of funding for adequate management is not being met. A shortfall is indicated by a negative value. A positive value indicates an excess in funding provided over funding required. The shortfall or excess was calculated as:

S_W or $E_W = MB_W - MC_{OW}$

(Note, the variables MB and MC were transposed from the model given previously, in order to generate a negative sign for a shortfall).

NPV of shortfall or excess

The NPV of the shortfall or excess were calculated as a convenient way of comparing total shortfalls/excesses over the 10 year period.

9.2.2 Baseline scenarios

The baseline scenario involved projecting the circumstances pertaining in a single year for a number of years into the future, and provides a reference scenario against which to assess other scenarios generated. In this case, it was assumed that the number of visitor -days remained constant for the ten years. For sensitivity analysis, both the estimated number of 3.4 million visitor-days, and half that amount were modelled. The values of variables used for the baseline scenarios are shown in Table 9.3. For similar data for the remainder of the scenarios modelled see the spreadsheets in Appendix I.

Table 9.3: Baseline scenarios - values of variables

	Scenario 1	Scenario 2
Visitor-days (VD)	3.4 million	1.7 million
Consumers surplus (CS_A)	$49 per visitor-day	$49 per visitor-day
Consumers surplus (CS_L)	$0 per visitor-day	$0 per visitor-day
Producers surplus (PS_T)	$0 per visitor-day	$0 per visitor-day
Management budget (MB_W)	For values 1994 to 2003, see Table 9.2	For values 1994 to 2003, see Table 9.2
Management costs (MC_{OW})	For values 1994 to 2003, see Table 6.14	For values 1994 to 2003, see Table 6.14

9.2.3 Alternative visitor growth and management strategy scenarios

The first set of alternative scenarios was generated to look at the effects of events that have some likelihood of occurring over the next ten years and affecting visitor use of the Wet Tropics WHA. The issues included were: growth in tourism to North Queensland, and therefore the Wet Tropics WHA; and different management strategies to accommodate growth in visitor numbers. It was assumed initially that both management strategies can accommodate projected visitor growth with no crowding. That assumption was dropped in a following section where the potential for crowding at sites in the Wet Tropics WHA were modelled. In all cases, the aim was to look for the NEB_Cs and NPV_C that would result if the Wet Tropics WHA is managed to meet the criteria and conditions for sustainable tourism in protected areas, and to see if a shortfall in funding adequate management will occur if actual management budgets remain as projected.

Visitor numbers

North Queensland and the Wet Tropics WHA have experienced significant growth in tourism in recent years. Predictions are for continuing significant growth in the number of overseas visitors. When this is combined with moderate growth of domestic tourism and population growth in the region, the resulting potential number of visitor-days to the Wet Tropics WHA in 2003 is between 50% and 100% above the 1994 level of visits.

It is projected that tourism will grow for Australia as a whole and for regions within the country. National forecasts are for a 10% growth in overseas arrivals in Australia to the year 2003 and a 1.6% growth in domestic trips to the period 1988-98 (BTR 1995). Forecasts for growth in visitor-nights for the period 1992 to 2001 were constructed for the Far North Region as background to developing a Cairns Region Tourism Strategy (Office of the Co-ordinator General 1993). Forecasts of population growth in the region were also made for this strategy. Low, medium and high projections are shown in Table 9.4.

Applying these forecasts to the data on the number of visitor-days to the Wet Tropics WHA in 1994 and extended to 2003, resulted in the projections shown in Table 9.5 for visitor-days to the Wet Tropics WHA.

Table 9.4: Forecasts of population and tourism growth, Far North Region 1992 to 2001

	Average annual growth 1985-92 %	Low growth forecast %	Medium growth forecast %	High growth forecast %
Resident population*	2.8*	1.9	2.5	3.1
Intrastate tourists	4.3	1.7	1.9	3.5
Interstate tourists	3.6	3.2	6.5	9.9
Overseas tourists	18.3	9.0	13.4	16.4
All tourists	na	5.2	8.5	11.4

*Average for last two decades.

Source: Office of the Co-ordinator General 1993.

Table 9.5: Projected number of visitor-days to the Wet Tropics WHA

	1994 '000	1995 '000	1996 '000	1997 '000	1998 '000	1999 '000	2000 '000	2001 '000	2002 '000	2003 '000
Baseline	3 400	3 400	3 400	3 400	3 400	3 400	3 400	3 400	3 400	3 400
Low	3 400	3 524	3 655	3 794	3 941	4 098	4 264	4 441	4 629	4 829
Medium	3 400	3 590	3 797	4 022	4 269	4 540	4 837	5 163	5 523	5 919
High	3 400	3 651	3 930	4 241	4 590	4 989	5 417	5 910	6 465	7 092

Management strategies

With growth in visitor numbers, it is expected that there will be a need to invest more funds in management to accommodate the visitors without compromising sustainable tourism. The relationship between increasing visitor-days and the funds required for adequate management may not be a linear one. Different management strategies, including the option of developing new sites to accommodate extra visitors need to be considered.

Two future management strategies were developed in Section 6.3. Strategy 1 involves upgrading existing sites but providing no additional facilities at new sites. Strategy 2 involves upgrading plus developing additional facilities at extra sites. As explained in Section 6.3, these strategies were constructed by the author based on raw data from the Ecotourism Strategy. It was assumed that management strategy 2 would accommodate the projected medium and high growth in visitor numbers without crowding. Trying to accommodate these levels of visitors with in management strategy 1 may result in crowding at sites in the future, and this is modelled in a later section.

Values of variables

The values used in these scenarios were the same as the baseline for consumers' surplus, producers' surplus and the management budget (MB_W). The number of visitor days were varied from a base of 3.4m, using low, medium and high growth forecasts. The requirements for adequate management (MC_{OW}) varied with the two management strategies (ms 1 and ms 2) and the growth in visitor numbers. Sensitivity analysis with 1.7 m visitor-days as the base was also undertaken. The actual data used are shown in the spreadsheets in Appendix I.

9.2.4 Crowding effects scenarios

An impact of increased visitor numbers may be crowding and loss of amenity at sites (not necessarily associated with ecologically significant impact) which translates into reduced visitor satisfaction and demand. The potential effects on demand for visits to the Wet Tropics WHA of crowding effects were discussed in Chapter 7. It was found that when respondents were asked if anything had contributed to dissatisfaction with their visit to the Wet Tropics WHA, 15% of respondents nominated impacts of tourism and crowding, but that less that one per cent of respondents were dissatisfied overall with their visit to the Wet Tropics WHA. It was concluded that without targeted research over a longer time period, it was difficult to predict when crowding effects might set in for sites in the Wet Tropics WHA.

The crowding effect is a shift in the demand curve that has the opposite effect of a shift outwards due to growth, thus the net effects are modelled. Crowding effects were simulated in the model in two scenarios, one where a gradual 10% per annum reduction in visitor-days was assumed and the other where a threshold was reached after which a 50% reduction per annum was experienced. The threshold was set at 5 million visitor-days, which, at the medium growth rate and no fees, was reached during the year 2001. The crowding effects are simulated for management strategy 1 where the increased visitor numbers are confined to existing sites.

9.2.5 Environmental limits scenarios

This set of scenarios was aimed at simulating environmental limits set on visits to the Wet Tropics WHA, with the aim of finding the NPV_C achievable within these limits. This exercise also illustrated the opportunity costs of restricting visitor numbers to these limits. Scenarios were constructed for upper limits on visitor numbers set at 4 and 5 million visitor-days. At the medium growth rate, the limit of 4 million visitor-days was reached in the year 1997 and the 5 million visitor-day limit was reached in the years 2001. Environmental limits were modelled for both management strategies 1 and 2.

9.2.6 Introduction of entry fees

The effects of introducing entry fees were modelled. Currently, there are no entry fees directly levied on independent visitors or visitors on commercial tours. The operators of commercial tours pay a per head charge for passengers taken into National Parks or State Forests. The amount is $1.15 for up to three hours and $2.30 for over three hours. This charge is not made obvious to visitors by operators. As the charge on operators has been taken into account in calculating the current cost of visits, it was relevant to treat current entry fees to visitors as $0.

The effects on tourism in protected areas of the introduction of entry fees was illustrated in Chapter 3. If demand is price elastic, the introduction of an entry fee will reduce the quantity of visitor-days to a site. This will result in a 'deadweight loss' of gross economic benefits. The introduction of entry fees brings a change in the relationship between the willingness to pay for entry and the consumers' surplus enjoyed by visitors. At zero entry fee, the consumers' surplus is the same as the willingness to pay. If a fee is imposed, the consumers' surplus is reduced by any deadweight loss, plus the fees actually paid. Willingness to pay is reduced only by any deadweight loss. A new variable, 'CS with fees' was generated to reflect this change in consumers' surplus.

The introduction of fees will have the effect of reducing gross and net economic benefits by any deadweight loss. These benefit measures are not reduced by the amount of fees paid. The fees remain on the benefit side of the equation as they represent a redistribution of benefits between visitors and park managers on behalf of society, not a reduction.

A series of extra steps were introduced into the model to generate measures for NEB_C, NPV_C, etc., with the imposition of entry fees, and these steps follow.

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In the model, the growth projections were retained and an extra row was added to calculate the net effects in terms of visitor-days of applying the price elasticity of demand effect for a particular fee level.

The price elasticity of demand for entry fees for Australian tourists was estimated in Chapter 8, using an upper limit of 42 000. In that chapter, the predicted behaviour of Australian tourists in response to the introduction of a range of fees from $1 to $50 was also estimated. Table 9.6 shows these estimates, which were used in modelling the potential fall in visitor-days with an introduction of fees.

Table 9.6: Price elasticity of demand estimates for increases in entry fees from $0 to a range of fees

Entry fee increase	Price elasticity of demand
$0 to $1	-0.012
$0 to $2	-0.023
$0 to $5	-0.057
$0 to $10	-0.110
$0 to $15	-0.158
$0 to $20	-0.202
$0 to $50	-0.405
$0 to $2000	-0.755

As it was not possible to generate price elasticity of demand estimates for local North Queensland residents, it is not known whether, and by how much, they differ from the predicted behaviour of Australian tourists. It is possible that demand is more elastic as any entry fee will be a larger percentage of the cost of a day trip for locals than for Australian tourists. In the absence of better information, the price elasticity of demand for entry fees of local residents was assumed to be the same as that of Australian tourists.

The survey of visitors reported in Chapter 7 included questions of overseas visitors on their attitudes to, and willingness to pay, entry fees. It is difficult to compare results on price elasticity of demand from the TCM, which works on revealed preference, with those from a survey where respondents have control over their answers and can employ strategic bias to keep nominated fees low. It would be expected that the survey results would indicate more elastic demand. This was the case for overseas visitors. It was found that 87% of respondents nominated a fee they were willing to pay. If the possibility of strategic bias is ignored and these results are interpreted to indicate that a fee rise from $0 to $1 would prevent 13% of respondents visiting the Wet Tropics WHA, the reaction at this end of the fee scale is more elastic than for Australian tourists. Overall, when the results were analysed to include fees nominated from $1 to $20, the mean nominated was $8.78 and the mode was $10. This overall result indicates that demand is fairly inelastic over low fees. In the absence of better information, the price elasticity of demand for Australian tourists was taken to be representative of that for visitors from overseas in the fee scenarios.

Consumers' surplus without fees

This value was generated as previously, by multiplying the mean consumers' surplus from the sample by the number of visitor-days without fees.

Deadweight loss (DWL)

The deadweight loss is represented as the triangular area in the right hand corner of the demand curve. This is illustrated in Figure 3.4 (page 72). The triangular area was calculated as:

DWL = ((visitor-days without fees - visitor-days with fees)* fee)/2

Willingness to pay (WTP) with fees

WTP with fees is the WTP without fees, (which is the same as CS without fees), minus any deadweight loss. It is calculated as:

WTP with fees = CS without fees - DWL

Fee revenue, Australian tourists and local residents

This value is calculated as the projected visitor-days with fees for both groups, multiplied by the entry fees modelled.

Consumers' surplus with fees

The consumers' surplus accruing to visitors if they have to pay entry fees was calculated as the willingness to pay, with fees minus the amount of fees paid, as follows:

CS with fees = (WTP with fees - Fee revenue Australian tourists and local residents)

Producers' surplus

It was assumed that any fees collected would not be retained by commercial operators but would all be forwarded to government and that operators would be compensated for any costs involved in collecting fees on behalf of government. The impact of fees on producers would therefore be limited to the effects of the potential reduction in the number of visitors to the Wet Tropics WHA.

As discussed in Appendix F, the actual situation regarding producers' surplus in the Wet Tropics WHA was not documented. It may be speculated that the impact of a reduction in visitor numbers may have different effects depending upon the situation of sectors of the tour industry. If the number of visitors declines absolutely, individual producers may be forced to operate where marginal costs are higher and earn less producers' surplus per visitor-day. This would translate to a reduction in mean producers' surplus per visitor-day for the industry. If however, only the growth in the number of visitors declines, the marginal costs of production may continue to decline for individual producers, until they reach a threshold, such as needing to add another vehicle to their operation. The situation for the industry, and therefore for mean producers' surplus will depend upon the rate of growth in visitor numbers and the market conditions operating. It seems that it is not wise to generalise about the potential impact of the introduction of visitor fees on producers' surplus. A thorough assessment for the Wet Tropics WHA was however beyond the scope of this study. A $0 value continued to be used in this model.

Management costs for adequate management

MC_{OW} continued to vary with the number of visitor-days.

Management budget (actual)

The actual management budget and projections used previously were retained.

Fee revenue from all visitors (FR)

The introduction of fees will not be without costs to the agency collecting the fees. It was assumed that the cost of collecting fees is 5% of the revenue. This may be paid as commission to operators or used to cover management agency costs. The fee revenue was therefore the total number of visitor-days projected, multiplied by 95% of the fee by the entry fee.

Shortfall or Excess in management funding

To this point, the shortfall or excess was calculated using only the budget appropriations from consolidated revenue. Revenue raised from fees would be available to supplement or replace appropriations. The shortfall of excess with fees was calculated as the difference between the fee revenue from all visitors and the funds required for adequate management MC_{OW}:

S_{FO} or $E_{FO} = FR - MC_{OW}$

A negative result indicates a shortfall in funding of adequate management and a positive result an excess. The NPVs of each of these indicators were calculated.

9.2.7 Alternative fee scenarios

The introduction of entry fees of $2 and $5 were modelled in relation to visitor number and management strategy scenarios developed in the previous section. It was assumed that the price elasticity of demand was uniform for all groups of visitors and that there was a 100% success rate in collecting fees.

9.2.8 Rationing use via fees

It is possible to ration use of protected areas using fees, although this is not common practice and is subject to practical problems where it is difficult to exclude people. An exercise was undertaken to estimate the size of the visitor fee necessary to achieve visitor-days in the year 2003 equal to 4 million and 5million visitor-days. It is projected that demand for visits to the Wet Tropics WHA will grow, driven by external factors. In order to achieve visitor-days of around 4 million and 5 million in 2003, it was necessary to drive the current number of visitor-days down dramatically with a relatively high daily fee. This was illustrated for the projected medium growth rate. A price elasticity of demand of around -0.158 resulted in a reduction of visitor-days to 2.8 million in the first year, and the number of visitor-days then climbed to around 5 million by 2003 at the medium growth rate. The visitor fee needed to produce this result was around $15 per day. Similarly, a price elasticity of demand of around -0.340 drove visitor-days even further down in the first year to 2.2 million and this grew to 4 million visitor days by 2003. The fee required to achieve this was around $35 per visitor day. This last scenario showed results of a negative consumers' surplus, which was due to the fact that consumers' surplus for local residents was included as a $0 value, while it was modelled that in fact local residents did pay an entry fee. The limitations of using the $0 value become significant for this scenario.

9.3 RESULTS AND DISCUSSION

9.3.1 Results of scenarios

The results of scenarios modelled are presented in Tables 9.7 to 9.12 below and discussed in this section. The values for variables used in the scenarios are a mixture of values that may be considered robust for the Wet Tropics WHA and some which required assumptions due to a lack of information specific to the Wet Tropics WHA. The latter include the potential reaction of visitors to crowding and the management strategies as currently developed. The discussion of results in this section broadly illustrates the type of information produced by the model and the potential trends and impacts in the Wet Tropics WHA. In the following section, those results that can be accepted as robust for the Wet Tropics WHA are highlighted. The detailed results for each scenario are included in Appendix I.

Table 9.7: Results of baseline scenarios

	Scenario	NEB_C positive and non-declining?	NPV_C $'000	NPV of shortfall $'000	Visitor-days in year 2003 '000
1	Baseline, 3.4m vd.	generally yes	315 853	-13 283	3400
2	Baseline, 1.7m vd.	generally yes	142 579	-13 283	1700

Table 9.8: Results alternative visitor growth and management strategy scenarios

	Scenario	NEB_C positive and non-declining?	NPV_C $'000	NPV of shortfall $'000	Visitor-days in year 2003 '000
3	ms 1*, low growth	generally yes	341 046	-27 516	4829
4	ms 1, med growth	generally yes	378 299	-29 974	5919
5	ms 1, high growth	yes	430 497	-32 493	7092
6	ms 2, low growth	generally yes	336 484	-32 078	4829
7	ms 2, med growth	generally yes	373 666	-34 536	5919
8	ms 2, high growth	yes	425 934	-37 056	7902
9	ms 1, med growth 1.7 m visitor-days	yes	176 863	-18 547	2960
10	ms 2, med growth 1.7 m visitor-days.	generally yes	172 300	-23 110	2960

* management strategy 1

Table 9.9: Results of crowding effects scenarios

	Scenario	NEB_C positive and non-declining?	NPV_C $'000	NPV of shortfall $'000	Visitor-days in year 2003 '000
11	Crowding, 10% reduction in visitor-days per year, ms 1, med growth	yes	337 952	-27 688	5327
12	Crowding, 50% reduction in visitor-days from year 2001, ms 1, medium growth, no fees	increases then declines	324 176	-25 827	2960

Table 9.10: Results of environmental limits scenarios

	Scenario	NEB_C positive and non-declining?	NPV_C \$'000	NPV of shortfall \$'000	Visitor-days in year 2003 '000
13	Limit of 4m visitor-days, ms 1, medium growth	generally yes	342 046	-26 667	4000
14	Limit of 4m visitor-days, ms 2, medium growth	generally yes	337 484	-31 229	4000
15	Limit of 5m visitor-days, ms 1, medium growth	generally yes	369 782	-29 198	5000
16	Limit of 5m visitor-days, ms 2, medium growth	generally yes	365 219	-33 761	5000

Table 9.11: Results of alternative fee scenarios

	Scenario	NEB_C positive and non-declining?	NPV_C \$'000	NPV of excess \$'000	Visitor-days in year 2003 '000
17	\$2 fee, baseline	generally yes	315 438	11 654	3322
18	\$2 fee, ms 1, medium growth	yes	378 303	7 118	5783
19	\$2 fee, ms 2, medium growth	generally yes	374 192	2556	5783
20	\$5 fee, baseline	generally yes	313 285	71 495	3206
21	\$5 fee, ms 1, medium growth	generally yes	379 531	84 169	5582
22	\$5 fee, ms 2, medium growth	generally yes	374 969	79 606	5582
23	\$2 fee, ms 2, medium growth, 1.7m vd	generally yes	177 126	-8707	2892
24	\$5 fee, ms 2, medium growth, 1.7m vd	generally yes	177 514	-9258	2791

Table 9.12: Results of rationing use via fees scenarios

	Scenario	NEB_C positive and non-declining?	NPV_C \$'000	NPV of excess \$'000	Visitor-days in year 2003 '000
25	\$15 fee, ms 1, medium growth	generally yes	311 981	1 031 106	4984
26	\$35 fee, ms 1, medium growth	generally yes	257 548	842 405	3907

Conditional NEB results

In all cases the conditional Net Economic Benefits (NEB_Cs) obtained in each year are positive. That means a net economic benefit results when management is funded at the level considered to be adequate management. For the Wet Tropics WHA, the case is therefore established for tourism to be considered desirable as measured by standard neoclassical criteria of a positive NPV and, provided safe minimum standards are met, to also be considered desirable according to ecological economics criteria.

Criterion (ii) in the definition of sustainable tourism in protected areas calls for not only positive NEB_C, but also a non-declining stream of these. Results for scenarios except where crowding and environmental limits are modelled are discussed first. The result for these scenarios is that the stream of NEB_Cs is generally non-declining. The results show 1, 2 or 3 years out of 10 where a decline is recorded. Significantly these are all in early years and correspond to investment in infrastructure construction and upgrading. The results are obviously a function of decisions made on when to undertake the construction. As this type of temporary decline is logically not inconsistent with sustainable tourism, it raises questions of whether criterion (ii) is useful and how it should be interpreted.

The scenario modelled with crowding setting in after visitor numbers reach a threshold, results in NEB_Cs declining in the years after the 50% crowding effect sets in. This situation is the type that criterion (ii) is designed to identify as an indicator that the economic benefits of tourism may not be sustainable. The scenarios with upper limits of 4 million and 5 million visitor-days set for environmental reasons show a levelling out of NEB_Cs, which is consistent with positive and non-declining benefits.

Shortfall in funding results

In all scenarios modelled without fees, a shortfall in funding occurs and the condition of adequate management is **not** met. Therefore, the criteria and conditions for sustainable tourism in the Wet Tropics WHA are **not** met.

Given the positive NEB_Cs found, governments can justify making the required funds available for adequate management. In the scenarios modelled without fees however, it is assumed that the only funding made available is the projected budgets. The scenarios with fees illustrate that governments could appropriate generally more than enough revenue from visitors through only modest fees to either make up any shortfall in funding, or fund all management from fee revenue.

***Conditional* NPV results**

In all cases, the conditional Net Present Values (NPV_Cs) are positive. In addition at over $300 million, they are quite large values. The NPV_C values would be even higher if positive values were to be included for consumers' surplus to local residents and producers' surplus. Even where the NEB_Cs are declining due to crowding and environmental limits, the NPV_Cs over the ten year period are positive.

The NPV_C measures provide a basis for comparison of outcomes of alternative scenarios. All other variables remaining the same, when the number of visitor-days increase, the NPV_C increases. For example, compare the results of scenarios 1, 3, 4 and 5. This is despite a proportion of costs of adequate management also increasing with the number of visitor-days. The scenarios of crowding and environmental limits have been designed to illustrate the probability that growth in benefits is not unlimited, as eventually a limit on visitor-days will be reached, either by internal factors such as crowding or imposed by managers. One growth rate, the medium rate, was used in most scenarios, to allow comparisons of NPV_Cs to be made across scenarios.

The different NPV_C results for management strategies 1 and 2 are a function of the assumed costs for adequate management being higher for management strategy 2. Where no crowding is assumed, the NPV_Cs for management strategy 1 is higher than for management strategy 2.

However, the rationale for developing management strategy 2 is that trying to accommodate increased visitor-days with only management strategy 1 may result in crowding effects. If the NPV_C for management strategy 1 with both crowding scenarios (scenarios 11, NPV_C of \$337m and 12, NPV_C of \$324m) are compared with the NPV_C for management strategy 2 with no crowding (scenario 7, NPV_C of \$373m), the latter scenario provides the higher NPV_C. Therefore, in this example, greater benefits result from expanding investment in facilities via management strategy 2 to accommodate visitor numbers without crowding.

The results of these particular scenarios have to be interpreted with care in the context of the Wet Tropics WHA as the management strategies are based only on the raw data of the Ecotourism Strategy, not on the finalised Strategy, and so are illustrative only. In addition, information was not obtained on when crowding might set in, at any or all sites, and so the crowding scenarios used here are illustrative also.

If managers decide to place a limit on visitor-days for reasons of avoiding environmental damage, the opportunity cost of this in terms of NPV_C forgone gives a threshold value of the unpriced benefits of avoiding damage. For example, scenario 13 with a 4 million visitor-day limit, with a NPV_C of \$342m, can be directly compared with scenario 4 with a NPV_C of \$378m. The opportunity cost of placing a limit on visitor-days is \$36m.

The introduction of the fees modelled could be expected to result in a reduction in NPV_Cs, due to the deadweight loss of benefits occurring with reduced visitor numbers.

This result occurs for the scenarios where the baseline is modelled (compare scenarios 17 and 20 with scenario 1).

In all other scenarios, the NPV_Cs with fees are actually marginally higher than without fees (compare scenarios 18 and 21 with scenario 4; scenarios 19 and 22 with scenario 7; scenarios 23 and 24 with scenario 10). In all cases, the gross benefits are lower with fees, as could be expected, due to the deadweight loss in benefits. However, at the low fee levels modelled, demand is fairly inelastic and the deadweight losses are small relative to benefits. The NEB_C values are calculated by subtracting the assessed budgets required for adequate management from gross benefits. Because the management budgets are related to visitor numbers, they fall with reductions in visitor numbers. In the scenarios modelled this fall in management costs more than offsets the deadweight losses, resulting in the higher NPV_Cs with fees. This result emphasises the difficulty in predicting impacts without full information on how costs and benefits behave under different scenarios.

Where use is rationed by the application of higher fees, the NPV_Cs with fees are lower than if no fees are imposed (compare scenarios 25 and 26 with scenario 4). The higher fees result in greater deadweight losses which do reduce net benefits.

It is interesting to compare the NPV_Cs of the two alternatives to rationing use, via environmental limits and via fees. In order to contain use to an upper limit of 4 million visitor-days per annum, a fee of $35 is required. The NPV_C for this scenario (scenario 26) is $257m. The NPV_C for the comparable scenario with environmental limits (scenario 13) is $342m. The difference occurs because the total number of visitor-days over the years with the fees scenario is lower due to the need to force numbers down early in the period.

Fee revenue results

The model shows that at even modest fees, with a 100% success rate of collection, sufficient fee revenue can potentially be generated to cover the costs of adequate management. The fee revenue achieved with a 50% success rate of collection was also calculated and the results in terms of NPV of a shortfall/excess are compared in Table 9.13. It can be seen that at a $2 fee, insufficient revenue can be collected at this lower success rate to cover costs of adequate management. However a fee of $5 could potentially fund adequate management, even with only a 50 % success rate of collection.

Table 9.13: Fee revenue with 100% and 50% collection success

Scenario	Fee $	NPV of shortfall/excess, 100% collection success $'000	NPV of shortfall/excess, 50% collection success $'000
17	2	11 654	-9521
18	2	7118	-19 871
19	2	2556	-24 434
20	5	71 459	20 400
21	5	84 169	19 042
22	5	79 600	14 480
25	15	1 031 106	130 677
26	35	842 405	279 454

The fee revenues predicted with fees of $15 and $35 are significantly high, and should be interpreted cautiously. The price elasticity of demand estimates used for these fees are more elastic than the result for the entire entry fee demand function, as estimated in Chapter 8. While it is relevant to estimate the price elasticity of demand for segments along the demand curve for low entry fees, it might be wise to use the higher estimate for the entire demand function at higher fees.

9.3.2 Findings relevant to the Wet Tropics WHA

One very obvious finding is that the NEB_Cs and NPV_Cs arising from visitor use of the Wet Tropics WHA are positive and large. The values are large under all scenarios of no fees, low fees and even allowing for management costs including a significant expansion of facilities. It is thought that the values reported are underestimated as they do not include consumers' surplus to local residents and any producers' surplus arising.

This result points to the significant national benefits that arise from tourism and recreation in this protected area, under adequate management.

In all cases where projections are based on current levels of management funding, there is a shortfall in funding identified. Thus the criteria and conditions for sustainable tourism in the Wet Tropics WHA are **not** being met.

The fact of the positive NPV_C is a justification for costs of adequate management to be met. The policy recommendation that arises is therefore that funding be provided by government for adequate management for the Wet Tropics WHA, regardless of the source of the funds.

The scenarios where fees are modelled show that with modest fees of around $2 to $5 per visitor-day, visitor growth will decline only marginally, and will be offset by projected growth in visitor use. If there is a high success rate in collecting fees, fees at this level would provide sufficient revenue for funding adequate management. Fees at this level would not raise substantial equity issues.

A caveat must be added that it is possible that demand by local residents and overseas visitors is more elastic. This may mean that the revenue raised from a $2 fee might not fully fund adequate management, but revenue from a $5 fee as modelled would.

It is shown that relatively modest fees can generate revenue to not only cover the costs of adequate management of visitor use but also leave a surplus that could be applied to more general management of the Wet Tropics WHA or other protected areas (or other government functions). If this surplus can be generated with modest fees, there is not a substantial equity issue in having users pay more than the costs that can be attributed to them directly. Importantly if their willingness to pay reflects not only the value they obtain from direct use but also non-use values, there is no conflict with economic efficiency in applying revenue raised more broadly to management of the Wet Tropics WHA (there would be a conflict in appropriating it for uses other than nature conservation).

The finding that significant fee revenue may be collected with higher fees raises some issues. Firstly, caution in interpreting these results is recommended. If raising levels of revenue beyond that required for adequate management is contemplated, the equity implications are likely to be challenged by visitors and commercial tour operators. The latter would be likely to oppose measures that might mean a reduction in use levels. The broader regional economic benefits of visits to the Wet Tropics WHA would be reduced if visitor-days were to be reduced via a fee which has the effect of rationing use.

The results of the scenarios show that, in the absence of factors such as crowding and environmental impacts being limiting, the total benefits to visitors increase in line with increases in visitor-days. Total producers' surplus probably also increases with visitor-days, or at least the tour industry might expect producers' surplus to increase. These tendencies will place economic and probably political pressure on managers to accommodate growth in visitor use. It is not obvious that there is any internal factor in the system to make it self-regulating with respect to meeting criterion (i) for sustainable tourism in protected areas. Information presented in Chapter 2 highlighted that there is no guarantee for any protected area that crowding or reactions of visitors to environmental damage will set in to limit use before significant environmental impacts occur. The need therefore exists for managers of the Wet Tropics WHA to regulate visitor use to maintain critical natural capital.

It may also be necessary for managers to invest in management and/or regulate visitor use to maintain positive non-declining net economic benefits. Under the modelled scenarios, the NEB_Cs were shown to fall when significant crowding set in. It was shown that a higher NPV_C was obtained when investment was made in management strategy 2, than without the investment, due to simulated crowding effects. These results suggest that there is no self-regulation in the system to prevent such a decline in economic benefits occurring.

The potential impact of entry fees to Queensland National Parks

As already noted, during the second half of 1996, the Queensland Government announced the introduction of entry fees to National Parks and then reversed that decision. The following discussion explores what the implications of the proposed system for the Wet Tropics WHA might have been. The system proposed was that visitors would need to be in possession of a *'ParkPass'* when in a National Park. The cost of a *ParkPass* would be \$3 for one day, \$10 for month and \$20 for a year. The fees would not apply to State Forests.

There are a number of problems faced in trying to estimate the impact of the fees. Estimates of price elasticity of demand generated for this study can be used to predict the effect of fees on demand. However as fees would not be uniform, it is necessary to make an assessment of the mean cost per visitor-day that visitors would face. Visitors to State Forests, and visitors to National Parks who did not comply with the fees, would not change their demand. Visitors to National Parks would make a choice between purchasing a \$3, \$10, or \$20 *ParkPass*. Their actual cost per visit to the Wet Tropics WHA would depend upon the total number of visits they would make to any National Park during the period for which the pass was valid. It is difficult to know how visitors would perceive of the cost of a visit. The first visit made using a pass may be perceived of as costing the total price of the pass. Alternatively, visitors may have a perception of the average cost, having already calculated how many visits they intended to make using the pass.

There is no information available on how many visitor-days are made to National Parks per year by local residents. It is therefore not possible to predict which level of pass they might purchase and what the average cost of a visit to the Wet Tropics WHA might be. Presumably many local residents would make use of a \$20 year pass. In the visitor survey undertaken for this study, the number of visitor-days to the Wet Tropics WHA made by Australian and overseas tourists surveyed was recorded. The mean number of visitor-days was 3.5 while the median and mode were 2. These visitors would presumably make a decision on whether to purchase one or more $3 day passes, or a $10 or $20 pass, based on the number of National Parks they intend to visit and the time they intend to spend in Queensland. If visitors chose wisely, they would be likely to face costs of around $2 or $3 per visitor-day. The information on price elasticity of demand suggests that at fees of this level, demand would reduce marginally, by around 2%. If growth occurs as predicted, it would offset any reduction in demand by the following year.

It would be difficult to know how much of the revenue from *ParkPasses* in any year could be attributed to visits to the Wet Tropics WHA, as *ParkPasses* would be sold remotely from the area. The amount of revenue raised which the Queensland Government would chose to allocate to management of the Wet Tropics WHA is unknown.

9.3.3 Comments on the model

Like any model, this model encourages a focus on a system and how the elements in it interact. This is generally useful even if the model is never operationalised with data. It addresses an issue critical to management of protected areas where demand exists for a use that is both potentially environmental damaging and potentially beneficial to society and, ironically, to the overall management of the protected area.

The main overall shortcoming of the model is that it leaves the essential ecological relationships between tourism and the natural environment of the Wet Tropics WHA exogenous to the model. It requires that another process be invoked to set and monitor the limits of acceptable change, and it assumes that it is possible to thereby set safe minimum standards that will maintain critical natural capital. This approach was taken for a number of reasons, and may well be the best way to approach the difficult problem of linking the economic and environmental components of the system. The ecological system of the Wet Tropics WHA that is potentially impacted by visitor use is complex and the impacts of use are diverse and widespread. Impacts are not necessarily acute but could be cumulative. This system has not been modelled by ecologists, and suitable models to link with the model presented here may never be developed.

The model used here necessarily focuses on the processes required for adequate management being in place, instead of trying to optimise any economic-environment trade-off. The stress placed on funding for adequate management is in order that the processes can be maintained. Of course, adequate management is more than just spending money, but the funding has to be available for managers with the right intentions to put them into practice.

The model as developed requires data on a number of variables. Not all the data required was able to be put together in the exercise undertaken here and values for some variables were assumed for the purposes of the exercise. This is testimony to the difficulty in measuring some of the variables included. It is worth commenting briefly on where it was straightforward to measure values for variables and where it was not.

The economic literature suggested that measurement of consumers' surplus using TCM would be relatively straightforward. The analysis undertaken for Australian tourists in fact illustrated that the TCM could not produce absolute measures of benefit. The concerns of Randall were confirmed, with respect to both consumers' surplus and price elasticity of demand measures. Results obtained using the TCM must be considered to be 'order of magnitude estimates'. The visitor pattern of local residents proved not to be able to be analysed using conventional TCM and so benefits enjoyed by a significant group of users were not measured in this study.

Measurement of producers' surplus is quite complex, requiring generation of marginal cost curves for producers. The data required would be difficult to collect from producers as the cost of production over a range of output levels, not just the current one, would be required. The cost of generating this information is multiplied where there are distinct sub-groups of producers.

Calculation of historical costs of visitor management was a straightforward exercise. The records kept for the Wet Tropics WHA are probably better than for many protected areas because of the reporting requirements for joint Commonwealth and Queensland funding.

Placing a cost on adequate management requires that the elements of adequate management have been defined. This requires a forward looking exercise such as the Wet Tropics Ecotourism Strategy, which is unfortunately not completed at the time of writing.

A value very critical to the findings of the model is the number of visitor-days made currently and over the period modelled. Where it is difficult to record visitor-days accurately and estimates are must be made, such as for the Wet Tropics WHA, the results of calculations requiring this value should also be treated as estimates.

The model was developed at the scale of the Wet Tropics WHA because it is a policy relevant scale with respect to issues such as funding and overall visitor use policy. It can be used to look at the costs and benefits of trade-offs between visitor numbers and expenditure on management, for example for decisions such as whether to implement management strategy 2.

In Chapter 5, it was proposed that the usefulness of the model without measurements of benefit be considered. A simple approach would be to model the costs of adequate management and compare these against projected budgets to identify any shortfall. This could be all that is required to encourage governments to adjust budgets to prevent a shortfall, if there is a high level of commitment to protected area management. However even in Australia where the awareness and commitment is high relative to other parts of the world, budget appropriations for World Heritage Areas have been declining. Often some measure of economic benefits from protected areas is required to convince government that funding of management is justified. Measures that government respond to are not necessarily only net economic benefits - indicators such as gross expenditure by tourists and regional employment generated may be seen as even more important by governments.

It would be fairly simple to address potential revenue from fees without requiring measures of net economic benefits or even price elasticity of demand. If low fees are contemplated, the general findings of a number of studies that demand is relatively inelastic at low fees could be adopted in the context of any protected area

9.3.4 Findings against the objectives of the empirical analysis

The objectives of the empirical analysis were listed at the beginning of this chapter. The first objective was to test the ability to operationalise in practice the concept of sustainable tourism in protected areas, according to the criteria and conditions proposed in Section 5.1, using empirical analysis of tourism in the Wet Tropics WHA.

The economic model provided measures against criteria (ii). It was possible to measure NEB_Cs and determine if they were positive. Measures that could be acceptable as robust enough for policy formulation with respect to the Wet Tropics WHA were derived, even given shortcomings in the data on some variables. The part of the criterion that requires net economic benefits to be non-declining was shown to be probably too inflexible in that net economic benefits declined in years where there was investment in infrastructure that would obviously benefit sustainable tourism, as well as years where the decline was due to a fall in visitor-days as a result of crowding or reaching environmental limits.

The condition of 'maintain investment in adequate management' was operationalised and the information proved particularly useful as a guide to shortfalls in current management budgets and for setting targets for revenue raising. The option of using this information, without measures of net benefits would provide useful information for managers of protected areas.

The second objective of the case study analysis was to provide an example of the potential for implementing entry fees. The modelling exercise was successful in providing estimates of the potential effect on demand and revenue raised if the economic instrument of 'entry fees' were to be applied in the Wet Tropics WHA. The information on price elasticity of demand needed to model the effect of fees required the employment of the TCM. This required resources for both collection of original data and analysis. The model does not address the practical issues of collecting fees in a cost effective manner.

The third objective was to assess the role of results of the model in providing guidelines to managers. Managers of protected areas do not need the type of information generated in this model in their day to day work in managing protected areas. However there are policy issues such as whether to support visitor use to protected areas, whether to introduce user fees, and how much investment in management is justified, which can be addressed by this model. The model can be used by management agencies and possibly central departments of treasury or finance to address such policy issues. (A constrained optimisation model with safe minimum standards might not be what such central departments are used to, but may be the way to go if society is serous about sustainable development). It has been shown how the economic data is complimentary to ecological approaches to management. It could be argued that only with information from both economics and ecology could managers have guidelines for promoting sustainable tourism in protected areas.

The main caveats to the empirical application of the model include the need to be certain that the processes for setting appropriate constraints on visitor use to maintain critical natural capital are in place. As the costs of environmental damage are not incorporated into the model, except as some costs of avoiding damage, the benefits inferred would not be <u>actual</u> benefits if the appropriate constraints were not in place. The other caveat to practical application of the model is that it requires some effort in generating values and setting it up for a protected area.

CHAPTER 10
CONCLUSIONS

This thesis commenced with a statement that it grew out of an interest in how to operationalise the broad guidelines and objectives of sustainable development. The topic of tourism in protected areas and the case study of tourism in the Wet Tropics WHA were selected in part to meet this broader objective. The selection of the topic and the case study was made in recognition of the importance of protected areas to sustainable development, interpreted in this study as being particularly important to maintaining critical natural capital. Nature-based tourism, including tourism in protected areas, has been growing significantly in recent years and is expected to continue to grow. Tourism in protected areas raises particular dilemmas as it provides benefits to visitors and potentially to local and national communities, yet it poses a threat to natural environments. Tourism benefits may provide a justification for declaration and management of protected areas and funds may be raised from tourists for management.

Tourism in protected areas has similarities with other uses of natural environments, including harvesting and waste disposal, where the environment provides a potentially renewable resource for the use. There is believed to be a genuine but finite capacity for the environment to assimilate impacts and respect for this capacity and its limits is essential to sustainable development. Tourism is different to most natural resource uses in that visitor perceptions are important in determining benefits arising, and these may or may not be linked to actual environmental conditions. This additional psychological dimension to tourism makes the management of tourism to meet sustainable development goals quite complex.

The approach taken

Understanding the problem of achieving sustainable tourism in a protected area was approached by developing a definition with measurable criteria. The ability to operationalise this was tested via a case study, using a model based on an ecological economics approach. The exercise produced findings of relevance to the general question of operationalising sustainable tourism in protected areas and findings of relevance to managing the Wet Tropics WHA.

The first steps in this process were to gain an appreciation of the dimensions of the issue of sustainable development and of issues specific to tourism in protected areas. The early chapters (2 and 3) canvassed these issues. This provided essential background to developing a working definition of sustainable tourism in protected areas. In Chapter 4, the case study area of the Wet Tropics WHA and relevant issues were introduced.

In Chapter 5, in addition to presenting the working definition of sustainable tourism in protected areas, an ecological economics approach was developed for operationalising the definition. This involved an essentially economic model to be used with exogenous limits on tourism for environmental and cultural protection reasons. The data sets required for its application to the Wet Tropics WHA were identified. Much of the data had to be collected from original sources for this particular application.

Information on any current environmental impacts of tourism to the Wet Tropics WHA or future potential impacts was not available from the literature, and so was sought in qualitative form via a survey of scientists and managers. This was reported in Chapter 6. A tentative conclusion that tourism is not currently causing unacceptable or irreversible impacts must be qualified by concerns about cumulative impacts and recognition that research and monitoring is sparse.

The views of respondents about potential future impacts emphasised the uncertainty about such, given the complexity of the system and the diverse sources of threat, and the potential for cumulative impacts. Scientists and managers interviewed emphasised the need for ongoing management and research and monitoring. This is one area where adequate investment is required if there is to be any chance of meeting criteria (i) of maintaining critical natural capital, over the long term, and in the face of tourism growth.

Also in Chapter 6, ironically, the decline in funding for management of the Wet Tropics WHA was identified. Estimates of what might be adequate funding for visitor management were made, for use in the model.

The survey of tourists, reported in Chapter 7, revealed a large amount of information about them, their activities and their attitudes. Of relevance for this analysis was the finding that current levels of satisfaction amongst visitors was high. However, the review of the literature in Chapter 2, pointed to a danger in drawing conclusions on potential behaviour from one-off surveys. For this reason, the possible impacts on demand of the development of crowding effects were 'simulated' in the economic model.

The calculation presented in Chapter 8, of economic benefits to tourists via the TCM provided data for use in the model. The analysis however revealed that the TCM does not necessarily produce absolute measures of welfare. The information produced can be used with confidence as long as it is used as an order of magnitude estimate of benefits or where minimum estimates of benefits exceed costs. The use of estimates produced via TCM would be more questionable if the trade-offs were more sensitive to the estimate used.

Chapter 9 included modelling of data and the interpretation of results. It was illustrated that different scenarios can be compared in terms of conditional NPVs to determine superior management strategies. The results for the Wet Tropics WHA revealed that unless management funding greater than that projected is provided, the essential condition for sustainable tourism of maintaining investment in adequate management is **not** being met. The conditional NPV is large in most cases, signalling that tourism and recreation in the Wet Tropics WHA is of net benefit to Australian society, as long as funding for adequate management is provided and exogenous limits are set in a precautionary manner and upheld. The findings regarding criterion (ii), to maintain net economic benefits, were that in all cases, conditional net economic benefits in each year were positive and in most cases, they were non-declining. The crowding scenario modelled illustrated that net economic benefits could decline under such conditions. Adequate funding for management could be met from the revenue raised with only modest entry fees, even if were only possible to collect fees from 50% of visitors.

Successes and limitations of the approach

The approach taken assumes that appropriate limits which do not allow irreversible ecological damage, or unacceptable impacts on cultural values can be set on visitor use. It also assumes that processes can be put into place whereby impacts of visitor use are monitored against measurable criteria, and that management can adapt before irreversible or unacceptable impacts occur. It became obvious that for the Wet Tropics WHA, information to facilitate this approach was lacking. This deficit of information could be addressed by a research and monitoring program, but the question remains as to whether this is enough. Uncertainty will continue to exist about many of the potential impacts of tourism on the environment. An economist's approach of assuming the ecological information will be available to managers is fairly naive in these circumstances. So it must be said that in reality the approach of incorporating exogenous limits is accompanied by uncertainty - but potentially decreasing uncertainty if the research and monitoring effort is improved.

It was difficult in practice to estimate measures for several of the variables included in the model. It was not possible to estimate 'true' measures of benefit for either consumers' or producers' surplus. The limitations to the TCM have been described. The complexity of measuring producers' surplus limits its use in practical applications. It was found not possible to place numerical values on possible crowding effects without more long term research. The value of undertaking an exercise such as developing an

Ecotourism Strategy which addresses future requirements for management was illustrated, however the failure thus far to develop a generally accepted Management Plan and Ecotourism Strategy for the Wet Tropics WHA illustrates practical difficulties in obtaining agreement to future development plans.

The model did make a contribution in that it forced the relationships between tourism benefits, the environment, visitor perceptions and management to be delineated. This is so even though the ecological aspects of the relationships are exogenous. It was possible to measure some of the variables and use them in the model, and further to illustrate how the model could be fully operationalised if values of all the variables were available. The results obtained where values for variables were robust for the Wet Tropics WHA allowed a number of policy recommendations to be made with some confidence.

The model for sustainable tourism in protected areas was developed at the scale of the entire protected area. This was because it was intended as a tool for overall policy formulation rather than site management. The protected area scale is relevant for management planning in terms of how much of the protected area will be available for tourism, within which recreational settings. It is also the appropriate scale to address funding for management whether from government budget appropriations, or from user fees. A site specific application could perhaps be justified at high use sites but the data requirements for the model preclude use at low use sites. The model as developed could be used both as an annual monitoring tool and to inform policy decisions on management and funding.

The model approach could be applied to other issues of sustainable use of natural resources where the requirement for conservation of critical natural capital is clear. The model does not address any case where it is contemplated that substitution of manufactured capital for critical natural capital is consistent with sustainable development.

Findings relevant to the thesis posed

The thesis was posed in Chapter 1, in three parts. With respect to proposition 1, it was found that policy recommended using a neoclassical economics approach could not be relied upon to move a system towards sustainability. This does not necessarily mean that ecological economics will achieve sustainability, as might be implied by proposition 1. It can only be argued that the approaches available in ecological economics might provide a better chance of moving in this direction. The exercise of operationalising the concept of sustainable tourism in protected areas, using an ecological economics approach provides a potentially useful model.

It was shown that the economic instrument of entry fees could contribute in principle to sustainable tourism by providing revenue for management and potentially act as a rationing tool. Proposition 2 is consistent with general approaches to public policy using economics and can be accepted.

The third proposition in the thesis is that empirical analysis will provide only broad guidelines to managers. The empirical results of the case study provide quite clear direction for policy, and the exercise might be considered more successful than suggested by proposition 3.

Research implications

Is it relevant to consider if it is worth refining the model further at this stage. The finding that in some circumstances the net economic benefits can in fact be declining and still be seemingly consistent with sustainable tourism in protected areas leads to a need to refine criteria (ii) of the model to better match the intentions of this criteria.

Perhaps the priority for research on tourism in protected areas should be on those variables and relationships which had to be represented in the model by simulated values. Further work on these issues is warranted, whether for use in this model or in other approaches to protected area management. The variables and relationships referred to include:

- visitor perceptions and reactions to crowding and environmental damage;
- environmental impacts of tourism; and
- developing processes of setting limits of acceptable change and monitoring these

The results for the Wet Tropics WHA were of very high benefits relative to the funding required for adequate management. It would be useful to apply the model to other applications to see if this is a usual or unusual finding. It may be possible to develop some principles that could be applied to protected area management in general.

Recommendations regarding the management of the Wet Tropics WHA

The following are the main policy relevant points that emerged from the empirical analysis for the Wet Tropics WHA:

1. The high conditional NPVs estimated show that investment in adequate management is indeed justified, whether funded from consolidated revenue or revenue raised from users.
2. The current budget projections result in a shortfall in funding and this was interpreted as indicating that criteria and conditions for sustainable tourism in the Wet Tropics WHA are **not** being met.
3. A modest visitor entry fee could raise sufficient funds to meet the requirement for investment in adequate management.

Concluding comments

While the big issues of sustainable development remain unresolved, it is hoped that the model and approach developed for sustainable tourism in protected areas can contribute to this more modest goal. It is clear that an improved understanding of ecological systems is critical to any assessment of the levels of use that can be sustained, generally and in protected areas. The economic model presented is useful, but is only as good as the ecological limits set. This illustrates well the need to pursue an ecological economics approach to resource use and management.

APPENDIX A

ECOLOGICALLY SUSTAINABLE DEVELOPMENT AND TOURISM FOR AUSTRALIA

A major source of direction for resource use issues in Australia comes from the comprehensive ecologically sustainable development (ESD) process that was carried out in the years 1990 to 1992. This response to the challenge laid by the Brundtland Report led to intensive discussion of how to adopt ESD in and across sectors of the Australian economy and society. The process resulted in a *National Strategy for Ecologically Sustainable Development* (COA 1992b). The Australian process is described briefly first to provide context for a closer look at findings regarding tourism and the use of economic approaches. The tourism sector was the subject of deliberations of a Working Group which determined what the ideal characteristics of ecologically sustainable development for the tourism sector would be, assessed how the Australian tourism sector was performing in terms of these ideal characteristics and made recommendations on changes needed to move the sector towards the goal of ESD. The role of economics in achieving ESD was discussed in the overall ESD process and in respect of the tourism sector. Findings that provide direction for economic analysis are presented.

The Australian ESD process.

Australia's Commonwealth Government took up the challenge posed by the Brundtland Report and embarked on a process of exploring what sustainable development would mean for Australia. The term 'ecologically sustainable development' (ESD) was adopted for use in the Australian context. The 'ESD process', as it came to be known, commenced with the release of *Ecologically Sustainable Development, A Commonwealth Discussion Paper*, in June 1990. It proposed the following definition of ESD:

> Ecologically sustainable development means using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased (COA 1990, p. i).

The use of the word 'ecologically' to describe the form of sustainable development being considered may or may not have significance depending upon how it is interpreted. Following the typology put forward by Pearce et al (1989), ecologically sustainable development may be interpreted as equivalent to the strong sustainability rule, to be achieved by conserving critical natural capital. Looking at the outcomes of the ESD process, the interpretation evident was not this precise, but concern did tend to focus on maintaining essential ecological processes.

The definition adopted for ecologically sustainable development does not explicitly refer to the current inequities between rich and poor nations, that were given prominence in the Brundtland Report (WCED 1987). This has perhaps influenced the subsequent direction of the debate in Australia, which emphasised concerns for national ecological resources, giving less attention to the current level of consumption in Australia *vis a vis* poorer nations. Intragenerational equity within Australia, particularly disparities between Aboriginal Australians and others, was considered.

An extended discussion/definition of the meaning of ESD developed by the Chairs of the Working Groups is presented in Box AA.1. Economic growth was not rejected but rather the social target was redefined away from GDP targets to more broadly based economic and social development, that is ecologically sustainable.

Box AA.1 Discussion of ESD by the Chairs of the ESD Working Groups, from the Intersectoral Report

'We know that ESD involves both economic (including social) development and ecological sustainability. Defining economic development provides less ambiguity in principle than ecological sustainability. Economic development is wider in context than economic growth as it has been traditionally understood. Development includes material well-being but also non-material well- being, satisfaction and quality-of-life elements. Intrinsic to these considerations is the quality of the environment, the evidence being that in Australia, as in most countries, environmental conditions are an increasingly important contributor to quality of life. The social aspects of economic development encompass economic stability and security (including freedom from want) and social equity (including equality of opportunity). These go well beyond what we normally mean by economic growth, although without economic growth, other economic and social objectives will be difficult to achieve.

'The policy challenge is how to achieve the necessary integration of economic development and ecological sustainability. What is important is the understanding that *as a broad principle there is no necessary conflict between economic and environmental goals*, and indeed that both have to be pursued simultaneously and in harmony in an economic development process that is ecologically sustainable. Ecological factors provide the complexity, in part because they are the less familiar part of the package, but in part because of their intrinsic complexity' (ESD Working Group Chairs 1992, p. 2, italics added).

The ESD process involved the setting up of a number of Working Groups consisting of representatives of the three levels of government, industry, unions, environment groups, community groups and experts in various fields. A Working Group was established to address each of the 'sectoral' issues; Agriculture, Energy Use, Energy Production, Fisheries, Forest Use, Manufacturing, Tourism, and Transport. In addition, the three Chairs of the Working Groups addressed Greenhouse and a number of intersectoral issues. The report which was prepared on 'Intersectoral Issues' covered; health, population, urban issues, the coastal zone, water issues, employment, gender and Aboriginal issues.

The Working Groups produced Draft Reports which were released for public comment. Final Reports were released at the end of 1991 and early 1992. These reports represent a valuable contribution to thinking about development and management of environmental resources in Australia. There appeared at the time to be general consensus that ESD is a desirable goal.

The Commonwealth Government along with the governments of the States and Territories established an Intergovernmental ESD Steering Committee to examine and respond to the reports and recommendations of the Working Groups. By this process, a *National Strategy for ESD* was developed. A draft of this was released for public comment in May 1992 and the final was endorsed at a meeting of the Council of Australian Governments in December 1992. The *National Strategy for ESD* (COA 1992b)was released as a public document in December 1992. Accompanying this is a *Compendium of Ecologically Sustainable Development Recommendations* (COA 1992c) which brings together all the recommendations of the ESD Working Groups together with comments on any action already taken or proposed at the time of publication.

The *National Strategy for ESD* has a goal, core objectives and guiding principles, (see Box AA.2). The core objectives address issues of community well-being, equity and ecological processes. The guiding principles include the 'precautionary principle' which states that where uncertainty exists, lack of information should not prevent action being taken to prevent environmental degradation (Young 1993). In addition the *National Strategy for ESD* includes strategies and objectives for each of the 8 sectoral and 22 intersectoral issues. The Council of Australian Governments on endorsing the *National Strategy for ESD*, qualified their support by noting that the rate at which it would be implemented would depend upon budgetary priorities and constraints.

Box AA.2 National Strategy for Ecologically Sustainable Development

The Goal
'Development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends'.

The Core Objectives
'• to enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations;
• to provide for equity within and between generations; and
• to protect biological diversity and maintain essential ecological processes and life support systems'.

The Guiding Principles
'• decision making processes should effectively integrate both long and short-term economic, environmental, social and equity considerations;
• where there are threats of serious or irreversible environmental damage, lack of fill scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;
• the global dimension of environmental impacts of actions and policies should be recognised and considered;
• the need to maintain and enhance international competitiveness in an environmentally sound manner should be recognised;
• cost effective and flexible policy instruments should be adopted, such as improved valuation, pricing and incentive mechanisms; and
• decisions and actions should provide for broad community involvement on issues which affect them' (COA 1992b, p.8)

The Australian ESD process was not undertaken in a vacuum. Governments and industry in Australia already had processes in place for resource and environmental management, impact assessment and relevant research and education. Many of the *National Strategy for ESD* objectives called for strengthening, extending and integrating processes already occurring. New initiatives range from the specific objective to 'establish across the nation of a comprehensive system of protected areas including representative samples of major ecosystems, both terrestrial and aquatic' (COA 1992b, p. 54), to the more general principle of taking a precautionary approach in assessing proposals.

In 1996, the term ESD has faded from regular use at a government level compared with the early 1990s but this is not an indication that the actions initiated by the ESD process have ceased. A perusal of the *Compendium of Ecologically Sustainable Development Recommendations* in 1996, reveals that many of the recommendations of the ESD Working Groups have been taken up in some form, yet others have not been taken up. Those recommendations that have been taken up have changed or strengthened policy and implementation, for example, new fisheries legislation at the Commonwealth level and for Queensland sets ESD as a goal for fisheries management[1]. There has been no assessment to date of the effectiveness of the process and its outcomes. One recommendation that is being implemented is introduction of national State of the Environment Reporting, which should provide a basis for assessment of outcomes in the future. The first State of the Environment Report was released in June 1996 (DEST 1996).

Tourism in the context of ESD

The section presents a review of the 1991 *Ecologically Sustainable Development Working Group Final Report - Tourism* (ESD Working Groups 1991). This report is important as it is the result of the first comprehensive examination of tourism in Australia undertaken with ESD

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[1] The relevant legislation is the Commonwealth Fisheries Management Act 1991 and the Queensland Fisheries Act 1994.

as an objective. The Working Group succeeded in developing principles for and characteristics for an ecologically sustainable tourism sector which are broadly consistent with the literature on sustainable development. Australian tourism was broadly evaluated against these principles and characteristics and recommendations were made for policies and practices that would direct tourism operation and development towards meeting these principles and characteristics. The findings of the report subsequently formed the basis for the objectives for tourism contained in the *National Strategy for ESD*.

Members of the Working Group included representatives of the Australian Council of Trade Unions, the Tourist Ministers' Council, the Australian and New Zealand Environment and Conservation Council (both Councils include State and Territory Governments), Commonwealth Government departments, CSIRO, peak conservation groups and industry organisations (including a Local Government representative). The Working Group drew on published research, consultancies, written submissions, site visits, and meeting and presentations for information. A Draft Report was released for public comment and the Final Report was produced in November 1991.

The Working Group interpreted its task as to: 'examine the relationship between the environment and the ... industry, identify the most important problem areas, develop practical policy options to resolve these problems that meet both environmental and economic goals' and to set priorities and time frames for change (ESD Working Groups 1991, p.xii).

The Working Group in its report emphasises that it reached a consensus that ecologically sustainable tourism was achievable. '[The Working Group] has identified the fundamental principles of ESD, applied them to the industry and has concluded that tourism can exist on an ecologically sustainable basis in Australia' ((ESD Working Groups 1991, p.xii). Flowing from this, the recommendations of the Working Group represent a consensus.

The potential for tourism to impact the very resources on which the activity depends was noted.

> From the point of view of ESD, it is important to recognise that a major motivation for tourism activities in Australia, both domestic and international, is to experience aspects of our natural and cultural environment. Tourism development which exploits and degrades the environment is not only contrary to the principles of ESD, but is also likely to be ultimately self-defeating (p.xviii).

In a review of environmental, social and cultural impacts of tourism in Australia, the Working Group found examples of environmental damage and conflicts between tourism and indigenous communities. Other social impacts were not thought to be a real problem in Australia. The review of impacts was not a comprehensive cataloguing of examples but rather concentrated on identifying types of impacts and their causes. The Working Group considered that many of the types of impact could be avoided through better planning and design and consultation with communities. Thus the emphasis in its recommendations is on integrating planning for tourism within broader planning for the use of natural resources, and incorporating environmental impact assessment in planning for tourism. The Working Group included a number of recommendations to improve the two-way understanding and communication between indigenous people and tourism.

The Working Group proposed the following principles for ecologically sustainable tourism:

- Improvements in material and non-material well-being;
- Intergenerational equity and intragenerational equity;
- Protection of biodiversity and maintenance of ecological systems and processes; and
- Recognition of the global dimension.

The Working Group considered that the focus for improvements in well-being should be on quality experiences for tourists (and it is also implied, but not clearly stated, quality returns to host communities). It considered the measurement of changes in well-being would require the development of new indicators of quality, not merely numbers of tourists and dollars.

In the view of the Working Group, the pursuit of inter and intra generational equity could be enhanced by guaranteeing constant natural capital, dealing cautiously with risk and uncertainty, placing bio-physical limits on natural resource use, involving the community in decision making and promoting social equity.

To protect biodiversity and ecological systems and processes, the Working Group recommended that the kind and scale of developments be managed to allow the retention of all species and ecological processes and the capacity for ecological systems to adapt to environmental change (such as climate change).

Recognising the global dimension of tourism, the Working Group stated that 'an ecologically sustainable tourism industry ought not to contribute to non-sustainable activities elsewhere through the use of inputs derived from unsustainable activities or the actions of outbound tourists' (ESD Working Groups 1991, p. 39).

Along with the principles, the Working Group proposed a number of ideal characteristics which would be necessary for an ecologically sustainable tourism industry. These describe the way tourism should be planned and managed by government (with community input) and operated by the public and private sectors.

The ideal characteristics are:

- As tourism is a resource based industry, use of natural resources would be based on the best available information;
- Use of natural resources for tourism would be within the context of integrated land use plans which provide for the maintenance of biodiversity by means including a national system of conservation reserves;
- Tourism would operate within bio-physical limits, set with respect for risk and uncertainty;
- The range of opportunities for tourism experiences available to future generations would be at least those available now (through the avoidance of 'homogenisation' of tourism experiences);
- Biodiversity would be maintained;
- The ability of other sectors to achieve sustainability would not be impaired;
- On site impacts would be minimised through waste management , energy efficiency and design;
- Management of tourism in protected areas would be particularly sensitive and some areas could be off limits to tourism;
- Management would incorporate concepts of carrying capacity and limits of acceptable change (as the best available guidelines, though having limitations);
- Management of tourism in arid and semi-arid and alpine areas would balance the popularity of these areas with the particular vulnerability of these areas to human impact;
- Management of tourism in coastal areas would be underpinned by effective coastal management strategies; and
- Management would plan ahead to accommodate predicted impacts of climate change.

Having compared tourism in Australia with the principles and ideal characteristics of an ecologically sustainable tourism industry, the Working Group formulated 31 recommendations aimed at achieving an ecologically sustainable tourism industry. The recommendations are summarised in Box AA.3. They place emphasis on managing environmental impacts, improving relationships between tourism and indigenous people and human resource development within the tourism industry.

Box AA.3 ESD Working Group on Tourism: Recommendations summarised

The Working Group made 31 recommendations and many of these had more than one part to the recommendation. The main points are summarised here. The recommendations marked with (ESD) promote ESD in general and those marked with (T) particularly concern tourism. Those marked with an asterisk (*) are presented in full in the following Boxes 4 and 6, as they are about tourism in protected areas and the use of economic instruments.

1. (ESD)	The ESD process should continue and tourism should be managed for ESD.
2. (ESD)	Regional planning should set the context for ESD.
3. (ESD)	Environmental impact assessment procedures should be improved and applied.
4. (T)	Tourism strategic plans should be developed within the context of regional plans.
5.	The Landcare approach should be examined for possible application to tourism.
6. (ESD)	A national system of protected areas should be established.
7.* (T)	Management of protected areas should be adequately funded including by user pays.
8. (T)	Information should flow between indigenous people and the tourist industry about possibilities for involvement in tourism and the cultural diversity and aspirations of indigenous people.
9. (T)	Market research about potential for cultural tourism and social impact research is required.
10. (T)	The training needs for indigenous people should be assessed and met.
11. (T)	Consultative mechanisms with indigenous people should be established.
12.	Tourist and Cultural Ministers' Councils should interact.
13.* (T)	Infrastructure provision and private or public funding should be carefully assessed
14. (T)	Industry codes of practice should be developed and implemented.
15. (T)	ESD implications should be considered in marketing.
16. (T)	Recycling and retrofitting of developed sites and other means of impact minimisation should be promoted.
17.* (T)	Criteria should be developed for management of commercial tourism and facilities in and nearby protected areas.
18.* (T)	Effective penalties for non compliance and performance bonds be adopted.
19. (T)	Visitor experience should be enhanced and impacts minimised through education and interpretation.
20. (T)	Coordination between all levels of government should be improved.
21. (T)	Tourist should be made aware of a code of behaviour.
22. (T)	Communities should be made aware of the benefits of ecologically sustainable tourism and community participation in planning etc. should be facilitated.
23. (ESD)	ESD principles should be promoted to the planning, engineering and architecture institutes and in education in these fields.
24. (T)	Tourism industry training should incorporate ESD principles and tourist operations in protected areas should be accredited.
25. (T)	Foreign language training should be further developed.
26. (ESD)	A body should be established for funding and coordinating strategic ecological research.
27. (ESD)	Flora and fauna inventory programs should be adequately funded.
28. (T)	Funding of the International Visitor Survey and Domestic Tourism Monitor should be maintained, state and regional data bases should be established and overseas market research enhanced.
29. (T)	Government and industry should provide additional funds for strategic research.
30. (T)	An inquiry into funding of tourism research and its capacity to meet the needs of ESD should be conducted
31. (T)	Potential impacts of climate change on tourism should be studied and tourism's contribution minimised.

(ESD Working Groups 1991, pp. xxvii - xxxvi)

Specific discussion and findings of the Working Group regarding tourism in protected areas are reported in Chapter 3. The recommendations of the Working Group that specifically mention tourism in protected areas are listed in full in Box AA.4.

Box AA.4. ESD Working Group on Tourism: Recommendations concerning tourism in protected areas, in full

Recommendation 7 - the Working Group recommends:
(a) that governments provide adequate budget funding to ensure that protected areas are managed and maintained to the highest standard; and
(b) that governments introduce, or review, systems of park-use fees so that those persons using facilities and/or services in protected areas contribute directly to the costs of management, wherever this can be effectively implemented.

Recommendation 17 - the Working Group recommends:
(a) that criteria and conditions be established under which commercial activities within protected areas may be appropriate; and
(b) that a coordinated approach be taken to the management of protected areas and the development and operation of the tourist facilities located nearby.
(ESD Working Groups 1991, pp. xxvii - xxxvi)

The *National Strategy for ESD* which was subsequently developed included a section on tourism which set out a challenge, a strategic approach and four objectives for tourism. The challenge was stated thus:

> 'To develop and manage the tourism industry in a way which conserves its natural resource and built heritage base and minimises any negative environmental, social and cultural impacts' (COA 1992b, p. 44).

See Box AA.5 for the strategic approach and objectives.

Box AA.5 National Strategy for Ecologically Sustainable Development, Tourism Objectives

Strategic Approach

Key actions will include: encourage strategic planning at the regional and local level; development and adoption of industry codes of environmental practice and impact minimisation programs; examination of regulatory mechanisms for the tourism industry, including performance bonds; improving public information and education materials on environmental impacts associated with tourist activity; and encouraging further research into economic and environmental impacts of tourism.

Objective 7.1
To ensure tourism strategies developed at all levels are based on ESD principles and provide effective mechanisms for industry and community input.

Objective 7.2
To examine the most appropriate use of regulatory measures to ensure tourism development is ecologically sustainable.

Objective 7.3
To encourage environmentally appropriate tourist operator and visitor behaviour through the production and adoption of codes of environmental behaviour and practice and to improve tourist awareness of ESD principles.

Objective 7.4
To develop a greater understanding of the economic and environmental impacts of tourism developments, including monitoring of tourism trends, such as eco-tourism.
(COA 1992b, pp. 44-5).

Economics for ESD

The reports of the ESD Working Groups expose flaws in the economic system where environmental consequences of resource use are not properly taken into account. Several approaches to tackle this are suggested in recommendations scattered through the various reports of working groups. The extension of economic analysis to include valuation of non-market values and identify intra and intergenerational equity effects is recommended. In addition, greater use of economic instruments to correct for market failure is recommended.

The recommendations arising from the intersectoral reports, listed in the *Compendium of Ecologically Sustainable Development Recommendations* (COA 1992c), include a range of recommendations for using economic analysis and instruments to promote ESD generally. These include:

- use discount rates more reflective of the social rate of time preference to promote intergenerational equity;
- evaluate equity effects of pricing and economic instruments to promote intragenerational equity;
- undertake full social benefit-cost analysis of proposals for investment in infrastructure;
- improve pricing and allocation of water to improve efficiency and ensure environmental requirements are met;
- review economic modelling for the potential development of integrated economic-ecological modelling;
- support the development of analytical procedures: contingent valuation, option value estimation, the incorporation of scientific uncertainties into risk-benefit analysis, extended forms of cost-benefit analysis including ways to incorporate the interests of future generations or take account of other equity issues;
- accord priority to examining methods for valuing environmental resources; and
- consider pilot schemes for the application of tradeable pollution permits and more effective use of economic incentives in general.

Developed from consideration of the reports of the Working Groups, the *National Strategy for Ecologically Sustainable Development* puts forward the nationally agreed steps for promoting ESD. The National Strategy includes specific objectives to use pricing and taxation to promote ESD. These are:

> Objective 20.1
> To develop, improve and enhance the effective use of pricing and economic instruments as a means of achieving better management of Australia's natural resources.
>
> Objective 20.2
> To ensure that adequate attention is given to social and environmental costs when assessing the use of pricing, taxation and other economic instruments (COA 1992b, pp.78 & 79).

Several of the recommendations of the ESD Working Group on Tourism also focused on a greater use of economic analysis, strategic investment and economic instruments for promoting ecologically sustainable tourism. A full list of the relevant recommendations is in Box AA.6. The section on tourism in the *National Strategy for ESD* only picked up recommendations on the use of performance bonds and a general reference to examination of regulatory mechanisms. There is no explicit mention of users or industry paying for costs of minimising impact. However, the *National Strategy for ESD* does refer to pricing and taxation, generically, as discussed above. The recommendations of the ESD Working Group on Tourism are taken for the purposes of this study to provide a useful direction for approaches economic analysis and the use of economic instruments, to promote sustainable tourism.

Box AA.6 ESD Working Group on Tourism: Recommendations concerning economic instruments, in full

Recommendation 7 - see Box AA.4.

Recommendation 13 - the Working Group recommends:

(a) that assessment of the infrastructure needs of the tourism industry be made in the context of integrated regional land-use plans;

(b) that public sector provision of infrastructure only be considered in cases where it is clear that there is a market failure such that commercial considerations will result in the provision of the facilities needed. In such cases, governments should be guided by cost-benefit analysis, taking fully into account environmental and social benefits and costs; and

(c) that where infrastructure is provided by government, charges be levied wherever possible to provide a return to the community for the use of those facilities and to enable more efficient and effective management and use.

Recommendation 17 - see Box AA.4

Recommendation 18 - the Working Group recommends:

(a) that penalties for non-compliance with environmental regulations be related to the environmental damage caused by the infringement; and

(b) that performance bonds of identified duration be a condition of development approval in cases where there is a risk of unacceptable environmental damage.

(ESD Working Groups 1991, pp. xxvii - xxxvi)

It is worth noting that the recommendations for improvements to economic approaches arising from the Australian ESD process are broadly are consistent with proposals put to the United Kingdom government for promoting sustainable development by Pearce et al (1989) and with the directions being taken within ecological economics. Thus there is some consensus that new approaches to economic analysis are more likely to direct economic activity towards sustainability than the unregulated workings of the market or intervention aimed only at promoting neoclassical efficiency.

APPENDIX B

THE NATURAL ENVIRONMENT OF THE WET TROPICS WHA

The information in this Appendix provides a brief introduction to the features, significance and vulnerability of the natural environment of the Wet Tropics WHA.

AB.1 SIGNIFICANCE OF THE NATURAL ENVIRONMENT OF THE WET TROPICS WHA

The Wet Tropics WHA essentially includes the majority of native forest cover remaining in the strip between the coast and the Great Dividing Range from north of Townsville to south of Cooktown. The core of this forested area is the tropical rainforest and associated acacia and eucalypt forests that cloak the ranges and these have been largely retained in the form they were before European settlement. The areas have not been cleared but parts have been subject to other impacts, notably logging. Also included in the Wet Tropics WHA is a portion of what remains intact of the lowland rainforest and associated coastal mangrove vegetation. These vegetation assemblages once covered the coastal strip but have been extensively cleared for agriculture and urban settlement. To the west of the ranges are the Atherton and Evelyn Tablelands, areas of which were once covered with rainforest but which have been so extensively cleared for agriculture that only remnant patches of rainforest vegetation remain (House & Moritz 1991). Tall open eucalypt forests also occur on the western fringe of the Wet Tropics WHA.

Some relatively small but significant areas of rainforest held under freehold title are not included in the Wet Tropics WHA. North of the Daintree River, some of the last remaining areas of lowland rainforest are held as freehold title.

The Wet Tropics WHA includes the largest assemblage of rainforest in Australia and includes most of the continent's tropical rainforest.

The rainforests of the Wet Tropics WHA are of international significance in terms of biodiversity and as a historical record of evolution. These qualities of the area have earned the area's placement on the World Heritage List. To merit inclusion on the World Heritage List, an area must meet at least one of four criteria for outstanding natural heritage. The Wet Tropics WHA has been judged to meet all four natural heritage criteria and is one of only about twelve natural World Heritage sites in the world to meet all four criteria (WTMA 1995d). To meet these criteria, the area must:

- be an outstanding example representing the major stages in the earth's evolutionary history;
- be an outstanding example representing ongoing geological processes, biological evolution and man's interaction with his natural environment;
- contain superlative natural phenomena, formations or features or areas of exceptional beauty; and
- contain the foremost natural habitats where threatened species of animals or plants of universal interest still survive (WTMA 1992a, p 11).

The flora and fauna of the Wet Tropics WHA represent major stages in the evolutionary history of life on earth. To quote the Wet Tropics Management Authority:

> These forests are living museums. They contain one of the most complex and diverse living records of the major stages in the evolution of the land plants, from the very first plants on land to the higher plants (gymnosperms and angiosperms). They also provide

one of the most important living records of the history of the marsupials and the songbirds (WTMA 1992a, p 11).

The Wet Tropics WHA, as is typical of rainforests, has a high floral diversity. This area has been rated as one of the world's twelve tropical rainforest priority 'hotspots' for preservation based on high having high biological diversity, high levels of endemic species and being under threat of species extinctions (Primack 1993).

The Wet Tropics rainforests contain many endemic species. According to RCS (1994), 'the Wet Tropics is the only habitat for more than 500 species of plants and 30 species of animals that are regarded as rare, vulnerable or endangered' (p. 43).

AB.2 Development and physical geography

AB.2.1 Gondwanaland origins

The current natural environment of the Wet Tropics WHA can be traced directly back to the time when present day continents were joined as Gondwanaland. The ancient continent of Gondwanaland began to break up about 120 million years ago. The landmass that is now the Australian continent was one of the last pieces to break off, about 50 million years ago. This continent broke off Antarctica where it remains now and drifted northwards for about 35 million years in isolation from all other land masses. About 15 million years ago, the Australian continent collided with the Asian landmass (forming New Guinea in its current form in the process). More recently, the current period , known as the Holocene, commenced about 10,000 years ago with a warmer and drier climate following the glacial periods of the Pleistocene (RCSQ 1986).

The current rainforest assemblages of the Wet Tropics WHA are similar to those of Madagascar and New Caledonia and are believed to be the principal surviving remnants of those that existed more than 60 million years on Gondwanaland (WTMA 1995d). The flowering plants, angiosperms, had evolved in primitive form and were distributed throughout Gondwanaland before it broke up. Subsequently, the floras of each continent evolved differently. Some families of flora were isolated on the Australian continent. Over the period when Australia moved northwards, the climate changed and the tropical type of forest that once covered Gondwanaland retreated to North East Queensland. In other areas the vegetation more typical of a dry continent evolved.

The collision of the Australian and Asian landmasses allowed the interchange of some plant species. The colder climate of the Pleistocene caused the tropical flora to retreat even further. The warmer conditions of the Holocene allowed areas of tropical flora to expand to those existing at the time of European settlement. Throughout this long period, relicts of the primitive flowering plants of Gondwanaland have survived in the Wet Tropics (RCSQ 1986).

Several of the primitive angiosperm families are now restricted to refugia areas which provided a haven for the tropical flora during the Pleistocene. These include wet upland areas and very wet valleys. These refugia areas remain significant today as a number of species (including more highly evolved flora) are restricted to these areas. The continuing existence of these refugia areas is a major feature in the flora and faunal diversity of the natural environment of the Wet Tropics WHA (RCSQ 1986).

AB.2.2 Topography and Geology

The region is formed of three geomorphic units; the uplands/tablelands of the Great Dividing Range; the lowland coastal plains belt; and the intermediate Great Eastern Escarpment

(Werren 1992). The uplands lie at an altitude of around 900 metres and include summits rising above 1200 metres. These summit zones, along with protected wetter areas, are the distinctive refugia areas which have featured in the historical development of the region's biodiversity. The soils of the tablelands are largely derived from basalt and are rich in nutrients.

The escarpment was formed by uplifting and exhibits steep slopes and rugged topography. Active erosion has formed steep sided river valleys and waterfalls. The diversity of terrain contributes to diversity of rainforest distribution in this zone. The alluvial coastal plain carries a number of rivers to the sea.

AB.2.3 Climate

The climate features a distinctive wet season lasting from around December to March. The Wet Tropics WHA receives a high proportion of its rainfall in these few months and can receive the majority over a few days (Bonnell 1991). The highest rainfall episodes in Australia have been recorded in the Wet Tropics WHA (Bonnell 1991). The Far North region is in the cyclone zone and is visited by an average of one severe cyclone every three years. Around 40% of these cyclones impinge on the Wet Tropics area (Werren 1992). The climate of the Wet Tropics is more seasonal than that of equatorial rainforests in other parts of the world (Turton 1991). One implication of the rainfall regime is the potential for erosion of disturbed areas coinciding with high intensity rainfall episodes.

The temperature regime is tropical with average summer temperatures on the coast ranging from 23^{o}C to 31^{o}C with average winter temperatures 5^{o}C lower. Cooler temperatures prevail on the mountain tops and tablelands with a range from 17^{o}C to 28^{o}C in summer and 9^{o}C to 22^{o}C in winter (Werren 1992).

AB.3 Flora and Fauna

AB.3.1 Vegetation communities

The vegetation communities are the elements which define the rainforest ecosystems. These display considerable diversity throughout the region. A classification of rainforest types developed by Tracey and Webb (1975, quoted in RCSQ 1986) is widely used in the study and description of rainforest structure. The classification identifies 11 rainforest types with subgroups making a total of 17 different classifications. The Wet Tropics WHA also supports acacia and eucalypt forest, types 12 and 13 (Adam 1992).

A number of the rainforest types are restricted in extent either naturally (the summit zone vegetation communities) or as a result of clearing (Werren 1992). Of the complex notophyll vine forests, type 5, type 5a is naturally restricted to high cloudy areas on basalt soil while type 5b, which once was extensive on the Atherton Tablelands, has been cleared until a only a few remnants remain (Adam 1992). Of particular note is the reduced extent of lowland rainforest types (1a, 2b, 3a, 3b) due to clearing for agricultural and urban, including tourism, land use. Some of the remaining lowland rainforest areas are not included in the Wet Tropics WHA and continue to be under threat of clearing. It is obvious that past clearing has had a non-uniform impact on the rainforest types of the region and that the Wet Tropics WHA is not truly representative of distribution of rainforest types present in the 1860s. This has implications for biodiversity conservation as remaining fragments of some rainforest types are more vulnerable to processes that threaten their integrity and viability.

AB.3.2 Flora

The flora of the Wet Tropics has been described as providing 'one of the most complete living records of the evolution of land plants' (RCS 1994, p. 19). This includes primitive relict members of ferns, cycads and conifer families. The flora of the Wet Tropics WHA is particularly significant in including representatives of primitive flowering plants. The existence and distribution of these are thought to be explained by, and give weight to, theories about events in the earth's geological history. These flora are not only significant for representing ancient forms, they are significant for their concentration. Of the 19 families of more primitive angiosperms in the world, 12 families are represented in the Wet Tropics making this the highest concentration of such families in the world. (RCSQ 1986).

The majority of plant species are found in small numbers (uncommon) and/or found only in some parts of the Wet Tropics WHA (restricted). Particularly important for biodiversity conservation are those species which are the sole representatives of a genus (monotypic endemic genera)(RCSQ 1986). The Wet Tropics WHA contains many species of plant categorised as rare, threatened or restricted.(RCS 1994).

The records of vascular plants are of over 3400 species and may go higher. Of the higher plants (angiosperms and gymnosperms), about 710 species are Australian endemics, with 500 of these confined to the Wet Tropics (Werren 1992).

AB.3.3 Fauna

The fauna of the Wet Tropics WHA also includes species that are relicts of Gondwanaland species. Other species entered the area after the Australian and Asian landmasses connected 15 million years ago. Knowledge about the fauna of the Wet Tropics WHA is limited. Complete or near complete species lists are only available for vertebrates, butterflies, cicadas, odonates and a few small invertebrate groups (Jones & Kitching 1991). It is anticipated that the number invertebrate species described is but a small proportion of those inhabiting the Wet Tropics WHA (Jones & Kitching 1991). Crome (1991) notes that there is reasonable information available on 'distribution, breeding and diet of birds and selected mammals, notably possums. Information on reptiles and amphibians is appallingly limited' (p. 100).

The RCSQ (1986, p 21) claims that 'the wet tropical rainforests of North-East Queensland have the richest fauna in Australia'. Information on vertebrate and invertebrate species numbers in the Wet Tropics WHA is presented in Table AB.1. The numbers in brackets are from a 1986 report which assembled information available just prior to listing the Wet Tropics WHA (RCSQ 1986), and other numbers are from a 1994 review of records (RCS 1994), indicating advances in knowledge in this period.

There have been 30 species of non-flying mammals described within the Wet Tropics WHA (Winter 1991). Their distribution is well established; two distinct subregions have been identified in the Wet Tropics region (Winter 1991). A feature of the distribution is 'distinct altitudinal zonations of mammals' (Winter 1991). A number of species are limited to the upland regions, none are limited to the lowlands (Winter 1991). Populations of a number of the mammal species are completely separated as they are restricted to separate mountain or tableland areas. The medium to larger mammals occur in low densities (Winter 1991). A number of the mammal species are rare and restricted within the region, some may be threatened or endangered (RCSQ 1986).

Of the 35 or so species of bats found in the Wet Tropics WHA, it is thought that all but one species are also found outside the conserved area.

Table AB.1 Species numbers, selected vertebrate and invertebrate groups, Wet Tropics WHA

Group	No. species in Wet Tropics WHA	No. endemic species	No. endemic subspecies	No. spp only Australian occurrence*	% of Australian species
Mammals (excluding bats)	(55), 58	(9), 11	8	1	36% of all mammals, 30% of marsupials, 25/5 of rodents
Bats	(34), 36			(1), 1	58%
Birds	(128), 370	(10), 13	(3), 10	(13), 10	50%
Frogs	(47), 53	(19), 21			25%
Reptiles	(160) 170	(16), 22			23%
Fish	69	3 - 5			37%
Butterflies	(227), 200+	(10)			60%

* for birds includes Cape York
Source: Figures in brackets from RCSQ 1986, other figures from RCS 1994.

The diversity of bird species within the rainforests of North Queensland is the highest in Australia (RCSQ 1986, quoting Kikkawa 1982). The Cassowary is the largest bird in the area and is thought to be a 'keystone' species responsible for dispersion of seeds throughout the forest (Crome & Moore 1990). The species found in the Wet Tropics WHA, *Casuarius casuarius*, is one of three species of Cassowary found in the world and is at the southern limit of its distribution in the Wet Tropics WHA. *Casuarius casuarius* is also found in New Guinea. It is now restricted to a few isolated lowland rainforest areas and there is concern about its future viability and that of the rainforest dependent on it (House & Moritz 1991). Crome (1991) lists a number of species of birds found in lowland rainforest which are vulnerable to continued habitat reduction of those forest areas outside the Wet Tropics WHA (Crome 1991).

There are approximately 25% of Australia's frog species and 23% of Australia's reptile species found in the rainforests of North Queensland (RCS 1994). Several species are restricted to the region. In common with a world wide trend, a number of frog species have not been sighted in recent years leading to fears of extinction.

The known insect fauna includes over 200 species of butterflies (RCS 1994) which is around 60% of Australia's butterfly species, some are endemic to the region. The invertebrate fauna of the rainforest include species important to the functioning of the rainforest system as distributors of pollen and responsible for the breakdown of detritus. Over 4000 species of invertebrates were identified from a 5 kilometre transect on Mt Belleden Ker, indicating high diversity in the area (Jones & Kitching 1991). The fauna as a whole exhibits altitudinal zonation in the Wet Tropics WHA.

AB.3.4 Rare and threatened species

As noted above, the Wet Tropics WHA and native vegetation within the region but outside the WHA, supports many species of naturally uncommon occurrence. The issue of whether any of these species was threatened with extinction was addressed at a workshop of experts held in 1992. There are two versions of outcomes of this workshop (Werren 1992, Nias et al 1993) which differ somewhat in reporting the outcomes of the workshop, but the differences are few.

The IUCN has determined standard classifications for the status of species warranting special conservation concern, see Table AB 2. The term 'threatened species' is used to refer to species classified as endangered, vulnerable or rare (Primack 1993).

Table AB.2 IUCN conservation categories

Extinct	Species that are no longer known to exist in the wild.
Endangered	Species that have a high likelihood of going extinct in the future.
Vulnerable	Species that may become endangered in the near future because populations of the species are decreasing in size throughout its range.
Rare	Species that have small numbers of individuals, often due to limited geographical ranges or low population densities. although these species may not face any immediate danger, their small numbers make them likely candidates to become endangered.
Insufficiently known	Species that probably belong in one of the conservation categories but are not sufficiently known to be assigned to a specific category.

Source: Primack 1993, p105

The workshop assessed the status of; vegetation communities, plants, mammals, birds, reptiles, frogs, fish and invertebrates. In all cases, information available was not sufficient to permit an exhaustive assessment. The assessment was not confined to the Wet Tropics WHA but also included adjacent natural environments in the region between Townsville and Cooktown.

Vegetation communities

The lowland rainforest north of the Daintree River held in freehold title was identified as an area of high endemism and diversity under threat of clearing or modification. The refugia areas were also identified as vulnerable.

Plants

Of the 3400+ vascular species, 488 are considered rare or threatened. This figure is composed of; 11 endangered, 63 vulnerable, 323 rare and 91 insufficiently known species. Those species most under threat are populations known only from one site, under threat of clearing because they are not included in conservation reserves or from accidental clearing within the Wet Tropics WHA. Some 'near-misses' are reported where rare populations have only become known about only after areas have been cleared and infrastructure for transport and tourism installed (Werren 1992).

Mammals

The most endangered mammals in the Wet Tropics are thought to be the Mahogany Glider (endemic), the Tropical Bettong (endemic) and the Flute-nosed Bat, see Table AB.3. The habitat of the Mahogany Glider is lowland open forest/woodland, most of which is not conserved within the Wet Tropics WHA and is under threat of clearing. The Tropical Bettong is confined to a few areas due to habitat modification through grazing and changed fire regimes and is vulnerable to predation by dogs (Werren 1993) and road kills (personal observation). The Flute-nosed Bat is one of the world's rarest mammals and is known from only 21 specimens collected world wide including 3 in the Wet Tropics WHA (RCS 1994).

Table AB.3 Wet Tropics rare and threatened vertebrate species warranting highest priority conservation management

	Taxon	CONCOM status (April 1991)	Workshop determination (September 1992) Werren
MAMMALS	Petaurus gracilis, Mahogany Glider	not listed	critically endangered
	Murina florium, Flute-nosed Bat	not listed	threatening process not established
	Bettongia tropic, Tropical Bettong	endangered	endangered, threatening process possibly increasing
BIRDS	Casuarius casuarius, Southern Cassowary	vulnerable	Australian subspecies considered endangered
	Prionodura newtonia, Golden Bowerbird	not listed	appears to be in decline
FROGS	Taudactylus acutirostris, Sharp-snouted Dayfrog	endangered	massive and rapid range contraction; critically endangered
	T. rheophilus, Northern Tinkerfrog	not listed	not recorded for 2 years; critically endangered
	Litoria nannotis, Waterfall Frog	not listed	declining; critically endangered
	L. nyakalensis, Mountain Mistfrog	not listed	no recent records: critically endangered
	L. rehocola, Common Mistfrog	not listed	declining; critically endangered
	Nycimystes dayi, Australian Lace-lid	not listed	declining; critically endangered
FISH	Melanotaenia eachamensis, Lake Eacham Rainbowfish	endangered	extinct in the wild; captive population

Source: Werren 1993

Another two species of mammals, were classified as endangered but presumed not critically. Species assessed as vulnerable included the two endemic species of Tree Kangaroo and six species with sparse or declining population numbers, including three subspecies restricted to the Wet Tropics. All other endemic species were assessed as being rare.

The majority of Australia's bat species are rare/uncommon and many have specialised habitat or feeding requirements. The bat species found in the Wet Tropics WHA include a proportion which range both within and outside the Wet Tropics WHA. Information on most species is insufficient to establish population status, the importance of the Wet Tropics WHA to species survival or the level of threat to critical habitat outside the Wet Tropics WHA. It is thought that at least 16 of the 35 species recorded for the Wet Tropics WHA are rare or threatened or insufficiently known but suspected to be threatened (Werren 1993). Habitat conservation outside the Wet Tropics WHA may be particularly important to these species.

Birds

Cassowaries (*Casuarius casuarius*) are the largest animals living in the rainforest of the Wet Tropics WHA. These birds are thought to play an important part in dispersing the seeds of rainforest trees and vines and may be considered as keystone species for the role they play in rainforest regeneration and possibly succession (Crome & Moore 1990, Winter 1991). It is of concern that, following a survey of the status of the cassowary, Crome and Moore (1990) consider the cassowary to be the most threatened species in the Wet Tropics WHA.

Cassowaries were found to be distributed from the south to the north of the Wet Tropics WHA but the distribution is patchy with greater numbers on the coastal plains and coastal ranges. Populations are concentrated in some areas, and some of these concentrations are isolated from other native vegetation by extensive clearing for agriculture etc. The clearing that has occurred already is likely to have reduced cassowary numbers, particularly in lowland areas. Continuing threats to the species include: habitat loss, predation by humans, predation by dogs, traffic accidents, disease, competition from pigs, and restriction of movement along regular routes (Crome & Moore 1990).

The Golden Bowerbird is naturally sparsely distributed but concern has grown that bowers have disappeared from some areas in recent years. It has been suggested that ecotourism activities may be disrupting displays by males, reducing reproductive success (Werren 1993).

There are a number of species whose ranges include the Wet Tropics and whose populations are affected by process occurring both inside and outside the conserved area. These include raptors and finches. Species whose stronghold is the coastal lowlands are at greatest threat from habitat clearing outside the Wet Tropics WHA and this may impact on the conserved area where these species are important for dispersing seeds and pollinating.

Reptiles

Many species of this taxa are rare, but none were assessed to be threatened within the Wet Tropics WHA.

Frogs

The RCS (1994) note that about one third of frog species endemic to the Wet Tropics are endangered. At least six species of stream-dwelling frogs have recently disappeared or undergone large reductions in population numbers. The cause(s) of this are not understood. The species are all confined to undisturbed upland forested streams within the Wet Tropics WHA. The possible loss of frog species is concurrent with a world wide phenomena of frog disappearances. The workshop assessed the six stream dwelling species as highest priority for conservation, see Table AB.3. Another group of at least nine species of narrowly distributed endemics were assessed as of high conservation priority.

Fish

Information about freshwater fish distribution and status is very poor. Only about half of the species are considered to be relatively secure, and too little is known about those thought to be threatened to classify their status further. The Lake Eacham Rainbowfish is extinct from the wild. This species was restricted to Lake Eacham and the population was wiped out by the introduction of predatory fish. A captive population remains in a government laboratory.

Invertebrates

Insufficient information is available to assess the status of invertebrate species. It is believed there are many species yet to be identified. Many of the species that have been observed have restricted ranges in the Wet Tropics WHA, for instance some are confined to the summit zones.

AB.4 ECOSYSTEM DYNAMICS IN RAINFOREST

Tropical rainforests are amongst the complex environments in the world. In this section processes important to the conservation of the Wet Tropics WHA are introduced briefly.

AB.4.1 Succession

Succession is the process whereby vegetation progresses from a pioneering to a mature (climax) state. Clearings in the rainforest occur naturally through tree falls, or on a larger scale cyclones, fire, landslips etc. Gaps in the forest open to light are colonised by pioneer species, usually fast-growing, short, shade-intolerant species. This is followed by a number of phases in which successive groups of species first establish a low canopy and then a higher canopy creating a 'secondary' forest. This may be characterised by low tree species diversity (Whitmore 1991). The conditions then exist for the re-establishment of a high diversity of slow-growing large trees that are characteristic of mature rainforest.

The time taken for the attainment of mature rainforest from a cleared plot is dependent on local conditions. If gaps are small, early stages may be skipped. Winter et al (1991) reports estimates of about 50 years from clearing to the establishment of young individuals of the mature phase and up to another 50 to 100 years for mature fruiting to be reached. At that age, trees may not have attained their mature size. Whitmore (1991) notes observations of forests in West Africa where a steady state had not been reached by 250 years.

The process of succession can be 'deflected' resulting in a different final stage. One cause is leaching of nutrients from soils exposed for some time and the result may be a vegetation typical of a lower nutrient environment. Fire can deflect succession towards grassland or eucalypt forests. Succession can be 'truncated' by exotic species that out-compete natives Winter et al (1991).

AB.4.2 Species diversity and rarity

Tropical rainforests are characterised by high species diversity but often small population sizes and low densities of individual species. The rainforests of the Wet Tropics WHA are the most floristically diverse in Australia (RCSQ 1986). Twenty-five percent of all plant genera in Australia are represented in this 0.1% of the land area (RCSQ 1986).

AB.4.3 Fragmentation

The rainforests of the Wet Tropics WHA are naturally fragmented and fragmented due to clearing. The incursion into forest areas of roads, telecommunications corridors and other clearing for infrastructure increases fragmentation. Fragmentation has both direct impacts on populations of flora and fauna and impacts on the flow of genetic material.

Fragmentation is accompanied by increases in the area of rainforest 'edges' which are exposed to impacts including fire, invasion of exotic plants and feral animals. Where populations are isolated, the risk of reduced population numbers or local extinction due to natural catastrophe or environmental changes is increased. Over the long term, isolated populations may experience a decrease in genetic variation that may reduce the viability of the population (House & Moritz 1991).

Where the effects of fragmentation is negatively affecting the viability of species populations, conservation of biodiversity may not be guaranteed merely by awarding conservation status to an area. Active management may be needed to avoid inevitable decline in the diversity of isolated areas and those exposed to increased edge effects.

AB.4.4 Links outside the conserved area

A number of the more mobile species of fauna, particularly bats and birds, have ranges which include the Wet Tropics WHA but are not limited to this area. These species may be threatened due to problems in those parts of their ranges outside the Wet Tropics WHA. The services provided by the mobile species in linking forested areas of the Wet Tropics WHA with outside areas, such as seed and pollen dispersal, may be important to the viability of parts of the Wet Tropics WHA. Other species have populations located outside the Wet Tropics WHA that may be important to their survival as a species in the region as a whole (for example, Cassowaries). Conservation of the Wet Tropics WHA will need to take account of these links to maximise the conservation of biodiversity.

APPENDIX C

THE DRAFT WET TROPICS PLAN

AC.1. FEATURES OF THE DRAFT WET TROPICS PLAN

The Draft Plan is set out in a document that includes; a description of policies to be implemented in the Plan, a draft Statutory Plan, and maps of the proposed zoning and management guidelines (WTMA 1995b). The basis of the Draft Plan is a zoning scheme which consists of four zones covering the entire Wet Tropics WHA. The proposed locations of the zones are shown on Zoning Maps of the area. The Core Natural Zone covers the largest proportion of the area, 52%. This is land that has been relatively undisturbed and falls within the criteria of being more than 500 metres away from roads etc. and 700 metres from clearings, with a core of at least 150 hectares, and has not been logged in the last 40 years. The Future Core Natural Zone covers 46% of the area and covers all land not included in other zones. The intention for land in this zone is to halt or phase out any disturbing processes and that it be included in the Core Natural Zone in the future when sufficiently recovered from disturbance, either naturally or with rehabilitation as resources allow.

The Natural Zone includes areas between 50 and 250 metres either side of roads, powerlines, pipelines, dams and cableways. Cleared areas are included in this zone but are not buffered. Although covering only 2% of the area, the Natural Zone is distributed throughout the area along the network of roads. The Visitor Facility Zone includes current and potential nodes of visitor facilities. The nodes are unevenly distributed through the area and together cover less than 1% of the area. The management intentions for these zones taken together are to focus existing and future uses into the small area of the Visitor Facility and Natural Zones while protecting and restoring the majority of the area in its natural state.

There are two overlays to the zones depicted on the Zoning Maps. These are Priority Vulnerable areas and Existing Use Rights. The Priority Vulnerable areas are inhabited by vulnerable plants, animals or communities. In these areas, management activities and consideration of permit applications must take account of Flora and Fauna Management Guidelines (see below). Existing Use Rights are recognised in the other overlay to the Zoning Maps. These include grazing and mining leases and freehold land. Where existing use rights 'are inconsistent with World Heritage management, the intention is to reduce or remove them (or the impact of the actual uses) as opportunities arise over time' (WTMA 1995b).

Three sets of Management Guidelines are presented with maps showing the proposed locations of their operations. The Flora and Fauna Management Guidelines identify the location of eight categories of species, communities and habitats and specify appropriate management actions for each category. This information is directly linked to the Zoning Maps in that categories 1 to 5 together make up the area indicated by the Priority Vulnerable overlay. Scenic Management Guidelines classify the area into four priority classes for restrictions on scenic alterations. Even the 'Low Priority' class limits any scenic alterations to those that will not be visually dominant in three years. There is no direct link between these guidelines and the Zoning Maps.

The Visitor Management Guidelines consist of a map showing the proposed distribution of four Visitor Opportunity Classes. A table in the text of the Draft Plan describes each of the Visitor Opportunity Classes in some detail. The four classes are; Visitor Facility Node, Recreation, Semi-remote and Wilderness. These classes do not coincide exactly with the four zones. The Wilderness class is by far the most extensive and extends over areas zoned Core Natural and Future Core Natural. The criteria for Wilderness is that it is 3 km from settlements and motorised access routes. At the scale of the Zoning Maps, the Visitor Facility Node locations correspond exactly to the Visitor Facility Zone locations on the Zoning Maps. The Recreation class approximately coincides with the Natural Zone, but extends 0.5 km from access routes. The Semi-remote class forms a buffer zone between the Recreation class and the Wilderness class.

Other proposed guidelines and policies are presented in the Draft Plan, but not in map form.

AC.2 Directions for management of tourism and recreation proposed in the Draft Plan

The release of the Draft Wet Tropics Plan provides information on the proposed directions for management of visitor use of the Wet Tropics WHA. The four zones proposed have been described above. The Visitor Management Guidelines which implement a Recreational Opportunity Spectrum and proposed locations of opportunity classes overlie the zoning scheme to give direction on the location and types of visitor activities and facilities allowed. 'The zoning scheme allows a permit to be issued for development of visitor infrastructure in all zones consistent with Visitor Management Guidelines and visitor opportunity classes' (WTMA 1995b, p.89).

The opportunity classes are described in Table AC.1, taken from the Draft Plan. The locations proposed for these four classes do not exactly match the four zones of the Draft Plan. Significantly, the Wilderness class covers the largest area, including all areas more than 3 km from settlements and roads. The Visitor facility node class is only located over areas that have been designated as Visitor facility zone.

Employment of the Recreation Opportunity Spectrum (ROS) approach follows developments in recreation planning and management in the United States, Canada and other parts of Australia (see Chapter 2). The details of the actual classes proposed have been developed for the Wet Tropics WHA following reports from consultants, discussions with local and overseas experts on the technique[1] and input from land managers and WTMA planning staff.

The Visitor Management Guidelines shown on a map in the Draft Plan define the proposed extent of each visitor opportunity class. The locations adopted in the Wet Tropics Plan may be changed over the seven year life of the Plan by amending the Plan. The locations can be specified in greater detail or amended by the production of Area Plans for parts of the Wet Tropics WHA. As the Area Plans are intended to be developed for the most heavily used areas, it is likely that more detail on the extent of the Visitor facility node class will be included in these plans. It will be possible to add further Visitor facility nodes through Area Plans or amendments to the Wet Tropics Plan. Thus the means exist for expansion of intensive settings beyond the 1% of the Wet Tropics WHA proposed in the Draft Plan.

The Visitor facility node class allows the most intensive setting in terms of visitor numbers, visitor facilities and site hardening. There is a distinction made in the Draft Plan between visitor facility nodes which may feature visitor centres, large carparks, vehicle based campsites, day use facilities with toilets and picnic facilities etc., and visitor sites which may include roadside lookouts, carparks for up to six cars and short walking tracks.

The Visitor facility node is the only class where built accommodation facilities are considered appropriate. The Draft Plan does not prohibit the construction of built accommodation in the

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[1] In particular, the Dr George Stankey and Dr Roger Clark of the United States Forest Service, who were influential in developing the ROS concept visited the Wet Tropics WHA and consulted with WTMA planning staff (WTMA 1992b).

Wet Tropics WHA. It does state that 'preference will be given to developing visitor infrastructure on land neighbouring the area' (WTMA 1995b, p. 112). In the Draft Plan it is claimed that infrastructure to support current and future demands for accommodation is available in surrounding populations centres. The Draft Plan acknowledges that specialist rainforest oriented accommodation may be proposed on private land within the Wet Tropics WHA. Any proposals for building accommodation would require a permit from the WTMA and be subject to environmental impact assessment.

Construction of any other visitor infrastructure such as camping facilities and walking tracks will require a permit from the WTMA in all zones. An exception is made for construction by DoE, but land managers will be required to conduct an assessment of likely impacts of any facilities they propose.

Commercial tour operators will continue to require a permit from either DoE or DNR for operation in all zones. The appropriateness of any commercial tour will be assessed on an individual basis for consistency with the Wet Tropics Plan, visitor Management guidelines, the Wet Tropics Ecotourism Strategy, Area Plans and any other relevant information or issues. The possibility of awarding tour operators exclusive access to sites is put forward in the Draft Plan. This is proposed for 'particularly sensitive sites' where supervision of visitors is required.

The provision of visitor facilities of certain types are also proposed to be consistent with overall strategies. Strategies are being developed for walking tracks, wild and scenic rivers and roads. The development thus far of these strategies is described in the Draft Plan. Other strategies may be developed in the future, for example on presentation of Aboriginal and non-Aboriginal cultural values.

Agreed standards and procedures for construction and maintenance of tourism and recreation infrastructure will be developed with the land managers and the Queensland Department of Transport.

Table AC.1 Visitor Opportunity Classes in the Draft Wet Tropics Plan

Criteria	Visitor facility node	Recreation	Semi-remote	Wilderness
Description (Physical character and potential recreation experience)	Developed visitor facilities, accessible by conventional vehicle, for presenting the Area to large numbers of people and which serve as a hub for associated opportunities radiating for the node. Opportunities exist for nature appreciation and intensive social interaction.	Natural areas providing vehicle-based recreation opportunities to appreciate nature and interact with other users.	Predominantly natural areas providing recreation opportunities for challenge, self reliance and nature appreciation away from motorised vehicle use and large numbers of other visitors.	Pristine natural areas remote from disturbances associated with modern technological society. Opportunities for solitude and self reliance in an environment that offers a high degree of challenge.
Access (Remoteness from settlement and major access routes, access standards and type of transport used)	Will include substantial visitor facilities on major access corridors with conventional vehicle access along well maintained roads.	Will usually include or be within 0.5 km of major access routes. Most access is via four wheel drive or conventional vehicles along maintained and signposted roads subject to possible seasonal closure.	At least 0.5 km from settlement and motorised access routes. While motorised access is generally not allowed, some roads may remain open for essential management activity or access for existing use right holders. Public access by walking tracks.	At least 3 km from settlement and motorised access routes. Walk in access only with no motorised use.
Site Modification (Extent, type and design of infrastructure, facilities, amenities and the style of accommodation provided)	Components of natural environment modified to enhance specific visitor opportunities and reduce impacts. Accommodation facilities, toilets, information centres, picnic and day-use sites, camping areas, major lookouts and walking tracks may be present.	Predominantly natural areas with some modification evident at specific sites. Vehicle tracks and graded walking tracks, trails and routes may exist together with low-key camp sites. Toilets are appropriate.	Pristine area with minor modifications of some sites may occur but only for essential management or visitor safety. Walking tracks, trails and routes may exist together with undeveloped low-key camp sites. Toilets may be provided at sensitive locations.	Pristine area with no facilities or site modification except where absolutely necessary for essential management or visitor safety. There will be low-key and integrated into the surrounding landscape.

Criteria	Visitor facility node	Recreation	Semi-remote	Wilderness
Social Interaction (Density of users, degree of social interaction and opportunities for solitude)	Large numbers and groups of users on-site and in nearby areas with continuous human occupation (in accommodation) and interaction between users.	Frequent encounters with other user groups can be expected especially along access routes (roads, rivers or walking tracks) and at camp sites or day-use sites. Groups of more than 10 to 20 people can be expected.	There would be little interaction between users with usually less than about four to six other groups encountered during a day and no more than about tow other groups within sight or sound at camp sites. Maximum group size of about 10 or 20 people.	Interaction between users would be minimal with usually less than two other groups encountered during a day and no other groups within sight or sound at camp sites. Maximum group size of about six to eight people.
Degree of Self-reliance (Level of support services required)	A low degree of self reliance is required as a high level of support services and facilities may be provided.	Some support services and facilities may be provided. There may be a perception of self reliance for novice users.	Visitors must be almost totally self reliant as very few support services would be appropriate.	Visitors must be totally self reliant as support services would be inappropriate and not provided.
Style of Visitor Management (Level and type of on-site management including site constraints and regulations)	A very high degree of site management activity may be evident, including the use of physical barriers to constrain pedestrian and vehicular movement. Bookings may be necessary for accommodation or activities and length of visit may be controlled.	Moderate level of on-site management activity, including signs and management patrols to establish appropriate visitor expectations and behaviour.	Minimal on-site management which may include management patrols and occasional signs. Emphasis on off-site interpretation.	Very little on-site management. Focus would be on establishing expectations and standards for behaviour by off-site measures such as pre-visit brochures. Permit systems may be used.

Source: WTMA 1995b, p. 93.

APPENDIX D

FUNDING MANAGEMENT OF THE WET TROPICS WHA

In this Appendix, the recent history of funding for management of the Wet Tropics WHA is described, in order to place funding for management of tourism and recreation into context. The potential for funding in the future is also investigated.

The Appendix commences, in section AD.1 with information on funding for the entire Wet Tropics WHA by the Commonwealth and Queensland Governments. Expenditure on management of tourism and recreation in the Wet Tropics WHA is not reported separately in published sources. An exercise which was undertaken to estimate expenditure on the components of management activities by the WTMA, QDEH (now DoE) and QDPI-FS (now DNR)[1] is described in section AD.2. Possible directions for future funding are discussed in Section AD.3.

AD.1 RECENT HISTORY OF FUNDING FOR MANAGEMENT OF THE WET TROPICS WHA

Between the time of the listing of the Wet Tropics WHA and the establishment of co-operation between the Commonwealth and Queensland Governments in 1990, the Queensland Government continued to fund its various agencies with management responsibilities in the Wet Tropics WHA. As noted in Chapter 4, the staffing levels in National Parks were low and facilities were not adequate to meet demands of increased visitor use.

At the same time, the Commonwealth Government was administering a structural adjustment package for the region that was designed to provide compensation for businesses and alternative employment for individuals who had been displaced due to cessation of logging. The package approved by Federal Cabinet was for $75m (million), initially proposed to be implemented over three years. Some of these funds went to enhance tourism attractions in the course of Local Authority employment schemes. Included in the structural adjustment package was $10m earmarked for providing employment of rangers and enhanced visitor facilities in National Parks and State Forest recreation areas. This was not spent in the period 1988 to 1990 due to lack of co-operation from the Queensland (National Party) Government. An amount of $10m was later made available by the Commonwealth Government to fund Capital Works as part of the Management Scheme agreed in 1990.

The structural adjustment package for the North Queensland region operated until the 1994-95 financial year. The total expenditure, excluding capital works in the Wet Tropics WHA, was $48m (DEST 1995).

A Management Scheme for the Wet Tropics WHA was agreed between the Commonwealth (Labor) Government and the Queensland (Labor) Government on 16 November 1990. Included were the first joint funding arrangements for the Wet Tropics WHA outlined in the following quote:

> The Commonwealth shall provide $10m over three years for capital works and associated programs in support of Wet Tropics of Queensland management. Those funds will be disbursed by the Management Agency in accordance with programs approved by the Ministerial Council.

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[1] Department names relevant to the time of the funding/expenditure are used.

> The Commonwealth and Queensland Governments will provide ongoing funding for the Wet Tropics management on a matching basis from the first year of operation at a level which fully meets requirements for implementing the primary management goal.
>
> Both Governments will make annual appropriations to provide ongoing funds at the agreed level. Funds will be appropriated to the Management Agency in accordance with programs approved by the Ministerial Council (DEH 1992, p. 8).

On 29 May 1992, the Commonwealth and Queensland Governments agreed that the Commonwealth Government would contribute $4m per annum for four years commencing in 1990-91 for ongoing management, subject to Queensland matching the Commonwealth contribution on a dollar-for-dollar basis.

The Queensland contribution has been in the form of $2.5m in cash and nominally $1.5m in-kind. The Queensland Government's reports of actual in-kind contributions have always exceeded $1.5m, ranging from $2.7 to $3.8m up to 1994-95.

There is some continuing disagreement between the Commonwealth and Queensland Governments over interpretation of the Queensland Government's matching contribution for ongoing management. The Queensland Government's in-kind contribution is based on the operations of QDEH and QDPI-FS in the region. The Queensland Government's methodology for calculating in-kind contributions by QDEH is (excluding any Commonwealth grants):

- All expenditure on National Parks staff in the Wet Tropics WHA - Park Rangers, District Rangers, District Managers;
- Regional scientific and resource staff and associated expenditure to the extent of their work in the Wet Tropics WHA;
- Costs of projects undertaken in the Wet Tropics WHA including Jobskills and Youth Conservation Corps; and
- Labour and non-labour costs of providing human resources management, financial administration, information technology and workplace health and safety to staff engaged in Wet Tropics WHA management.

Using this formula, and a similar approach by the QDPI-FS, the Queensland Government in-kind contribution consistently has been greater than $1.5m per year.

The Commonwealth Government wants Queensland to include only expenditure required to bring management of National Parks and State Forests up to World Heritage Area standard, that is not including what would have been spent on management if the area was not a WHA, (presumably based on budgets before 1990-91).

For administration of the $10m capital works budget, capital works were defined as works that result in a new or improved asset and do not include maintenance. Included in the definition were; improved assets, land acquisition, construction and acquisition of buildings and structures, construction and upgrading of interpretive centres and visitor facilities and upgrading of roads. In practice, some works involved upgrading existing assets and it is difficult to differentiate between 'improvement' and 'maintenance' in these cases.

The initial funding agreement was current for the financial years 1990-91,1991-92,1992-93 and 1993-94. As of October 1996, no new forward agreement between the Commonwealth and Queensland Governments has been reached. Funding arrangements for the years 1994-95, 1995-96 and 1996-97 have been made via an exchange of letters each year.

In the 1994-95 financial year, the Commonwealth Government budgeted \$4m for ongoing management, to be matched on a dollar for dollar basis by Queensland (\$2.5m in cash and \$1.5m in kind), and \$2.195m for capital works (plus approval to spend \$828 700 remaining from the Commonwealth's contribution for capital works 1993-94).

The Commonwealth Government budgeted \$4.06m for recurrent funding in 1995-96, with the Queensland Government budgeting \$4m for recurrent funding, as in the previous year. In 1996-96, the Commonwealth cut the capital budget to zero while Queensland provided capital funding for the first time at \$285 000.

The budget for 1996-97 represents further cuts in funding for management. The Commonwealth has budgeted \$2.825m for recurrent expenditure and again provided zero capital funding. The Queensland government has undertaken to match the Commonwealth's contribution with \$1.471m in cash and nominally providing the remaining \$1.353m in kind. While the Commonwealth allowed unspent funds (\$480 430) to be carried over from 1995-96, for the first time, not all the Queensland cash appropriation remaining at the end of the previous financial year has been carried over, with \$20 451 being carried over from \$220 451 unspent.

A new agreement for general funding for the Wet Tropics WHA is currently being negotiated for the 1997-98 financial year and two years beyond.

Funding for the Daintree Rescue Package is subject to a separate agreement and this was made available from 1994-95. The Commonwealth government announced funding of the Daintree Rescue Package in the budget of May 1994. The Queensland Government subsequently announced matching funding. The total amount of the package is \$23.16m initially spread over the three financial years 1994-95 to 1996-97. In the 1996-97 Commonwealth budget it was announced that the remaining \$3m of the Commonwealth contribution would be spread over a longer period of time, with \$1.6m budgeted in 1996-97 (plus a carry over of \$2.8m).

Annual budgets which detail how funds are proposed to be spent are approved by Ministerial Council. This is now a requirement of the *Wet Tropics World Heritage Protection and Management Act 1993*. Table AD.1 shows the proposed budgets for management of the Wet Tropics WHA at the beginning of the financial years for the years 1990-91 to 1996-97, and Table AD.2 shows the budgets for the Daintree Rescue Package.

The forward budgets have been augmented by the often large amounts of funding carried forward from the previous year. The pattern of funding earmarked sums, first the \$10m of capital works and then \$23m for the Daintree Rescue Program has contributed to this budget pattern. The projects have taken some time to get up and running and the ability to carry funds forward has been important to successful implementation of the programs.

With regard to general funding of the Wet Tropics WHA (excluding the Daintree Rescue Package), new allocation of funds peaked in 1993-94 at around \$11.5m. This has dropped to \$5.6m in 1996-97. The capital works contribution from the Commonwealth Government has been zero since 1995-96.

Table AD.1: Budgeted Expenditure on Management of Wet Tropics WHA 1990-91 to 1996-97

	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97
New capital C'wealth	0	2 000 000	4 500 000	2 605 000	2 195 000	0	0
Qld	0	0	0	0	0	285 000	0
New recurrent C'wealth	4 000 000	4 000 000	3 000 000	5 000 000	4 000 000	4 060 000	2 825 000
Qld Cash	2 360 000	2 454 000	2 454 000	2 427 128	2 528 906	2 594 622	1 471 487
Qld In-kind	1 500 000	1 500 000	1 500 000	1 500 000	1 500 000	1 500 000	1 353 513
Total new funds	7 860 000	9 954 000	11 454 000	11 532 128	10 223 906	8 439 622	5 650 000
Carried forward	0	4 409 023	4 502 984	4 991 340	1 695 427	1 974 844	500 881
Total WTWHA	7 860 000	14 363 023	15 956 984	16 523 468	11 919 333	10 414 466	6 150 881

Source: Wet Tropics Management Authority unpublished, WTMA 1994, WTMA 1995a

Table AD.2: Budgeted Expenditure on the Daintree Rescue Package 1990-91 to 1996-97

	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97
Daintree RP C'wealth	0	0	0	0	4 068 000	4 000 000	1 584 000
Daintree RP Qld	0	0	0	0	2 000 000	2 068 000	4 428 000
DRP Carried fwd	0	0	0	0	0	4 902 746	2 801 000
Total DRP	7 860 000	14 363 023	15 956 984	16 523 468	17 987 333	21 385 230	8 813 000

Source: Wet Tropics Management Authority unpublished, WTMA 1994, WTMA 1995a

The actual expenditure on management of the Wet Tropics WHA over the years 1990-91 to 1994-95 is shown in Table AD.3. The increasing annual expenditure to 1993-94 was partly due to the staggering of capital works and partly due to increases in recurrent expenditure allowed by carrying forward unexpended funds from previous years.

In 1990-91, the capital works program had not commenced and actual recurrent expenditure was substantially less than budgeted, but the unexpended funds were able to be carried forward and used in subsequent years. The practice of carrying forward unspent funds has continued. The original $10m three year capital works program commenced in 1991-92. To the end of 1993-94, a total of $8.276m had been spent on capital works. The remainder of the $10m was carried forward into 1994-95.

The table shows that the actual in-kind contribution by the Queensland government has always been higher than the amount nominated in the forward budgets. This amount is the total expenditure on management of the Wet Tropics WHA by Queensland land management agencies, and is the relevant figure for the exercise undertaken in the next section to estimate expenditure on tourism and recreation management.

The expenditure excluding capital works is shown in the second last row of Table AD.3. This indicates the amount spent in the running of the Wet Tropics WHA, without construction of new infrastructure. Recurrent expenditure peaked in 1993-94.

Expenditure on the Daintree Rescue Package in the first year of operation, 1994-95, is shown in Table AD.4. The slow start to this program is reflected in these expenditure figures.

Table AD.3: Actual Expenditure on Management of Wet Tropics WHA 1990-91 to 1994-95

	1990-91	1991-92	1992-93	1993-94	1994-95
Capital C'wealth	0	1 854 052	2 867 190	3 555 058	2 156 783
Recurrent C'wealth	1 000 053	4 280 196	4 741 886	5 566 652	3 796 439
Qld Cash	950 924	2 225 791	1 856 568	4 206 331	2 491 267
Qld In-kind	2 726 786	3 690 692	3 802 683	3 039 956	3 627 892
Total Recurrent	4 677 763	10 196 679	10 401 137	12 812 939	9 915 598
Total WTWHA	4 677 763	12 050 731	13 268 327	16 367 997	12 072 381

Source: Wet Tropics Management Authority unpublished, WTMA 1994, WTMA 1995a

Table AD.4: Actual Expenditure on Daintree Rescue Package 1994-95

	1990-91	1991-92	1992-93	1993-94	1994-95
DRP C'wealth	0	0	0	0	305 234
DRP Qld	0	0	0	0	860 020
Total DRP	0	0	0	0	1 165 254

Source: Wet Tropics Management Authority unpublished, WTMA 1994, WTMA 1995a

In comparing budgeted amounts for management of the Wet Tropics WHA with actual expenditure over the years, the pattern of relatively high amounts carried forward has masked the effects of recent reductions in funding. However, for 1996-97, the budgeted funds are only 50% of the actual expenditure in the previous year. Although there is considerable funding provided for the Daintree Rescue Package, these funds are not available for management of the Wet Tropics WHA.

Revenue raised

Revenue raised in the Wet Tropics WHA consists of fees paid to land managers by commercial tour operators, camping fees, fees paid by rafting operators for water releases and lease fees.

In 1993, estimates were collected from QDEH and QDPI-FS on revenue raised from camping fees and the charge on passengers on commercial tours. The total was $300 000 (Driml & Common 1995). Attempts by the author to gather information on revenue raised in subsequent years have not been successful. As part of its current Inquiry into Management of World Heritage Areas, the House of Representatives Standing Committee on the Environment, Recreation and the Arts (HORSCERA) asked the Queensland Government to supply information on funds raised from World Heritage Areas in the past three years. The reply given was that it was not possible to answer that question because it was not possible in cases to separate revenue raised from World Heritage Areas from general receipts from National Parks (Goss 1995).

AD.2 FUNDING OF MANAGEMENT OF TOURISM IN THE WET TROPICS WHA

In this section, an exercise undertaken to estimate expenditure on the components of management activities which can be attributed to the need to manage visitors and sites visited in the Wet Tropics WHA, is described. This required examination of the records of expenditure often to individual project level. The methodology and results of the exercise follow[2].

Expenditure on the management of tourism and recreation in the Wet Tropics WHA is incurred by QDPI-FS (DNR) and QDEH (DoE) as part of their field management activities and by these agencies plus the WTMA in terms of providing capital works, infrastructure maintenance, interpretation and education, management planning, and research. None of the agencies report separately on the full range of expenditure that can be attributed to managing and enhancing the Wet Tropics WHA for people visiting for tourism and recreation. The exercise reported here was aimed at extracting as fairly as possible, the expenditure that could be attributed to tourism and recreation management. The term 'Visitor Management' was adopted to describe the new category of expenditure developed here.

The exercise was based as far as possible on the accounts of the WTMA, QDPI-FS and QDEH reporting to Ministerial Council on expenditure incurred in managing the Wet Tropics WHA. Because of the funding arrangements for the Wet Tropics WHA, a high degree of accountability is required and has been practised. Information from the accounts was complimented by discussion with officers of the agencies and a certain amount of personal observation of the activities of the various agencies. In a number of cases, the data are insufficient to give a precise measure of expenditure on Visitor Management. In these cases, estimates were made. These estimates are the author's own and are not necessarily endorsed by the management agencies.

There are three categories of funding for managing the Wet Tropics WHA. These are (i) capital works, (ii) recurrent expenditure by the WTMA, QDPI-FS and QDEH funded by the Commonwealth and Queensland cash contributions, and (iii) in-kind contributions by the QDPI-FS and QDEH. The in-kind contributions include labour and non-labour costs that are funded directly by the Queensland Government.

The WTMA report on all three categories of expenditure on an annual basis and these accounts give a full picture of the expenditure on Wet Tropics WHA management by the three agencies. All of the data reported below arise from these reports and more detailed information from the files of the WTMA.

The WTMA reported expenditure from 1990-91 to 1993-94 by four program areas. In 1994-95, an additional program area, the Daintree Rescue Package, was added. The program areas are:

Heritage Conservation includes all field and research work aimed at protection of the natural and cultural heritage of the area. It includes land acquisition, species management programs, and management of threats to World Heritage values. The construction and maintenance of buildings and facilities in National Parks, excluding visitor facilities, is included in the Heritage Conservation program. The work of field staff is considered to be allocated between Heritage Conservation and Community Relations. As a general rule, expenditure included in Heritage Conservation is not expenditure on Visitor Management.

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[2] Unless otherwise referenced, the information in this section was derived from the files of the WTMA. I am indebted to the WTMA for allowing access to the files.

Management Planning includes the research and staff time that goes into developing Area Management Plans and the Wet Tropics Plan. Expenditure in this area is not capital intensive. Although this expenditure is not identified in the WTMA's accounts as contributing to Visitor Management, there is a direct relationship between management planning and overall management of tourism activities and impacts.

Community Relations is the program area in which the bulk of expenditure on Visitor Management is allocated, but not all expenditure in this program area is on Visitor Management. Also included in this program area is contact with the resident communities adjacent to the Wet Tropics WHA, and contact further afield via publications etc. All capital works on visitor facilities and visitor centres and recurrent expenditure on maintenance of these facilities are included in Community Relations. As mentioned above, management staff in the field divide their time between activities that include Visitor Management and an estimate of this proportion of their time is allocated to this program area.

Corporate Support includes administrative expenses of the WTMA, QDPI-FS and QDEH that support the activities of the other program areas. Some administrative expenses that are directly related to the work of the other three program areas, principally the salaries of staff of the WTMA, are included under those program areas.

Daintree Rescue Package is a program funded by a three year funding package directed at the area north of the Daintree River. The funding is contributed by the Commonwealth and Queensland Governments. The funding is treated as a Capital contribution in the WTMA's accounts, although expenditure is on salaries and administration costs to run the program, land acquisition, costs of assistance to land holders to take conservation measures on their land, and the provision of tourism infrastructure. All the costs of running the Daintree Rescue Package are reported under this program area.

The exercise undertaken here to identify expenditure on Visitor Management involved examining the accounts for each year from 1990-91 to 1994-95. The first step of the exercise was to list expenditure for each year according to the three categories of capital, recurrent and in-kind, by the four or five program areas. All the totals reported here are the totals reported to Ministerial Council.

The next step was to allocate expenditure to Visitor Management, as far as possible using the most detailed accounts available in order to identify individual projects directly related to Visitor Management[3]. In addition, some conventions were adopted to allocate expenditure in some of the program areas to Visitor Management. The conventions were as follows:

- Generally expenditure on Heritage Conservation was not considered to be expenditure on Visitor Management, unless accounts identify specific projects directly related to Visitor Management;
- Generally 50% of all expenditure on Management Planning was allocated to Visitor Management. This is based on an understanding that the need for planning arises from the competing demands upon the resources of the Wet Tropics WHA, including from the major direct uses of tourism and recreation;
- Community Relations was the category in which most expenditure on Visitor Management was classified, but not all expenditure in Community Relations is on Visitor Management.
- A proportion of all expenditure on Corporate Support was allocated to Visitor Management. The proportion was based on the total of expenditure on Visitor

[3] There are some discrepancies arising from using different documents in this exercise. Internal documents that list expenditure in detail by project do not fully tally with the reports to Ministerial Council of total expenditure in some cases. The differences are in any case are small, less than 10% of the program area budgets. A very few adjustments were made so that the totals for projects identified as Visitor Management and non Visitor Management added up to the totals reported to Ministerial Council.

Management identified for the other three program areas (excluding the Daintree Rescue Package) divided by the total expenditure in the other three program areas. This convention was applied to recurrent and in-kind expenditure but not to capital works; and

- Expenditure on visitor facility infrastructure as part of the Daintree Rescue Package was allocated to Visitor Management.

Having established those conventions, the accounts for capital works, recurrent cash and in-kind expenditure were examined separately in order to decide on the allocation to Visitor Management. Each set of accounts differed in terms of the detail available and slightly different approaches had to be taken with each.

Capital Works

The details of projects included under the capital works program were obtained from an internal WTMA table that split up capital works by program area. The only projects identified under Management Planning were the purchase of hardware for tourism research and these were allocated 100% to Visitor Management. None of the projects listed as Heritage Conservation were allocated to Visitor Management (although it could be argued that works on National Parks management infrastructure could have some Visitor Management component). Expenditure listed under Community Relations on construction and upgrade of visitor facilities, visitor centres and access road upgrades was allocated 100% to Visitor Management. Expenditure on visitor facilities under the Daintree Rescue Package was allocated 100% to capital works.

Recurrent Cash

The accounts of recurrent cash expenditure kept by the WTMA detail expenditure on a project basis, according to the four program areas. There were no projects listed under Heritage Conservation that could be considered to be Visitor Management. For Management Planning, there was sufficient detail available in the accounts of recurrent cash expenditure to identify some research projects directly relating to Visitor Management. In addition there was sufficient information to isolate expenditure on preparation of the Wet Tropics Plan and Management Plans and allocate 50% of this to Visitor Management. Some administration expenses were listed under Management Planning. A proportion of these, equal to the proportion that tourism expenditure was of total non-administration expenditure in Management Planning, was allocated to Visitor Management. No recurrent expenditure under the Daintree Rescue Package was allocated to Visitor Management, although this may underestimate the cost of organising the construction of visitor facilities.

In the Community Relations program area, all projects on maintenance of visitor facilities and presentation within the Wet Tropics WHA were allocated 100% to Visitor Management. In addition, the administration expenses reported in this program area were allocated as described above for Management Planning.

There were some projects listed under Corporate Support that involved project management for visitor facility development. These expenses were allocated 100% to Visitor Management. The remaining Corporate Support expenditure was apportioned between Visitor Management and non-tourism expenditure. This was done by calculating the proportion that tourism expenditure in the other three program areas was of all expenditure in the other three program areas and applying this proportion to the remaining Corporate Support expenditure.

In 1990-91, the WTMA had not fully adopted the present four program areas for reporting expenditure. Expenditure of the Commonwealth and Queensland recurrent cash contribution was reported at the end of the 1990-91 financial year in seven categories: 'communications', 'planning', 'resource protection and rehabilitation', 'visitor facilities', 'field management', 'rainforest acquisition' and 'corporate support'. For the purposes of this exercise, these categories were collapsed into the current four program areas. All expenditure on 'visitor facilities' and 50% of the expenditure on 'field management' was allocated to Community Relations and classified as having been spent on Visitor Management.

In-kind Contribution

In-kind expenditure was reported quarterly to the WTMA by the QDPI-FS and the QDEH. Although the Management Agreement for the period 1990-91 to 1993-94 specified that $1.5 million should be contributed in-kind, the amount contributed has always proved to be more. The QDPI-FS and QDEH adopted different systems for reporting expenditure. Information was available for expenditure by the QDPI-FS classified both according to that Department's internal reporting system and converted to the four program areas used by the WTMA. The QDEH reported to the WTMA using the WTMA's four program areas, but in addition broke expenditure up between labour and non-labour components.

The first step in analysing in-kind expenditure was in checking reporting of the expenditure by the WTMA's four program areas and the second step was to allocate the appropriate amount to Visitor Management. It was found that the reporting of expenditure by the four program areas followed the conventions used by the WTMA, with one exception. In 1993-94, the QDPI-FS classified expenditure labelled as 'Recreation Management' to Heritage Conservation rather than Community Relations. For the purposes of this exercise, the amount reported was re-allocated to Community Relations.

Allocation to Visitor Management was based as far as possible on details contained in the accounts. Details were not available for the years 1990-91 and 1991-92 and so allocation for these years was based on the proportions evident in the accounts for later years. The QDPI-FS reported using seven categories of expenditure, which gave sufficient detail to allow classification to Visitor Management. Importantly, The QDPI-FS had a classification for Recreation Management and this was allocated 100% to Visitor Management. The conventions of allocation 50% of expenditure on Management Planning and a proportion of Corporate Support to Visitor Management were adopted for allocation of the remainder of QDPI-FS expenditure.

The QDEH provided very detailed reports but unfortunately expenditure on Visitor Management was not so readily identified. Expenditure on non-labour items was identified on a project and location basis. All projects involving construction and maintenance of visitor facilities and public contact at National Park sites were allocated 100% to Visitor Management. A number of schemes undertaken for youth employment involved rehabilitation in National Parks for conservation and presentation purposes. The QDEH allocated this expenditure 50 % to Heritage Conservation and 50% to Community Relations. The Community Relations component was allocated 100% to Visitor Management for this exercise. For 1992-93 and 1993-94, the component of Community Relations identified as Visitor Management expenditure was 90% and 82% respectively. A proportion of 85% was applied to the Community Relations totals for 1990-91 and 1991-92 in the absence of detailed data.

QDEH Wet Tropics WHA Labour expenditure was reported by location and by individual officer, broken down by the four program areas. The reports reflected the amount of each officers' duties that related to management of the Wet Tropics WHA, and the amount dedicated to activities in each of the four program areas. There was no further information contained in the accounts on which to base allocation into Visitor Management and other duties. The conventions adopted for Management Planning and Corporate Support were applied to allocate expenditure to Visitor Management. In addition, 85% of expenditure on Community Relations was allocated to Visitor Management.

The results of the exercise are listed in Tables AD.5 to AD.9, and summarised for all years in Table AD.10.

Table AD.5: Total expenditure on Visitor Management in the Wet Tropics WHA, 1990-91

	Corporate Support	Heritage Conservation	Management Planning	Community Relations	Total
Recurrent cash Visitor man.	33 785	0	8 753	740 382	782 920
Recurrent in-kind Visitor man.	454 479	0	11 369	458 829	924 677
Capital Visitor man.	0	0	0	0	0
Total Visitor man.	488 264	0	20 122	1 199 211	1 707 597
Total Expenditure WTWHA	1 906 858	1 236 035	105 624	1 429 245	4 677 762
Visitor man. % of WTWHA	26%	0%	19%	84%	37%

Table AD.6: Total expenditure on Visitor Management in the Wet Tropics WHA, 1991-92:

	Corporate Support	Heritage Conservation	Management Planning	Community Relations	Total
Recurrent cash Visitor man.	1 391 956	0	287 157	1 659 163	3 338 276
Recurrent in-kind Visitor man.	191 419	0	60 877	1 657 356	1 909 652
Capital Visitor man.	0	0	0	959 244	959 244
Total Visitor man.	1 583 375	0	348 034	4 275 763	6 207 172
Total Expenditure WTWHA	3 060 825	3 036 647	737 036	5 216 223	12 050 731
Visitor man. % of WTWHA	52%	0%	47%	82%	52%

Table AD.7: Total expenditure on Visitor Management in the Wet Tropics WHA, 1992-93

	Corporate Support	Heritage Conservation	Management Planning	Community Relations	Total
Recurrent cash Visitor man.	512 032	0	434 141	890 277	1 836 450
Recurrent in-kind Visitor man.	222 918	0	62 025	1 308 990	1 593 933
Capital Visitor man.	0	0	0	997 790	997 790
Total Visitor man.	734 950	0	496 166	3 197 057	4 428 173
Total Expenditure WTWHA	2 615 647	5 157 865	1 010 373	4 484 442	13 268 327
Visitor man. % of WTWHA	28%	0%	49%	71%	33%

Table AD.8: Total expenditure on Visitor Management in the Wet Tropics WHA, 1993-94

	Corporate Support	Heritage Conservation	Management Planning	Community Relations	Total
Recurrent cash Visitor man.	549 961	0	612 877	1 903 675	3 066 513
Recurrent in-kind Visitor man.	129 992	0	84 208	974 589	1 188 789
Capital Visitor man.	0	0	0	1 574 667	1 574 667
Total Visitor man.	679 953	0	697 085	4 452 931	5 829 969
Total Expenditure WTWHA	2 208 689	6 616 920	1 377 868	6 164 520	16 367 997
Visitor man. % of WTWHA	31%	0%	51%	72%	36%

Table AD.9: Total expenditure on Visitor Management in the Wet Tropics WHA 1994-95

	Corporate Support	Heritage Conservation	Management Planning	Community Relations	Daintree Rescue Package	Total
Recurrent cash Visitor man.	417 609	0	292 189	942 051	0	1 651 849
Recurrent in-kind Visitor man.	127 337	0	73 797	607 427	0	808 561
Capital Visitor man.	0	0	0	1 736 303	58 244	1 794 547
Total Visitor man.	544 946	0	365 986	3 285 781	58 244	4 254 957
Total Expenditure WTWHA	2 199 743	5 026 179	740 592	4 105 869	1 165 254	13 237 637
Visitor man. % of WTWHA	25%	0%	50%	80%	5%	32%

Table AD.10: Total expenditure on Visitor Management in the Wet Tropics WHA, 1990-91 to 1994-95

	1990-91	1991-92	1992-93	1993-94	1994-95
Recurrent cash Visitor man.	782 920	3 338 276	1 836 450	3 066 513	1 651 849
Recurrent in-kind Visitor man.	924 677	1 909 652	1 593 933	1 188 789	808 561
Capital Visitor man.	0	959 244	997 790	1 574 667	1 794 547
Total Visitor man.	1 707 597	6 207 172	4 428 173	5 829 969	4 254 957
Total Expenditure WTWHA	4 677 762	12 050 731	13 268 327	16 367 997	13 237 637
Visitor man. % of WTWHA	37%	52%	33%	36%	32%

The total expenditure on Visitor Management from 1990-91 to 1994-95 varied widely from $1.7m to $6.2m. The lowest figure was incurred in the first year of the program and represents establishment activities. Interestingly, the highest expenditure was in the second year, and was not the result of significant capital works. This year saw the highest single year expenditure on maintenance of visitor infrastructure (see Table AD.9), which was reportedly urgently needed. Expenditure on Visitor Management in subsequent years varied between $4.2m and $5.8m.

The proportion of total expenditure on management of the Wet Tropics WHA that was spent on Visitor Management hovered between 32% and 37% for four of the five years, but reached 52% in the exceptional year of 1991-92.

Expenditure on capital works increased in each year to 1994-95. There has been a carry over to 1995-96 of total funds for capital works, some of which will be spent on Visitor Management. The budgets for 1995-96 and 1996-97 contained no new funds for capital works.

There was variation in the expenditure of recurrent cash and in-kind expenditure in all years and no trend emerges. The lowest combined expenditure, apart from the first year, was $2.4m in 1994-95. The funding carried forward to 1995-96 for all Wet Tropics WHA management was a record $6.8m. This raises questions of whether funding provided was actually greater than required for management. However, this proposition is not consistent with the findings of the survey of scientists and managers that funding shortages occur for some elements of management. The issue may be one of distribution of funding.

The Community Relations program area consistently represented the greatest expenditure on Visitor Management. Apart from the first year, Management Planning for tourism was estimated to have cost between $300 000 and $700 000 per year. During this time, the Draft Wet Tropics Plan and management plans were prepared. Publicly stated timetables for planning have not been met. The survey of scientists and managers identified a shortage of planning staff as one source of delay. Other sources of delay were a matter of inter agency coordination and can not be blamed on lack of funding. A major exercise of public participation on the Draft Wet Tropics Plan was being conducted in 1995-96. The costs for this exercise should indicate requirements for future years when Area Plans are subject to public participation.

The Corporate Support program area expenditure attributed to Visitor Management, using the convention adopted for this exercise, varied between $500 000 and $1.5m, excluding the first year. The level of expenditure depended on the expenditure in other program areas.

A total of $10.2m was spent on construction and maintenance of visitor facilities in the Wet Tropics WHA in the period 1990-91 to 1994-95. Of this, $5.1m was spent on capital works identified in Table AD.11[4] and the other $5.1m was spent on infrastructure maintenance. The capital works included road upgrading, construction of visitor facilities and installation of visitor centres. The major road upgrading project was sealing of the road from the Daintree road to Cape Tribulation. An amount of $420 000 was contributed to this project from the WTMA budget. The whole project cost in the order of $6m and has been funded from fees raised on the Daintree Ferry and funds from the Queensland Government. The upgrading of access roads to visitor sites at Wallaman Falls, Lake Barrine and Tully Falls was accomplished in the Wet Tropics WHA capital works program.

Visitor facilities including campsites, lookouts, toilets, tracks and car parks were constructed in at least 28 locations in the Wet Tropics WHA. The most expensive project was development of a camping site and day use area at the Goldsbrough Valley at a cost of over $300 000. Redevelopment of a number of camping and day use sites has been completed. Typical costs for facilities were $50 000 to $60 000 for toilet blocks using composting toilets, $30 000 for car park sealing, and $60 000 to $90 000 for parking and signage at major lookout points. Several board walks are currently planned for Cape Tribulation with budgets of around $200 000 (WTMA 1995).

A program has been undertaken to install visitor centres in and around the Wet Tropics WHA. The 17 sites chosen have been selected to service the greatest number of visitors and so include airports and popular road stops adjacent to the Wet Tropics WHA. The visitor centres range from display panels installed in existing buildings to purpose built information centres. The most ambitious project is a purpose built visitor centre constructed at Ravenshoe. The cost of the centre was $264 900. Smaller installations consisting of several panels have ranged in cost

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4 The remaining part of the $10 million capital works funding was spent mainly on the provision of National Park management infrastructure and land acquisition. It could be argued that some of the National Parks infrastructure indirectly serves Visitor Management by housing field staff who spend some of their time on Visitor Management.

from $20 000 to $30 000. The visitor centre program has represented a significant increase in the interpretative information available to the public.

Expenditure on maintenance of visitor facilities has been spread throughout the visitor sites in the Wet Tropics WHA. Maintenance funds were spent by both the QDEH and QDPI-FS in the northern and southern regions of the Wet Tropics WHA on works such as walking track maintenance, access road maintenance and facility repair.

Table AD.11: Expenditure on construction and maintenance of visitor facilities in the Wet Tropics WHA, 1990-91 to 1994-95

	1990-91	1991-92	1992-93	1993-94	1994-95	Total
Capital works Visitor Facilities	0	756 719	687 763	783 091	526 392	2 753 965
Capital works Road Upgrades	0	0	240 000	394 971	347 670	982 641
Capital works Visitor Centres	0	54 764	336	486 561	862 241	1 403 902
Recurrent cash Infrastructure maintenance	35 375	1 639 176	830 279	1 576 213	771 861	4 852 904
Recurrent cash WH signs	0	14 098	0	157 797	37 206	209 101
Daintree Rescue Package	0	0	0	0	58 244	58 244
Total	35 375	2 464 757	1 758 378	3 398 633	2 603 614	10 260 757

Average expenditure per visitor-day

The information on expenditure on Visitor Management was further analysed to make an estimate of the cost per visitor-day of current Visitor Management. To do this, expenditure was averaged to an annual figure and then divided by the number of visitor-days per year, as follows.

Expenditure on Visitor Management was averaged over the four years 1991-92 to 1994-95. The expenditure in 1990-91 was excluded from the analysis as it does not represent a year of fully operational management. Table AD.12 shows total and average expenditure by funding type.

Table AD.12: Total and average expenditure on Visitor Management 1991-92 to 1994-95, by funding type

	Total for 4 years $	Average per year $
Recurrent cash	9 893 088	2 473 272
Recurrent in-kind	5 500 935	1 375 233
Capital	5 326 248	1 331 562
Total	20 720 271	5 180 067

The estimated number of visitor-days in 1993 was 3 400 000 (see Section 4.2). Because there is some uncertainty about the accuracy of the estimate of number of visitor-days, sensitivity analysis is undertaken using 50% of that number as a lowest estimate. Table AD.13 sets out the average expenditure in the form of recurrent cash and in-kind, and the estimated outlay per visitor day.

Table AD.13: Annual recurrent expenditure, per visitor-day

	Annual $	Per visitor-day 3.4m vd $	Per visitor-day 1.7m vd $
4 year average recurrent cash	2 473 272	0.73	1.45
4 year average recurrent in-kind	1 375 233	0.40	0.80
4 year average total recurrent	3 848 505	1.13	2.26

Estimation of the cost per visitor-day of capital works is more complex. Investment is 'lumpy' in that the large capital works expenditure over the period 1991-92 to 1994-95 was a catch-up over the previous five years or more of growth in visitor numbers and provided facilities which will be viable for some time into the future. The first approach was to use the average investment over the four year period. The assumption behind this approach is that this represents the annual expenditure required in future years also. The other approach taken is to depreciate the total four year investment in capital at an annual rate and take the result as the annual cost of providing new infrastructure. The rate of depreciation is assumed to be a flat rate of 10%. This means that a facility would need to be replaced every 10 years. Table AD.14 shows the result of this exercise, and that the high and low estimates are relatively close. The two approaches taken provide a sensitivity analysis to identify the range within which a reasonable estimate of annual costs of capital works would fall.

Table AD.14: Annual capital works expenditure, per visitor-day

	Annual $	Per visitor-day 3.4m vd $	Per visitor-day 1.7m vd $	Estimate
4 year average	1 331 562	0.39	0.78	high
10% depreciation	532 624	0.16	0.32	low

Combining the estimates in Tables AD.13 and AD.14 provides a high and low estimate of current outlays per visitor-day for Visitor Management, for two estimates of the number of visitor-days, (see Table AD.15). The current cost to the public of Visitor Management undertaken in the Wet Tropics WHA is up to $3.04 per visitor-day. The high estimate based on the 4 year average was used in Chapter 6.

Table AD.15: Current annual average cost of Visitor Management, per visitor-day

	Per visitor-day 3.4m vd $	Per visitor-day 3.4m vd $	Per visitor-day 1.7m vd $	Per visitor-day 1.7m vd $
	Low estimate	High estimate	Low estimate	High estimate
Recurrent	1.13	1.13	2.26	2.26
Capital	0.16	0.39	0.32	0.78
Total	1.29	1.52	2.58	3.04

AD.3 Future funding prospects for the Wet Tropics WHA

The pattern of funding for management of the Wet Tropics WHA has been one of a significant increase in funding over the years 1990-91 to 1994-95 and decreases from 1995-96 (although carry over to that year increased the funds effectively available). The 1996-97 year budget is about half of that available in 1993-94. There has been no allocation for capital works in 1995-96 and 1996-97, although funds for capital works in the area north of the Daintree are available from the Daintree Rescue Package.

To a certain extent, the significant capital works program carried out in the early 1990s has alleviated the pressure that had existed to upgrade facilities and provide new ones. The Commonwealth and Queensland Governments have obviously determined that the works completed are sufficient for the time being.

In 1996, there has been a change of attitude by both the Commonwealth and Queensland Governments to funding management. Not only has there been a decrease in outlays, there has been increasing interest in raising revenue from users, particularly visitors. The view of the previous Commonwealth Government was put in a 1995 submission to the HORSCERA (DEST 1995). In this submission, it was noted that the Commonwealth Government was examining 'user pays' but noted that the Wet Tropics WHA is amongst the areas which are fragmented and have many entry points, making the viability of fees questionable. The current Minister for the Environment has stated a much stronger position in a statement accompanying the 1996-97 budget, that the Government would move towards recovering a greater proportion of the costs of managing World Heritage Areas (Hill 1996). The Commonwealth Government has limited scope to raise revenue itself in the Wet Tropics WHA.

The Queensland Government's attitude to funding is currently difficult to determine. Greater revenue raising was introduced in the Queensland Government's 1996-97 budget, via introduction of entry fees to National Parks. It was proposed that charges would be $3 per day or $10 per month or $20 per year. Revenue raised would be retained by the DoE for use as determined by the Department, and would not necessarily be spent in the Parks in which it was raised (Littleproud 1996). Budget appropriation for the DoE was reduced in 1996-97 in anticipation of revenue generated from the fees (Littleproud 1996). However, in December 1996, the Queensland Cabinet decided to reverse the decision and cancel the entry fee system.

The proportion of funding for management of the Wet Tropics WHA historically spent on management of tourism and recreation, and the adequacy of funding for sustainable tourism are discussed in Chapter 6.

APPENDIX E

SURVEY METHOD AND RESULTS

This Appendix includes in AE.1, a discussion of the process of designing, conducting and analysing the survey conducted for this study. In Section AE.2 comparisons of results with results from other surveys and some of the results not included in Chapter 7 are presented. The questionnaire forms used in the survey are reproducedat the end of this Appendix.

AE.1 CONDUCT OF THE VISITOR SURVEY

AE.1.1 Design of the survey, consulting other data sources

There are a number of sources of information available on visitors to North Queensland and the Wet Tropics WHA, they are listed in Table AE.1. All of these were consulted before a decision was made on whether to conduct a separate survey for this study. .None of the existing data sources individually gives a comprehensive coverage of the population of interest here - that is people who visit the Wet Tropics WHA including tourists to North Queensland - with all the information, including economic information, that is required to answer the questions posed in this study. Thherefore the decision was made to undertake an additional data collecting exercise for this study. The survey undertaken for this study was designed to take advantage of information available in existing data sources.

All the existing information sources are based on surveys, not on censuses, so the results obtained are estimates, albeit estimates considered sufficiently reliable for publication. The approaches and populations surveyed differ and direct comparison of results is difficult.

The *1993 Visitor Use Survey, Wet Tropics WHA* (Manidis Roberts et al 1994), hereafter called the *1993 WTVUS,* covers the most common ground with the survey undertaken in this project. This survey was conducted for the Wet Tropics Management Authority and its aim was to establish the population of visitors to the Wet Tropics WHA and collect information on the use of individual sites within the area, for use in management. This was the first such survey conducted for this area. The difficulty in surveying the large area with multiple entry points was appreciated from the start and the survey design was developed accordingly. The survey was conducted at 58 sites over the entire Wet Tropics WHA during two main survey periods. These periods were in the wet season (March and April) and the dry season (September and October) 1993. The scope of the survey meant that emphasis was placed on obtaining a restricted amount of information from a large number of respondents. The final report of the survey is based on over 8317 individual responses. Interviews were conducted of independent visitors at sites in the Wet Tropics WHA and self-administered questionnaires were also made available at sites. Interviews were conducted of drivers of tour groups to collect information on the visitors carried. Information was not collected directly from visitors on commercial tours. for that reason, the survey only recorded detailed data on a number of variables for independent visitors. Independent visitors made 68% of the visits predicted for the population. The survey includes local residents (while the present survey does not). Scaling from survey results to an estimate of population was based on the use of road traffic counters recording vehicle use of sites for selected periods and information collected in the survey on the number of people in vehicles (Manidis Roberts et al 1994).

The survey as conducted in 1993 was a one-off exercise. Subsequently, data have continued to be collected using vehicle counters, including for additional sites. There is now a more complete picture of visits to sites. As no different methodologies have been employed in surveying visitor use of the Wet Tropics WHA, there is no way of validating the results of the *1993 WTVUS* by comparison with other data.

Published results of the *1993 WTVUS* are reported in terms of 'visits', with a visit being time spent at one site. People can and often do visit more than one site in a day. It was necessary to calculate visitor-days from the raw data for use in this study. Details of how this was done are given in Chapter 2.

In 1994, Pearce and Moscardo (1994) conducted a survey of visitors travelling to and from North Queensland. They analysed the data by factor and cluster analysis and identified three groups of visitors. This research is a precursor to a longer term research program being undertaken by these researchers that is aimed at addressing visitor attitudes to the environment and services. There is limited opportunity to compare the results for the three groups of visitors identified with the results of the present survey.

All other relevant data sources present information on tourism on a regional basis. The regions which include the Wet Tropics WHA are the Far North region (Statistical Division), centred on Cairns and the Northern region, centred on Townsville. The International Visitor Survey does not employ these regions but reports on visitation to the destination 'Cairns'. Characteristics of the surveys are listed in Table AE.1 and are discussed where relevant in the text.

Table AE.1: Data sources visitors to the Wet Tropics WHA

Data Source	Research Organisation	Scope	Frequency	Methodology	Comment
1993 Visitor Use Survey Wet Tropics World Heritage Area	Manidis Roberts Consultants for Wet Tropics Management Authority	All visitors to Wet Tropics WHA	One-off survey over wet and dry seasons 1993. Subsequent updates of vehicle counts, additional sites.	Interviews, self-administered questionnaires and vehicle counts at sites in the Wet Tropics WHA	A comprehensive survey to estimate the population of visitors and collect information on patterns of use. No expenditure data collected.
Domestic Tourism Monitor	Bureau of Tourism Research	All Australians who travelled from home	Annual, with supplementary expenditure survey 1992	Interviews of households in omnibus survey, covers trips made in last two months	Visitor characteristics available at regional level but small sample sizes. Expenditure results at state level only
International Visitor Survey	AGB McNair for Bureau of Tourism Research	All international visitors to Australia	Annual	Interviews of departing visitors at airports	Visitor characteristics available for 'Cairns'. Expenditure data not able to be extracted for Cairns region.
Queensland Visitor Survey	AGB McNair for Queensland Tourist and Travel Corporation	All visitors staying in commercial accommodation in Queensland regions	Annual, quarterly reports available	Self-administered questionnaires in sample of rooms in commercial accommodation	Visitor and Expenditure data reported by region. Does not cover visitors staying with friends and relatives.

Data Source	Research Organisation	Scope	Frequency	Methodology	Comment
Survey of Visitors staying with Friends and Relatives in Queensland 1989 and 1990	National Centre for Studies in Travel and Tourism for the Queensland Tourist and Travel Corporation	Visitors staying staying with friends and relatives in Queensland regions	One-off survey	Household survey by telephone interview	Results dated.
Survey of Daytripping by Queensland Residents 1989 and 1990	National Centre for Studies in Travel and Tourism for the Queensland Tourist and Travel Corporation	Residents taking day trips in Queensland regions	One-off survey	Household survey by telephone interview	Results dated.
Understanding visitor travel plans for, visitor expectations of and visitor reactions to the Wet Tropics WHA	Pearce P. L. & Moscardo G, Department of Tourism, James Cook University	Visitors travelling by car to and from North Queensland	One-off survey	Interviews at roadside in Cardwell, Ingham and Tully	Results specifically relate to visitor segments, no economic data
Economic survey of visitors to Wet Tropics WHA	Sally Driml Centre for Resource and Environmentla Studies, Australian National University	Visitors to Wet Tropics WHA excluding residents of local region	One-off survey, dry season 1994	Interviews at sites in Wet Tropics WHA, self-administered questionnaires for visitors on commercial tours	Results adequate for economic analysis.

AE.1.2 Design of the survey, accounting for seasonality

There is distinct seasonality in the climate of North Queensland with a wet season lasting from around December to May and a dry season for the remainder of the year. Until the late 1980s, tourism used to be strongly seasonal, concentrated in the dry season. The attraction for Australian tourists at that time is a chance to escape southern winter to the warm, sunny tropics. The comfortable climate at that time is also an attraction to tourists from overseas. Recent years have seen an increase in the numbers of tourists, particularly from overseas, arriving in the wet season. The wet season coincides with the northern hemisphere winter, and visitors are obviously prepared to escape winter and experience the often hot and humid climate of North Queensland at this time.

The survey was only conducted in the dry season and it is therefore legitimate to question whether the results can be extrapolated to represent annual visitor patterns. During the survey design phase, the question of whether to conduct a large survey at one time or to divide the survey effort over several periods of time in a year was considered. The data available on visitor patterns from the *1993 WTVUS* was one source of information on seasonality. The other source consulted on seasonality was the quarterly reports of the Queensland Visitor Survey (QTTC 1993, 1994). In particular these surveys were looked at to see if there was likely to be any difference in expenditure by visitors in different seasons.

The results of the *1993 WTVUS* must be interpreted in the context of the sample design used - visitors were surveyed during March and April 1993 to represent the Wet Season and during September and October 1993 to represent the Dry Season. Results were then extrapolated to the whole year characterised by a six month wet season and six month dry season. The results of the WTVUS show that there was not much difference between the wet and dry season in the total number of visits made to sites in the Wet Tropics WHA, see Table AE.2.

There was a difference in the mix of visitors by origin to the Wet Tropics WHA in different seasons, reported for independent visits only. The proportion of overseas visitors remained constant for both seasons while in the wet season locals were dominant and in the dry season the proportion of Australian tourists increased. This may be explained by the Wet Tropics WHA being used more heavily by locals over the summer when the beaches of the region are inhabited by marine stingers and the cool swimming holes of the rainforest are attractive. The mix of responses by origin for the sample of visitors on independent trips to the Wet Tropics WHA is illustrated on Table AE.3.

Significantly, there was very little difference in the number of visits made in the wet season and the dry season on both commercial tours and independently, see Table AE.2 again.. This points to the likelihood of equivalent expenditure patterns for day trips in both seasons.

Table AE.2: *1993 WTVUS,* Estimated visits 1993

	Wet Season	Dry Season	Total
Commercial tour	807 885	729 656	1 537 541
Independent	1 561 594	1 676 350	3 237 944
Total	2 369 479	2 406 006	4 775 485

Source: (Manidis Roberts et al 1994)

Table AE.3: *1993 WTVUS,* Normal place of residence of survey respondents, independent visitors only

Place of residence	Total %	Wet %	Dry %
Within North/Far North Queensland	47.9	59.9	38.5
Within Queensland	9.7	8.0	11.1
Within Australia	21.3	12.2	28.6
Overseas	21.0	20.0	21.9

Source: (Manidis Roberts et al 1994)

Further information on seasonality was sought from the Queensland Visitor Survey (QTTC 1993, 1994). Quarterly reports for 1993 for the Far Northern Region, centred on Cairns, were analysed for differences in patterns of visits and expenditure. The data confirm that the September quarter (July, August, September) experienced the highest number of visitors and visitor nights for tourists visiting for holiday and recreation, see Tables AE.4 and AE.5. The number of visitors from overseas, and the visitor nights they spent was relatively constant over the four quarters, peaking in the December quarter. This is consistent with the pattern of visits by people from overseas to the Wet Tropics WHA, reported above.

The data for visitors from Queensland (including the Northern and Far North regions) and interstate show that numbers of visitors from these areas peaked in the September quarter. The proportion of visitors from interstate was highest during the September quarter and lowest during the March quarter. The proportion of visitors from Queensland was highest for the September quarter and lowest for the December quarter. Interpretation of the QVS results for visitors , particularly from Queensland, must be qualified by the information that only visitors staying in commercial accommodation are included. Up to a third of visitors to the region stay with friends and relatives, with around half of the people visiting friends and relatives being from Queensland (QTTC 1991b, *VFR*).

Table AE.4: Holiday and recreation visitors by origin of visitors (000's), Far North Region

	Queensland	Interstate	Overseas	Total
March 1993	33	27	122	183
June 1993	44	68	123	236
September 1993	55	95	120	270
December 1993	30	40	182	252

Source: Queensland Tourist and Travel Corporation 1993, 1994

Table AE.5: Holiday and recreation visitor nights by origin of visitors (000's), Far North Region

	Queensland	Interstate	Overseas	Total
March 1993	147	217	631	995
June 1993	220	494	574	1289
September 1993	263	647	654	1564
December 1993	140	298	680	1118

Source: Queensland Tourist and Travel Corporation 1993, 1994

Expenditure by people staying in commercial accommodation is reported in the QVS. The data in Tables AE.6 and AE.7 suggest that for all origins, the lowest average expenditure was seen in the September quarter, for holiday and recreation and for all visits. There is no obvoius explaination for this. The total average expenditure in September is 89% of expenditure in the quarter for which it is highest (March), so the discrepancy is not great. Although a difference of this size might just be due to sample error, the fact that expenditure is consistently lower for all origin groups points to an actual difference.

Table AE.6: Holiday and recreation average daily expenditure by tourists, Far North Region

Quarter	Queensland	Interstate	Overseas	Total average
March 1993	114.08	148.86	182.11	162.45
June 1993	81.90	161.60	194.60	159.80
September 1993	97.09	131.54	179.68	145.89
December 1993	na	na	na	160.83

na: not available
Source: Queensland Tourist and Travel Corporation 1993, 1994

Table AE.7: Average daily expenditure by tourists, Far North Region

Quarter	Queensland	Interstate	Overseas	Total average
March 1993	106.70	155.67	181.52	160.08
June 1993	128.40	174.10	194.40	168.90
September 1993	82.77	122.42	177.23	131.44
December 1993	113.84	137.43	190.17	162.11

Source: Queensland Tourist and Travel Corporation 1993, 1994

The information available on seasonality from the *1993 WTVUS* suggests that there is no difference in the number of visitors to the Wet Tropics WHA, or the method of access, between the wet and dry seasons, but the number of domestic visitors from outside the region is greater in the dry season. This is backed up by the data from the QVS. These data point to the September quarter being the best in which to survey, to most efficiently target tourists to North Queensland. By surveying in the September quarter, the period of lowest expenditure is targeted. This avoids the possibility of overestimating annual expenditure. As the variation in expenditure between the highest and lowest quarters is only 11%, there is little likelihood that by surveying only in the September quarter the results will be a significant underestimate of the average. In summary, consideration of the information available on seasonality gave no compelling reason to survey over more than one period, and given that position, the September quarter was the optimum period to select for surveying.

AE.1.3 Design of the survey, grouping of visitors

The objective of surveying visitors to the Wet Tropics WHA was to collect the relevant information from people who *actually visited* sites within the Wet Tropics WHA. It was decided early on not to survey local residents at all, as a large data set including enough information to undertake travel cost analysis for local residents was available from the *1993 WTVUS*. This data set however did not include sufficient information for conducting a travel cost analysis for anyone but local residents. Local residents were defined as people living between Townsville and Cape York Peninsula.

Initial investigation in the field revealed that the target population of visitors to sites within the Wet Tropics WHA could be classified into a number of different groups depending upon their origin and method of visiting the Wet Tropics WHA. It was decided to classify groups at an early stage so questionnaire design and survey design could proceed for the groups chosen for survey. Visitors to the Wet Tropics WHA were classified into the following groups[1]:

1. Australian residents (excluding locals) travelling independently to the Wet Tropics WHA
2. Australian residents (excluding locals) travelling by commercial tour to the Wet Tropics WHA
3. Visitors from overseas travelling independently to the Wet Tropics WHA
4. Visitors from overseas travelling by commercial tour to the Wet Tropics WHA
5. Local residents

AE.1.4 Questionnaire design

Separate questionnaires were designed for the four groups. It was decided to conduct a travel cost analysis of Australian residents[2] and to ask visitors from overseas what they were willing to pay for entry into the Wet Tropics WHA[3]. The questionnaires of independent visitors were designed to be interviewer-administered at sites within the Wet Tropics WHA. The questionnaires for visitors travelling on commercial tours were designed to be self-administered.

The questionnaire design for Australian residents was built around collecting sufficient data for expenditure and travel cost analysis. Questions were also added on the importance of visiting the Wet Tropics WHA, opinions after visiting the Wet Tropics WHA and demographic variables. The questionnaire design for visitors from overseas was built around collecting data on travel patterns and expenditure, questions on willingness to pay for entry, plus the other subjects covered for Australians. All questions common to all four groups were identical. The questionnaire for visitors from overseas travelling on commercial tours was also made shorter and translated into Japanese[4].

The questionnaire design was developed using guidelines given in a number of texts (Warwick and Lininger 1975, Dilman 1978, Nyman et al 1991) and with reference to numerous questionnaires used in travel cost analysis studies[5]. Questionnaires were designed to be completed in around 15 minutes whether by interview of self-administered. The self-administered questionnaire for Australians was eight pages long (four double-sided pages) and the self-administered questionnaire for visitors from overseas was six pages long (three double-sided pages). Following the pilot test, these questionnaires were designed with large print so they could be read by visitors who didn't take their reading glasses with them on the day trip to the rainforest. Similarly, the show cards used in the face to face interviews were designed with large print.

Show cards were used with the face to face interviews to list the range of responses available for closed-response questions. To increase the response on demographic questions, these questions were designed to minimise any embarrassment or objections respondents may have

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[1] These groups are not totally mutually exclusive in terms of method of visiting as some people use more than one method if visiting the Wet Tropics WHA more than once. They are mutually exclusive for any one visit.

[2] It was decided not to do a travel cost analysis for visitors from overseas because it could produce questionable results due to the small number of visits from distance zones with large opoulations.

[3] It was decided not to ask this question of Australian residents because of the already long questionnaire and a view that respondents may be hostile to the question. On reflection, this should have been tested in the pilot survey.

[4] The Translation of the questionnaire and responses was by Yutaka Murayama and Lynne Colley of the Australia Japan Research Centre, Australian National University.

[5] **See Appendix on Travel Cost analysis.**

had in giving personal information. For questions on age, income, education and occupation, a numbered list of possible responses (age ranges, education levels etc.) was provided and respondents could just nominate the number of the response, rather than be asked to state their exact age, income etc.

The questionnaires were constructed with a mix of open-ended and closed-response questions. Open ended questions were used where there was little prior information on the issue about which information was being sought. These issues included reasons for satisfaction and dissatisfaction with visits to the rainforest and a closing question seeking comments to be passed on to the managers of the Wet Tropics WHA. Many of the questions sought information on simple facts, such as the name of the town where respondents stayed last night. These were designed as simple, short questions.

The questions requiring the greatest amount of information were: (i) a question asking respondents to recall how much money they had spent on their day trip, by categories of expenditure and location of expenditure, and (ii) a question asking respondents to recall what they had done so far on each day of their holiday in North Queensland. Both questions, and instructions on how to answer them, were explained by the interviewer and on the self-administered questionnaires. For question (i), a table to be filled in with the expenditure amounts was designed for use in the self-administered questionnaire, and this was reproduced on a show card for the face to face interviews. This table made it clear just what information was needed to fill in the spaces. This question was completed successfully in both survey modes. Question (ii) was administered in the face to face interviews by the interviewers ascertaining how many days the respondent had already been in North Queensland, and asking for each day, what sites the respondent had visited. A table was provided on the self-administered questionnaire, with an example given of how to complete it.

Visitors from overseas were asked a series of questions on their willingness to pay an entry fee. The sequence of the questions was designed to elicit reasons for agreeing or not agreeing with the levying of an entry fee.

AE.1.5 Pilot survey

A pilot survey was conducted to test both the questionnaire design and the survey design. The pilot survey confirmed the method of interviewing visitors at sites within the Wet Tropics WHA was feasible and resulted in a good response rate (around 90% for the pilot survey). To survey visitors on tours, the strategy of leaving questionnaires with a tour operator to distribute and collect was compared with the strategy of an interviewer accompanying a trip to hand out and collect questionnaires. Both strategies worked well but obviously depended on high motivation of the tour operator and the presence of the researcher. The questionnaires were completed relatively well but were modified somewhat in presentation for the actual survey.

AE.1.6 Conducting the Survey

The survey was conducted in August, September and the first two weeks of October 1994. This coincided with the peak tourist season for North Queensland. There was unseasonal rain in early August which meant numbers of visitors travelling independently and on tours was less that expected, so the survey was extended into October.

The aim in terms of responses was to complete at least 300 questionnaires for each of the Australian groups and the combined two overseas groups[6]. The survey was approached differently for independent visitors and visitors on tours.

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[6] These were to be combined for analysis.

Independent visitors

The survey of independent visitors was conducted at sites within the Wet Tropics WHA to ensure that respondents had actually visited the WHA. Several sites were selected that; covered the main areas visited in the Wet Tropics WHA, were amongst the most popular sites as reported in the *1993 WTVUS* and had good interviewing locations. As the Wet Tropics WHA was to be treated as one 'day trip site' for the travel cost analysis, it was not important to get a representative selection of the number of people visiting each site. Visitors commonly visit a number of different sites in the Wet Tropics WHA during a single day trip (Manidis Roberts et al 1993). A total of six interviewers were used in the survey. All were trained by the researcher. Each interviewer was assigned to one or more sites. The interviewers each chose the days for interviewing and the sites within those assigned. This introduced randomness into the selection of sites and days for interviewing.

All interviews were conducted at, or after, lunch time[7] to ensure that respondents had an opportunity to spend some time visiting sites in the Wet Tropics WHA and to incur much of their expenditure for the day, before being interviewed. Most of the interviewing locations chosen were between the end of a path leading out of the rainforest and the car park. This allowed the interviewer to use the 'next to pass' method of selecting respondents (Fielding et al 1992, Gale & Jacobs 1987). After each interview was completed, the interviewer immediately approached the next person emerging from the path. This method of selection was used to avoid introducting bias by only approaching certain types of people. All these interviews were conducted when the respondents were leaving the site. At some sites, groups of visitors sitting at picnic tables were approached and the interviewer selected the person closest to them on approaching, to interview. Interviews were conducted with only one person per group visiting together. When people were approached, they were asked where they usually lived. If they were local residents, they were thanked but told that the survey was only of tourists[8]. The appropriate questionnaire, for Australians or for visitors from overseas was then selected for the interview.

The response rate to the survey was very good. Most people approached were relaxed and happy to talk about their holiday. The main reasons for refusals were that people were in a hurry, had small children who were tired, or did not speak English well enough. There were surprisingly few refusals on the basis of language. The overall response rate is estimated from a number of days where detailed records were kept, at over 80%[9].

Visitors on Tours

Following the pilot survey, a strategy surveying visitors on commercial tours by of distributing a large number of questionnaires with reply-paid envelopes was selected. This strategy was chosen to minimise the need for involvement by tour operators in conducting the survey. Questionnaires were distributed both by tour operators and personally by the researcher.

A sample of commercial tour operators taking tours to the Daintree area and Cape Tribulation was approached and asked to distribute questionnaires to passengers[10]. Questionnaires were coloured white for Australian passengers and yellow for visitors from overseas and had a reply paid envelope attached. Each operator was given a bundle of 50 questionnaires and asked to distribute them all. Operators who were interested were given the option of distributing the questionnaires at afternoon tea or a similar stop on the trip and collecting the responses for

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7 At Cape Tribulation the period from 12 noon was popular for lunch at the picnic tables at the site, interviews were generally conducted later at all other sites.

8 Local residents are not counted as either respondents or refusals.

9 The average response rate determined over 13 interviewer days was 87%.

10 The sample was randomly selected from the tour operator data base, see Section 7.2.

pick-up by the researcher. This happened on a few occasions. In all other cases, responses were mailed back to the researcher. All 14 tour operators approached agreed to participate, but two did not distribute any of the questionnaires given to them and one operator only distributed a few. The operators were each followed up several times by personal visits and by phone. Where possible, undistributed questionnaires were collected but it is not certain that they all were, leading perhaps to an overestimate of the number of questionnaires actually distributed, and consequently an underestimate of the response rate.

Many of the day tours of the Atherton Tablelands which visit sites in the Wet Tropics WHA depart from Cairns via scenic train to Kuranda and then travel through the Tablelands and back to Cairns by coach. Tour passengers are delivered to the Cairns railway station in the morning and supervised in boarding the train by the tour operators. Passengers then spend up to 15 minutes on the train waiting to depart. The researcher obtained permission from the four largest tour companies to approach their passengers while on the train. Groups of passengers were addressed with an introduction to the researcher and a brief explanation about the survey, and they were asked to take a questionnaire for completion after their trip. Questionnaires were not given to people only visiting Kuranda. This was done on 18 mornings over the survey period. One tour company transports the majority of Japanese people who visit the Wet Tropics WHA by coach. That operator unfortunately refused to participate in the survey.

One of the two major rafting companies distributed questionnaires to all their clients over four days and collected the responses. Rafting attracts a substantial number of Japanese visitors. This was the only time the Japanese questionnaire was used.

AE.1.7 Response rate

The response rate for the surveys conducted by personal interview is based on the number of questionnaires completed as a function of all people approached for interviews. Detailed records of the number of people approached were kept for a proportion of the interview days and the response rate has been extrapolated from these. The number of refusals on any day was low, in the region of 0 to 4. There was a small number of questionnaires rejected for coding because they were not fully completed. The response rate of over 80% was very acceptable as a basis for analysis.

For the self-administered surveys, the response rate has been calculated as the number of questionnaires returned, completed sufficiently well to justify coding for analysis, as a proportion of the number distributed. Less than 10% of returns were rejected for coding because they were not fully completed. The response rate of 37% for Australian visitors on tours was at the lower end of the range of acceptability. It was not possible to conduct a follow-up exercise to try to improve the response rate as there was no way of contacting the visitors who had been given questionnaires after they finished their day trip. The response rate for overseas visitors on tours was 64%, which was relatively high for this type of survey and was acceptable as a basis for analysis.

The acceptable response rates obtained meant that the data from coded questionnaires could be accepted for analysis.

Table AE.8: Survey response rate

	Survey Method	Responses coded	Response rate
Australian Independent visitors	Personal interview	339	80%+
Australian Visitors on Tours	Self-administered, mail back	232	37%
Overseas independent visitors	Personal interview	159	80%+
Overseas visitors on tour	Self-administered, mail back	387	64%

AE.1.8 Success of the questionnaire

Overall, the questionnaire proved to be successful in gathering the data required for subsequent analysis. The only question with a poor response rate was that on the respondent's itinerary while in North Queensland. This question proved to be a problem for some interview respondents who had difficulty recalling their activities. Most of the people who had trouble with this question were those who had been in North Queensland for more than two weeks and those who were on extended trips. Where there were obvious recall problems, interviewers were instructed to ascertain only the visits made to sites in the Wet Tropics WHA, using a map of the area if necessary. The question was answered relatively well by respondents to the self-administered survey, but this question may have contributed to decisions by people not to respond. The responses to this question were suitable to ascertain how many days had been spent visiting the Wet Tropics WHA but not to put this into context with all other sites visited in North Queensland, as had been intended. Problems with recall on the question about sites visited on other days in North Queensland did not become evident in the pilot survey.

AE.1.9 Coding of the data

The completed questionaries were all coded by the researcher. During the coding, several variables were constructed for use in travel cost analysis. The actual road distance to North Queensland was calculated for respondents who drove. The cost per kilometre of driving was added, based on the type and year of vehicle nominated in the survey. Data from published sources on running costs of vehicles were used to construct the new variable (NRMA 1994, DPIE 1994). Where respondents took independent day trips to the Wet Tropics WHA, the actual distance driven was calculated for the description of the route taken. The cost of running the vehicle nominated, and the cost of petrol, were calculated separately.

Responses to open-ended questions were coded and then recoded to reflect the major catrgories of responses obtained.

The coded data were entered onto EXCEL spreadsheets.

AE.1.10 Analysis of the data

The excel spreadsheets were loaded into SPSS for data analysis. Tables, crosstabs and simple statistics were generated from the data using the SPSS facility. The results for key variables, expenditure, and willingness to pay entry fees, were generateed in this way and are reported in Section 7.2. More complex manipulation of the data was required for Travel Cost Analysis and this is discussed in Chapter 8.

AE.1.11 Representativeness of the sample

The results of the survey on several key variables including origin of respondents have been compared with published results from other surveys to evaluate the representativeness of the sample. It has been concluded that the sample achieved in this survey is adequate in terms of what is known about the population of visitors to the Wet Tropics WHA and it is reasonable to use the results of this survey to estimate characteristics of the population, without the need to weight results for any variables.

AE.2 VISITOR SURVEY RESULTS, A DESCRIPTION OF VISITORS TO THE WET TROPICS WHA

This section of Appendix SURVEY includes comparisons of results of the survey conducted for this study with results of other relevant surveys, and some results of this survey not included in Chapter 7. An attempt was made to compare th results of this survey with any other relevant data sources, in order to assess how similar or different the results might be. Limitations arise in comparing the sample data with results from the major regional tourism surveys (Domestic Tourism Monitor, International Visitor Survey and the Queensland Visitor Survey) as none of these major surveys addresses the same population as the one represented by the present survey, namely visitors to the Wet Tropics WHA. The only other survey which refers to this population is *1993 WTVUS*, as discussed above. In many cases, however, the *1993 WTVUS* only recorded detailed data for independent visitors, not including visitors on tours. Independent visitors made 68% of the visits predicted for the population. The WTVUS includes local residents while the present survey does not, though it has been possible to select out results for non-local visitors only in some cases. Therefore the ability to meaningfully compare the results obtained for the sample in this present survey with the population predictions from the WTVUS is limited. Where comparisons are made, they must be interpreted as giving some idea only of the size or proportions for the variables being considered.

AE.2.1 Characteristics of Visitors to Wet Tropics WHA

The sample of visitors to the Wet Tropics WHA (excluding locals) was evenly divided between visitors from overseas and visitors from Australia, see Table AE.9. This result was obtained by chance, not by setting targets for equal numbers. By comparison, the ratio of overseas visitors to Australian visitors reported for the WTVUS was 40% to 60% for independent visitors. However, the WTVUS recorded only origin for visitors on independent trips to the Wet Tropics WHA. It is quite possible that the WTVUS underestimates the overall proportion of overseas visitors by not including overseas visitors taking commercial trips.

Table AE.9: Origin of Visitors

Origin	Number responses	Percentage
Australia	563	50.1
Overseas	560	49.9

N = 1123

Visitors from Europe and the UK/Ireland made up the largest proportion of visitors from overseas included in the sample. No detail on country of origin was collected in the WTVUS. Information from the International Visitor Survey on the origin of visitors to the region based on Cairns, Table AE.10, can be used as a guide to the population of overseas visitors who might potentially visit the Wet Tropics WHA. Comparing Tables AE.10 and AE.11, it can be seen that the origins of visitors in the sample broadly mirrors the proportions of all overseas visitors to the Cairns region, and that visitor-days spent in the region might best predict visits to the Wet Tropics WHA.

Table AE.10: Country of Origin of visitors from overseas

Country	Sample Percentage of overseas visitors
New Zealand	8.6
UK/ Ireland	26.8
Other Europe	28.0
Japan	19.0
Other Asia	2.0
North America	12.5
Africa	1.2
Middle East	0.8
Pacific	0.6

N = 1120

Table AE.11: International Visitors Survey, visits and visitor nights spent in Cairns, 1994

Country	Percentage of overseas visitors	Percentage of visitor nights by overseas visitors
New Zealand	3.8	5.1
UK/ Ireland	12.6	18.1
Other Europe	26.6	31.2
Japan	28.4	15.6
Other Asia	9.0	8.8
North America	16.1	17.6
Other countries	3.5	3.2

Source: BTR 1994a.

The origin of Australian visitors in the sample is described in Table AE.12. The distribution roughly follows state population sizes.

Table AE.12: State of origin of Australian tourists

State	No. Respondents	Percentage of respondents	Percentage distribution of Australian population*
NSW	166	29.5	34.0
Victoria	150	26.6	25.1
Queensland	98	17.4	17.6
South Australia	57	10.1	8.3
Western Australia	55	9.8	9.4
Tasmania	13	2.3	2.6
Northern Territory	6	1.1	1.0
ACT	18	3.2	1.6

N = 563

*Source: Australian Bureau of Statistics, 1991 population census, unpublished tables.

The most common type of group travelling together to the Wet Tropics WHA was 'a couple' and the most common group size was two adults and no children, see Tables AE.13 to AE.15. In the sample, the mean group size travelling to the Wet Tropics WHA was 2.3 persons. The WTVUS recorded group type for independent visitors to the Wet Tropics WHA only and found that 'a couple' was the most common group type, accounting for 30% of responses. The WTVUS reports a mean occupancy of vehicles of independent visitors at sites in the Wet Tropics WHA was 3.2 persons.

Table AE.13: Type of Group travelling together*

Group type	Percentage
By yourself	14.2
Couple	41.2
Family	19.6
Friends	14.6
Family and friends	5.8
Organised group	4.6

N = 796

*The question refers to whole trip, not today's trip, on which visitors may be travelling on an organised commercial day tour.

Table AE.14: Number of people in group, over 15 years age

Number in group	Percentage
1	24.0
2	56.3
3	8.7
4	8.7
5	1.5
6	0.5

Mean = 2.1	Median = 2.0	Mode = 2.0

N = 1006

Table AE.15: Number of people in group, under 15 years age

Number in group	Percentage
0	87.6
1	4.7
2	4.9
3	1.7
4	0.9

Mean = 0.2	Median = 0	Mode = 0

N = 1012

The following tables describe the variables of gender, age, education, income and occupation, for the sample. Overseas visitors were only asked their gender and age.

Table AE.16: Gender of respondents

	Percentage of respondents		
	Australian visitors	Overseas visitors	All visitors
Male	47.2	47.8	47.5
Female	52.8	52.2	52.5

N = 1103

Table AE.17: Age of respondents

	Percentage of respondents		
Years of age	Australian visitors	Overseas visitors	All visitors
15 - 19	1.6	1.3	1.5
20 - 29	18.7	46.2	32.3
30 - 39	20.3	18.0	19.2
40 - 49	24.1	11.2	17.7
50 - 59	20.9	11.7	16.3
60 - 69	10.6	10.1	10.4
70+	3.8	1.5	2.6

N = 1101

Table AE.18: Australian respondents, Education

Highest level of education achieved	Percentage of respondents
Primary	2.2
Secondary	36.1
Technical	24.0
Degree	28.1
Higher degree	9.6

N = 551

Table AE.19: Australian respondents, Occupation

Occupation class	Percentage of respondents
Professional	36.5
Managerial	14.0
Clerical	7.1
Sales	4.9
Farmer etc.	2.5
Transport	1.5
Trade	5.4
Service	3.4
Home duties	5.6
Retired	15.2
Unemployed	1.1
Student	2.7

N = 551

Table AE.20: Australian respondents, Household income

Income range	Percentage of respondents
$0 - 5000	3.1
$5001 - 15000	8.8
$15001 - 25000	9.4
$25001 - 35000	15.0
$35001 - 45000	16.2
$45001 - 55000	9.6
$55001 - 65000	9.4
$65001 - 75000	7.9
$75000+	20.6

N = 520

The type of accommodation in which respondents stayed the night prior to the survey is shown on Table AE.21. By comparison, information was collected in the WTVUS on the type of accommodation in which visitors interviewed had stayed the previous night, but only for independent visitors. This is shown in Table AE.22. It is quite possible that visitors on commercial tours would be more likely to stay in motel/resort accommodation, and less likely to camp than independent visitors, resulting in a distribution more like the sample findings.

Table AE.21: Type of accommodation used last night

Type of accommodation	Percentage
Home of friends / relatives	10.2
Rented house / flat	11.8
Motel / resort	50.4
Backpackers / guesthouse	13.6
Caravan, campervan, tent	12.9
Other	1.0

N = 1016

Table AE.22: WTVUS, Type of accommodation used last night, independent, non-local visitors only

Type of accommodation	Percentage
Home of friends / relatives	5.8
Rented house / flat	12.7
Motel / resort	39.4
Backpackers / guesthouse	12.2
Caravan, campervan, tent	24.4
Other	5.1

N = 3941
Source: Manidis Roberts et al 1994.

The sample of visitors to the Wet Tropics WHA achieved in the visitor survey conducted for this study cannot be compared directly with any other survey or population data. However when key variables are compared 'indirectly' with other published data, it emerges that the sample achieved a reasonably similar distribution of characteristics. The sample can be used with some confidence as representative of all visitors to the Wet Tropics WHA. It is judged not necessary to weight the results for any groups within the population.

The survey was specifically designed to target the most popular sites in the Wet Tropics WHA, as revealed in the *1993 WTVUS*, to maximise responses from independent visitors. The same sites are also most popular for commercial tours. Therefore, the results reported in Table AE.23, of the number of independent visitors by the location at which they were surveyed, are a function of the survey design. Similarly, the number of visitors on different commercial tour routes included in the sample is a function of the survey design. The distribution of such respondents is shown in Table AE.24. The Daintree area and north of the Daintree River to Cape Tribulation can be visited on a day trip from Cairns. A one day round trip to Kuranda and the Atherton Tablelands can be made from Cairns. Whitewater rafting on the Tully River is a one day trip form Cairns and rafting on the Barron River is a half day trip from Cairns. This survey did not cover any sites south of Tully, as the WTVUS revealed a much lower annual visit rate to these sites.

Table AE.23: Locations of survey, independent visitor respondents

Location of survey	Respondents travelling independently
Barron Falls (Kuranda)	221
Cape Tribulation	82
Lake Barrine	53
Cathedral Fig	64
Mossman Gorge	70
Crystal Cascades	7

Table AE.24: Tour routes taken by respondents on commercial tours

Tour route	Respondents on a commercial tour
Daintree & Cape Tribulation	225
Daintree	5
Kuranda & Tablelands	193
Nocturnal wildlife viewing	3
Rafting Tully & Barron Rivers	195

N =

Rainforest Visitor Survey
Australian Private Visitors

Date ________ Time ________ Location ____________________
Respondent Number 1 _ _ _ _ Gender M F Interviewer ____

Q1. Where Do You Normally Live?

TOWN ______________ POSTCODE __ __ __ __

Q2. What were the three main features or attractions that prompted you to come to North Queensland? (For this research, North Queensland is the area from Townsville to Cooktown, including Cairns and the Atherton Tablelands)

____

____

____

Q3. Thinking about when you planned your holiday/trip, how important was the opportunity to visit the rainforest in your decision to visit **North Queensland**?

(Show card)

1. THE MOST IMPORTANT ATTRACTION
2. ONE OF A NUMBER OF IMPORTANT ATTRACTIONS
3. NOT PARTICULARLY IMPORTANT
4. YOU HAD NOT PLANNED TO VISIT THE RAINFOREST BEFORE COMING TO NORTH QUEENSLAND

The next questions are about today's visit to the rainforest and your holiday/trip travel.

Q4. What kind of group are you with today? (Circle number)

1. BY YOURSELF
2. COUPLE
3. FAMILY
4. FRIEND(S)
5. FAMILY AND FRIEND(S)
6. ORGANISED GROUP

Q5. How many people **including yourself** in your group are:

OVER 15 YEARS AGE _____
UNDER 15 YEARS AGE _____

Q6. Where did you stay last night?

TOWN __________________

Q7. Where will you stay tonight?

1. SAME PLACE
2. OTHER, TOWN ____________

Q8. What sites are you visiting today and what route are you taking?

____

____

____

Q9. What activities will you participate in today? (Show card)
(Circle all today's activities)

1. SCENIC DRIVING
2. SCENIC VIEWING
3. WALKING (< HALF HOUR)
4. WALKING (HALF TO ONE HOUR)
5. WALKING (> ONE HOUR)
6. PICNICKING /BBQ
7. SWIMMING
8. RIVER OR LAKE CRUISE
9. RAFTING OR KAYAKING
10. CANOEING
11. NATURE STUDY
12. TRAIN RIDE
13. PHOTOGRAPHY
14. OTHER, _________

Q10. How did you get to this site today?

1. PRIVATE MOTOR VEHICLE
2. HIRED MOTOR VEHICLE
3. MOTOR CYCLE
4. WALK ⇒GO TO 12
5. OTHER

Q11. If your drove by private or hired motor vehicle, what is the make and model and year of manufacture ? Please be as specific as possible.

MAKE AND MODEL ___________________________ YEAR ____________

Q12. How much do you think you will spend altogether on **today's trip**? Please look at the **card** and tell me the amount spent on each item, **either** by yourself or the total for your group, and the town where you spent the money.

	COST FOR YOURSELF	COST FOR YOUR GROUP	TOWN
PETROL			
HIRE CAR			
TOUR TICKETS			
LUNCH, REFRESHMENTS			
FILM			
SOUVENIRS, SHOPPING			
SPECIAL EQUIPMENT (EG. HAT, BINOCULARS)			

Q13. What type of accommodation did you stay in last night? (Circle number)

1. WITH FRIENDS/RELATIVES
2. RENTED HOLIDAY HOUSE/FLAT
3. MOTEL/RESORT
4. BACKPACKERS/GUESTHOUSE
5. CARAVAN
6. CAMPERVAN
7. TENT
8. OTHER _______________
9. OWN HOME
10. OWN HOLIDAY HOUSE/FLAT

Q14. What was the cost per night of that accommodation (excluding meals and drinks)? $ _____

Q15. How many people was that for? _____ PEOPLE

Q16. How many days away from home will you spend on this entire holiday/trip? _____ DAYS

Q17. How many days will you spend in North Queensland (between Townsville and Cooktown) on this holiday/trip? _____ DAYS

If Q16 and Q17 not the same:

Q18. What other main destinations will you visit on this holiday/trip and how many days will you be staying in each?

MAIN DESTINATIONS	DAYS

Q19. Please think about your holiday/trip North Queensland - what you have done so far, what you plan to do and how many days you will include a visit to rainforest.

Of the __ days you will spend in North Queensland, which day is it today?
DAY NUMBER _____ (CIRCLE NUMBER ON TABLE)

Starting with the first day, what are the main sites visited or activities you have already undertaken on each day?

What do you plan to do on each of the future days?
For all days with visits to the Wet Tropics/rainforest, circle if by private/hire car or by tour.

DAY	SITES AND ACTIVITIES (EG. ATHERTON TABLELANDS, VISIT CURTAIN FIG)	TRAVEL TO RAINFOREST
1		1. CAR 2. TOUR
2		1. CAR 2. TOUR
3		1. CAR 2. TOUR
4		1. CAR 2. TOUR
5		1. CAR 2. TOUR
6		1. CAR 2. TOUR

DAY	SITES AND ACTIVITIES (EG. ATHERTON TABLELANDS, VISIT CURTAIN FIG)	TRAVEL TO RAINFOREST
7		1. CAR 2. TOUR
8		1. CAR 2. TOUR
9		1. CAR 2. TOUR
10		1. CAR 2. TOUR
11		1. CAR 2. TOUR
12		1. CAR 2. TOUR
13		1. CAR 2. TOUR
14		1. CAR 2. TOUR

*If respondent can't answer **future** plans in detail.*
Q20. Do you plan to visit the rainforest again on this holiday/trip?

1. YES
2. NO ⇒GO TO Q22
3. DON'T KNOW ⇒GO TO Q22

Q21. If yes, how many days are you likely to visit rainforest?

_____ DAYS

Q22. So, this means you will visit rainforest areas on ____ days?

Q23. What transport did you use to travel from your home to North Queensland?

1. PRIVATE MOTOR VEHICLE ⇒ GO TO Q25
2. HIRED MOTOR VEHICLE ⇒ GO TO Q25
3. AEROPLANE ⇒ GO TO Q28
4. TRAIN
5. BUS ⇒ GO TO Q29, NEXT PAGE
6. ORGANISED COACH TOUR
7. OTHER _________
8. MORE THAN ONE OF THE ABOVE MODES ⇒ GO TO Q24

Q24. If more than one mode of transport was used, please give details of the transport used, starting from your home

(Example, Home to Brisbane by aeroplane)

_____________ to _______________ by _____________
_____________ to _______________ by _____________

If transport included private or hired motor vehicle, go to Q25, if aeroplane, go to Q28, otherwise go to Q29.

Q25. How many people including yourself travelled in the vehicle?

OVER 15 YEARS AGE ____
UNDER 15 YEARS AGE ____

Q26. Is it the same private or hired vehicle nominated previously? (in Q11)

1. YES ⇒GO TO Q28
2. NO

Q27. If no, what is the make and model and year of manufacture of the vehicle?
MAKE AND MODEL ____________________ YEAR __________

Q28. If you travelled by aeroplane, what fare rate did you pay?

1. DISCOUNT
2. ECONOMY
3. BUSINESS

The next questions seek your opinions on your visit to the rainforest

Q29. Have you enjoyed your visit to rainforest sites today?

1. EXTREMELY SATISFIED
2. VERY SATISFIED
3. SATISFIED
4. NO OPINION
5. UNSATISFIED

Q30. Thinking about rainforest sites, what were the aspects that MOST ADDED to the satisfaction derived from your visit?

____
____

Q31. What were the aspects of rainforest sites that MOST DETRACTED from the satisfaction derived from your visit?

____
____

Q32. Have you visited the rainforest before, on a previous holiday/trip to North Queensland?

1. YES
2. NO

Ask respondents who have visited a number of sites.
Q33. You have visited a number of rainforest sites now, did you enjoy any sites MORE or LESS than others?

1. YES
2. NO ⇒GO TO Q35

Q34. If yes, what sites and features made a difference to you?

____
____
____

I would like to end with some questions about yourself, for statistical purposes

These will be anonymous, please look at the card and give the number of the closest answer.

Q35. What is your age group? ____

Q36. What is the highest level of formal education you have completed so far? ____

Q37. What kind of work do you do? ____________________

Q38. What was your **household** income last year **before** tax? ____

Q39. Do you have any comments you wish to make about the rainforest or its management?

____
____
____
____

Thank you very much for participating in this survey.

2_ _ _ _

Rainforest Visitor Survey

Visitors who live in Australia

This white survey form is for visitors who live in Australia.
Visitors who live Overseas, please fill out the yellow survey form.
Please fill out one form per group of family or friends travelling together.

Dear Visitor,

The managers of the Wet Tropics World Heritage Area rainforest want to strike the right balance between providing for the enjoyment of visitors and protection of the natural environment. Knowing about the travel behaviour and opinions of visitors is an important part of the information managers need. As a visitor to the rainforest, your participation in this survey is very valuable.

The survey should take around 10 minutes to complete. Your anonymity will be ensured. There is no need to put your name on the form. Please place it in the reply paid envelope and seal it when you have finished.

If you have time to complete the survey during the tour, (best in the afternoon, after you have visited the rainforest), please hand the envelope to the driver at the end of the day.

If you do not have time to complete the survey during the tour, your extra effort in completing and returning the survey soon after your tour is important to the success of this research. You can leave the envelope for posting at reception where you are staying, or put it in a postbox.

Thank you for your time and effort in helping in this research.

Sally Driml
Centre for Resource and Environmental Studies
Australian National University
Canberra ACT 0200

Date of tour ________

Tour name ____

Q1. Where Do You Live?

TOWN ______________ POSTCODE __ __ __ __

Q2. What were the three main features or attractions that prompted you to come to North Queensland? (For this research, North Queensland is the area from Townsville to Cooktown, including Cairns and the Atherton Tablelands)

____

____

____

Q3. Thinking about when you planned your holiday/trip, how important was the opportunity to visit the rainforest in your decision to visit **North Queensland**?

(Circle number)

1. THE MOST IMPORTANT ATTRACTION
2. ONE OF A NUMBER OF IMPORTANT ATTRACTIONS
3. NOT PARTICULARLY IMPORTANT
4. YOU HAD NOT PLANNED TO VISIT THE RAINFOREST BEFORE COMING TO NORTH QUEENSLAND

The next questions are about today's visit to the rainforest and your holiday/trip travel

Q4. Where did you stay last night? (Circle number)

1. COOKTOWN/BLOOMFIELD
2. CAPE TRIBULATION
3. DAINTREE
4. MOSSMAN
5. PORT DOUGLAS
6. CAIRNS
7. KURANDA
8. TABLELANDS
9. INNISFAIL
10. MISSION BEACH/TULLY
11. CARDWELL
12. INGHAM
13. TOWNSVILLE
14. OUTSIDE NORTH QLD.
15. Other __________

Q5. What type of accommodation did you stay in last night? (Circle number)

1. RENTED HOLIDAY HOUSE/FLAT
2. WITH FRIENDS/RELATIVES
3. MOTEL/RESORT
4. BACKPACKERS/GUESTHOUSE
5. CARAVAN
6. CAMPERVAN
7. TENT
8. OTHER, ____________
9. OWN HOME
10. OWN HOLIDAY HOUSE/FLAT

Q6. What was the cost per night of that accommodation (exclude meals and drinks)?

$ __________

Q7. How many people was that for?

___________ PEOPLE

Q8. Where will you stay tonight? (Circle number)

1. SAME PLACE
2. OTHER, TOWN ___________

Q9. What activities will you participate in today? (Circle all today's activities)

1. SCENIC DRIVING
2. SCENIC VIEWING
3. WALKING (< HALF HOUR)
4. WALKING (HALF TO ONE HOUR)
5. WALKING (> ONE HOUR)
6. PICNICKING /BBQ
7. SWIMMING
8. RIVER OR LAKE CRUISE
9. RAFTING OR KAYAKING
10. CANOEING
11. NATURE STUDY
12. TRAIN RIDE
13. PHOTOGRAPHY
14. OTHER, __________

Q10. How much do you think you will spend altogether on **today's tour**? Please write in the amount spent on each item, **either** by yourself or the total for your group, and the town where you spent the money.

	COST FOR YOURSELF	COST FOR YOUR GROUP	TOWN
TOUR TICKETS			
LUNCH, REFRESHMENTS			
FILM			
SOUVENIRS, SHOPPING			
SPECIAL EQUIPMENT (EG. HAT, BINOCULARS)			

Q11. How many days away from home will you spend on this entire holiday/trip?

______ DAYS

Q12. How many days will you spend in North Queensland (between Townsville and Cooktown) on this holiday/trip?

______ DAYS

Q13. If you will visit other main destinations on this holiday/trip, what are they and how many days will you be staying in each?

MAIN DESTINATIONS (EG. BRISBANE	DAYS 4 DAYS)

Q14. What transport did you use to travel from your home to North Queensland?

1. PRIVATE MOTOR VEHICLE ⇒ GO TO Q16
2. HIRED MOTOR VEHICLE ⇒ GO TO Q16
3. AEROPLANE
4. TRAIN
5. BUS ⇒ GO TO Q18, NEXT PAGE
6. ORGANISED COACH TOUR
7. OTHER __________
8. MORE THAN ONE OF THE ABOVE MODES ⇒ GO TO Q15

Q15. If more than one mode of transport was used, please give details of the transport used, starting from your home
(Example, Home to Brisbane by aeroplane)

_____________ to _______________ by _____________
_____________ to _______________ by _____________
_____________ to _______________ by _____________

If your transport included private or hired motor vehicle, please go to Q16, otherwise go to Q18.

Q16. How many people including yourself travelled in the vehicle?

OVER 15 YEARS AGE ____
UNDER 15 YEARS AGE ____

Q17. What is the make and model and year of manufacture of the vehicle?

MAKE AND MODEL ___________________ YEAR ___________

Q18. Please think about your holiday/trip in **North Queensland** and fill out the table below as best you can.

What day of your time in North Queensland is it today?
DAY NUMBER _____ (CIRCLE NUMBER ON TABLE)

Starting with the first day, please write in the main sites visited or activities you have already undertaken.

Please write in what you plan to do on each of the future days. *If you do not have definite plans for the rest of your holiday/trip, please answer Question 19 below.*

For all days with visits to rainforest, please circle if by private/hire car or by tour.
(Circle number)

DAY	SITES AND ACTIVITIES (EG. CAIRNS AND GREEN ISLAND)	TRAVEL TO RAINFOREST
1		1. CAR 2. TOUR
2		1. CAR 2. TOUR
3		1. CAR 2. TOUR
4		1. CAR 2. TOUR
5		1. CAR 2. TOUR
6		1. CAR 2. TOUR
7		1. CAR 2. TOUR
8		1. CAR 2. TOUR

DAY	SITES AND ACTIVITIES (EG. CAIRNS AND GREEN ISLAND)	TRAVEL TO RAINFOREST
9		1. CAR 2. TOUR
10		1. CAR 2. TOUR
11		1. CAR 2. TOUR
12		1. CAR 2. TOUR
13		1. CAR 2. TOUR
14	*(more space on back page)*	1. CAR 2. TOUR

Q19. If you do not have definite plans for the rest of your holiday/trip.
Do you think you will visit the rainforest in North Queensland again on this holiday/trip?

1. YES ⇒ GO TO Q20
2. NO ⇒ GO TO Q21
3. DON'T KNOW ⇒ GO TO Q21

Q20. If yes, on how many days are you likely to visit rainforest sites in North Queensland?

_____ DAYS

Q21. So, in total, on how many days do you think you will visit rainforest sites in North Queensland on this holiday/trip?

_____ DAYS

The next questions seek your opinions on your visit to the rainforest

Q22. Have you enjoyed your visit to rainforest sites today? (Circle number)

1. EXTREMELY SATISFIED
2. VERY SATISFIED
3. SATISFIED
4. NO OPINION
5. UNSATISFIED

Q23. Thinking about rainforest sites, what were the aspects that MOST ADDED to the satisfaction derived from your visit?

____

____

Q24. What were the aspects of rainforest sites that MOST DETRACTED from the satisfaction derived from your visit?

____

____

Q25. Have you visited the rainforest before, on a previous holiday/trip to North Queensland? (Circle number)

1. YES
2. NO

Finally, some questions about yourself, for statistical purposes

Q26. What is your gender? (Circle number)

1. MALE
2. FEMALE

Q27. What is your age group? (Circle number)

1. 15-19
2. 20-29
3. 30-39
4. 40-49
5. 50-59
6. 60-69
7. 70+

Q28. What was your **household** income last year **before** tax? (Circle number)

1. \$0-\$5000
2. \$5001-\$15,000
3. \$15,001-\$25,000
4. \$25,001-\$35,000
5. \$35,001-\$45,000
6. \$45,001-\$55,000
7. \$55,001-\$65,000
8. \$65,001-\$75,000
9. \$75,000+

Q29. What is the highest level of formal education you have completed so far? (Circle number)

1. PRIMARY
2. SECONDARY
3. TECHNICAL/APPRENTICESHIP
4. UNIVERSITY DEGREE
5. UNIVERSITY POSTGRADUATE DEGREE

Q30. What kind of work do you do? (Circle number)

1. PROFESSIONAL AND TECHNICAL
2. ADMINISTRATIVE, EXECUTIVE, MANAGER
3. CLERICAL
4. SALES
5. FARMER, FISHER, TIMBERWORKER
6. TRANSPORT AND COMMUNICATION
7. TRADE, PRODUCTION PROCESS WORK
8. SERVICE, SPORT AND RECREATION
9. HOME DUTIES
10. RETIRED
11. UNEMPLOYED
12. STUDENT

Q31. Do you have any comments you wish to make about the rainforest or its management?

Thank you for completing the survey

Please place the form in the reply paid envelope and hand it to the driver.

If you complete the survey after you leave the tour, please place the form in the reply paid envelope and leave it for posting at reception where you are staying, or put it in a postbox.

Rainforest Visitor Survey
Overseas Private Visitors

Date ________ Time ________ Location ____________

Respondent Number 3 _ _ _ _ Gender M F Interviewer ____

Q1. Where Do You Normally Live?

COUNTRY ______________

Q2. What were the three main features or attractions that prompted you to come to **Australia**?

____

____

____

Q3. What were the three main features or attractions that prompted you to come to **North Queensland**? (For this research, North Queensland is the area from Townsville to Cooktown, including Cairns and the Atherton Tablelands)

____

____

____

Q4. Thinking about when you planned your holiday/trip, how important was the opportunity to visit the rainforest in your decision to visit **North Queensland**? (Circle number)

1. THE MOST IMPORTANT ATTRACTION
2. ONE OF A NUMBER OF IMPORTANT ATTRACTIONS
3. NOT PARTICULARLY IMPORTANT
4. YOU HAD NOT PLANNED TO VISIT THE RAINFOREST BEFORE COMING TO NORTH QUEENSLAND

Q5. Still thinking about when you planned your holiday/trip, how important was the opportunity to visit the North Queensland rainforest in your decision to visit **Australia**? (Circle number)

1. THE MOST IMPORTANT ATTRACTION
2. ONE OF A NUMBER OF IMPORTANT ATTRACTIONS
3. NOT PARTICULARLY IMPORTANT
4. YOU HAD NOT PLANNED TO VISIT THE RAINFOREST BEFORE COMING TO AUSTRALIA

The next questions are about today's visit to the rainforest and your holiday/trip travel

Q6. What kind of group are you holidaying with? (Circle one)

1. BY YOURSELF
2. COUPLE
3. FAMILY
4. FRIEND(S)
5. FAMILY AND FRIEND(S)
6. organised group

Q7. How many people **including yourself** in your group are:

OVER 15 YEARS AGE _____

UNDER 15 YEARS AGE _____

Q8. Where did you stay last night?

TOWN ____________

Q9. Where will you stay tonight?

1. SAME PLACE
2. OTHER, TOWN ____________

Q10. What sites are you visiting today and what route are you taking?

____
____
____

Q11. What activities will you participate in today? (Circle all today's activities)

1. SCENIC DRIVING
2. SCENIC VIEWING
3. WALKING (< HALF HOUR)
4. WALKING (HALF TO ONE HOUR)
5. WALKING (> ONE HOUR)
6. PICNICKING /BBQ
7. SWIMMING
8. RIVER OR LAKE CRUISE
9. RAFTING OR KAYAKING
10. CANOEING
11. NATURE STUDY
12. TRAIN RIDE
13. PHOTOGRAPHY
14. OTHER, _________

Q12. How did you get to this site today?

1. PRIVATE MOTOR VEHICLE ⇒*ASK 13*
2. HIRED MOTOR VEHICLE ⇒*ASK 13*
3. MOTOR CYCLE
4. WALK
5. OTHER

Q13. If your drove by private or hired motor vehicle, what is the make and model and year of manufacture ? Please be as specific as possible.

MAKE AND MODEL ____________________ *YEAR* ____________

Q14. How much do you think you will spend altogether on **today's trip**? Please look at the **card** and tell me the amount spent on each item, **either** by yourself or the total for your group, and the town where you spent the money.

	COST FOR YOURSELF	COST FOR YOUR GROUP	TOWN
PETROL			
HIRE CAR			
TOUR TICKETS			
LUNCH, REFRESHMENTS			
FILM			
SOUVENIRS, SHOPPING			
SPECIAL EQUIPMENT (EG. HAT BINOCULARS)			

Q15. What type of accommodation did you stay in last night?

1. WITH FRIENDS/RELATIVES
2. RENTED HOLIDAY HOUSE/FLAT
3. MOTEL/RESORT
4. BACKPACKERS/GUESTHOUSE
5. CARAVAN
6. CAMPERVAN
7. TENT
8. OTHER ______________
9. OWN HOME
10. OWN HOLIDAY HOUSE/FLAT

Q16. What was the cost per night of that accommodation (exclude meals and drinks)? $ _____

Q17. How many people was that for? _______ PEOPLE

Q18. How many days away from home will you spend on this entire holiday/trip? _______ DAYS

Q19. What countries will you visit on this holiday/trip? _______________ _______________ _______________

Q20. How many days will you spend in Australia? _______ DAYS

Q21. How many days will you spend in North Queensland (between Townsville and Cooktown) on this holiday/trip? _______ DAYS

Q22. What other main destinations will you visit in Australia? _______________ _______________ _______________

Q23. Of the days you will spend in North Queensland, which day is it today? DAY NUMBER ___

Q24. How many days so far, **including today**, have you visited rainforest sites in North Queensland? _______ DAYS

Q25. On how many days of the rest of your time in North Queensland do you plan to visit rainforest sites? _______ DAYS

Q26. So how many days in total do you think you will visit rainforest sites in North Queensland? _______ DAYS

The next questions seek your opinions on your visit to the rainforest

Q27. Have you enjoyed your visit to rainforest sites today?

1. EXTREMELY SATISFIED
2. VERY SATISFIED
3. SATISFIED
4. NO OPINION
5. UNSATISFIED

Q28. Thinking about rainforest sites, what were the aspects that MOST ADDED to the satisfaction derived from your visit?

____

____

Q29. What were the aspects of rainforest sites that MOST DETRACTED from the satisfaction derived from your visit?

____

Q30. Have you visited the rainforest before, on a previous holiday/trip to North Queensland?

1. YES
2. NO

Q31. Suppose there were a fee for visiting rainforest sites, to pay for park management. How much would you be willing to pay for each day, with access to as many sites as you wanted.

AUS$ ________________ (CHECK CURRENCY)

Q32. Do you think there should be such a fee?

1. YES
2. NO

WHY? ____________________________________

Q33. Finally, for statistical purposes, what is your age group?
Please look at the card and give the number of the closest answer. _______

Q34. Do you have any comments you wish to make about the rainforest or its management?

____

____

____

____

Thank you very much for completing this survey.

4____

Rainforest Visitor Survey

Visitors who live Overseas

This yellow survey form is for visitors who live overseas.
Visitors who live in Australia, please fill out the white survey form.
Please fill out one form per group of family or friends travelling together.

Dear Visitor,

The managers of the Wet Tropics World Heritage Area rainforest.want to strike the right balance between providing for the enjoyment of visitors and protection of the natural environment. Knowing about the travel behaviour and opinions of visitors is an important part of the information managers need. As a visitor to the rainforest, your participation in this survey is very valuable.

The survey should take around 10 minutes to complete. Your anonymity will be ensured. There is no need to put your name on the form. Please place it in the reply paid envelope and seal it when you have finished.

If you have time to complete the survey during the tour, (best in the afternoon, after you have visited the rainforest), please hand the envelope to the driver at the end of the day.

If you do not have time to complete the survey during the tour, your extra effort in completing and returning the survey soon after your tour is important to the success of this research. You can leave the envelope for posting at reception where you are staying, or put it in a postbox.

Thank you for your time and effort in helping in this research.

Sally Driml
Centre for Resource and Environmental Studies
Australian National University
Canberra ACT 0200

Date of tour ________

Tour name ____

Q1. Where Do You Live?

COUNTRY ______________

Q2. What were the three main features or attractions that prompted you to come to **Australia**?

____
____
____

Q3. What were the three main features or attractions that prompted you to come to **North Queensland**? (For this research, North Queensland is the area from Townsville to Cooktown, including Cairns and the Atherton Tablelands)

____
____
____

Q4. Thinking about when you planned your holiday/trip, how important was the opportunity to visit the rainforest in your decision to visit **North Queensland**?

(Circle number)

1. THE MOST IMPORTANT ATTRACTION
2. ONE OF A NUMBER OF IMPORTANT ATTRACTIONS
3. NOT PARTICULARLY IMPORTANT
4. YOU HAD NOT PLANNED TO VISIT THE RAINFOREST BEFORE COMING TO NORTH QUEENSLAND

Q5. Still thinking about when you planned your holiday/trip, how important was the opportunity to visit the North Queensland rainforest in your decision to visit **Australia**?

(Circle number)

1. THE MOST IMPORTANT ATTRACTION
2. ONE OF A NUMBER OF IMPORTANT ATTRACTIONS
3. NOT PARTICULARLY IMPORTANT
4. YOU HAD NOT PLANNED TO VISIT THE RAINFOREST BEFORE COMING TO AUSTRALIA

The next questions are about today's visit to the rainforest and your holiday/trip travel

Q6. What kind of group are you holidaying with? (Circle number)

1. BY YOURSELF
2. COUPLE
3. FAMILY
4. FRIEND(S)
5. FAMILY AND FRIEND(S)
6. ORGANISED GROUP

Q7. How many people **including yourself** in your group are:

OVER 15 YEARS AGE _____
UNDER 15 YEARS AGE _____

Q8. Where did you stay last night? (Circle number)

1. COOKTOWN/BLOOMFIELD
2. CAPE TRIBULATION
3. DAINTREE
4. MOSSMAN
5. PORT DOUGLAS
6. CAIRNS
7. KURANDA
8. TABLELANDS
9. INNISFAIL
10. MISSION BEACH/TULLY
11. CARDWELL
12. INGHAM
13. TOWNSVILLE
14. OUTSIDE NORTH QLD.
15. OTHER ___________

Q9. What type of accommodation did you stay in last night? (Circle number)

1. RENTED HOLIDAY HOUSE/FLAT
2. WITH FRIENDS/RELATIVES
3. MOTEL/RESORT
4. BACKPACKERS/GUESTHOUSE
5. CARAVAN
6. CAMPERVAN
7. TENT
8. OTHER, _______________

Q10. What was the cost per night of that accommodation (exclude meals and drinks)?
$_____

Q11. How many people was that for?

_______ PEOPLE

Q12. Where will you stay tonight? (Circle number)

1. SAME PLACE
2. OTHER, TOWN ______________

Q13. What activities will you participate in today? (Circle all today's activities)

1. SCENIC DRIVING
2. SCENIC VIEWING
3. WALKING (< HALF HOUR)
4. WALKING (HALF TO ONE HOUR)
5. WALKING (> ONE HOUR)
6. PICNICKING /BBQ
7. SWIMMING
8. RIVER OR LAKE CRUISE
9. RAFTING OR KAYAKING
10. CANOEING
11. NATURE STUDY
12. TRAIN RIDE
13. PHOTOGRAPHY
14. OTHER, _________

Q14. How much do you think you will spend altogether on **today's tour**? Please write in the amount spent on each item, **either** by yourself or the total for your group, and the town where you spent the money.

	COST FOR YOURSELF	COST FOR YOUR GROUP	TOWN
TOUR TICKETS			
LUNCH, REFRESHMENTS			
FILM			
SOUVENIRS, SHOPPING			
SPECIAL EQUIPMENT (EG. HAT, BINOCULARS)			

Q15. How many days away from home will you spend on this entire holiday/trip? _______ DAYS

Q16. What countries will you visit on this holiday/trip? _______________
____
____

Q17. How many days will you spend in Australia? _______ DAYS

Q18. How many days will you spend in North Queensland (between Townsville and Cooktown) on this holiday/trip? _______ DAYS

Q19. What other main destinations will you visit in Australia? _______________
____
____

Q20. Of the days you will spend in North Queensland, which day is it today? DAY NUMBER ____

Q21. How many days so far, **including today**, have you visited rainforest sites in North Queensland? _______ DAYS

Q22. On how many days of the rest of your time in North Queensland do you plan to visit rainforest sites? _______ DAYS

Q23. So how many days in total do you think you will visit rainforest sites in North Queensland? _______ DAYS

The next questions seek your opinions on your visit to the rainforest

Q24. Have you enjoyed your visit to rainforest sites today? (Circle number)

1. EXTREMELY SATISFIED
2. VERY SATISFIED
3. SATISFIED
4. NO OPINION
5. UNSATISFIED

Q25. Thinking about rainforest sites, what were the aspects that MOST ADDED to the satisfaction derived from your visit?

____
____

Q26. What were the aspects of rainforest sites that MOST DETRACTED from the satisfaction derived from your visit?

____
____

Q27. Have you visited the rainforest before, on a previous holiday/trip to North Queensland? (Circle number)

1. YES
2. NO

Q28. Suppose there were a fee for visiting rainforest sites, to pay for park management. How much would you be willing to pay for each day, with access to as many sites as you wanted.

AUS$ ________________

Q29. Do you think there should be such a fee? (Circle number)

1. YES
2. NO

WHY? ____

Finally, some questions about yourself, for statistical purposes

Q30. What is your gender? (Circle number)

1. MALE
2. FEMALE

Q31. What is your age group? (Circle number)

1. 15-19
2. 20-29
3. 30-39
4. 40-49
5. 50-59
6. 60-69
7. 70+

Q32. Do you have any comments you wish to make about the rainforest or its management?

____

____

____

____

Thank you for completing the survey

Please place the form in the reply paid envelope and hand it to the driver.

If you complete the survey after you leave the trip, please place the form in the reply paid envelope and leave it for posting at reception where you are staying, or put it in a postbox.

APPENDIX F
PRODUCERS' SURPLUS

The economic measure of the benefits of tourism to the Wet Tropics WHA is the combined consumers' surpluses and producers' surpluses generated by visits to the area. Producers' surplus may be generated in relation to the provision of commercial tourism services in the Wet Tropics WHA. Whether or not any producers' surplus will be generated depends upon conditions of the market for tourism services. In this appendix, the concept of producers' surplus will be illustrated and the general conditions for generation of surpluses descried. The various sub-sectors of the commercial tour industry are investigated in order to assess whether it is likely that producers' surplus is being generated.

AF.1 WHAT IS PRODUCERS' SURPLUS?

The surplus accruing to an individual firm is termed 'producer's surplus' while the sum of surpluses accruing across an industry is termed 'producers' surplus'.

Any producer's surplus accruing to an individual firm is the area above the supply curve and below the market price. This represents benefits to the firm that is willing to supply goods at the price indicated by the supply curve but actually receives the market price for the good. The amount of producer's surplus obviously depends upon the relationship between the market price and the supply curve. It is most advantageous for firms to supply where price equals marginal cost and therefore the supply curve for a rational firm is its marginal cost curve. In the short run, it is assumed that factors of production are in fixed supply. The firm's supply curve is the upward sloping part of the marginal cost curve, where it lies above the average variable cost curve. In the long run, factors of production are not fixed in supply and for an individual firm, the supply curve is the upward sloping part of the marginal cost curve that lies above the long run average cost curve (Varian 1993).

Producers' surplus generated for an industry is dependant upon the relationship between the market price and the industry supply curve. An industry supply curve is the horizontal sum of the supply curves of individual firms. In the short run, the industry supply curve can be relatively steep because the factors of production in fixed supply constrain production. In the long run, where factors of production are not fixed in supply and firms can enter (and exit) the industry, the industry supply curve becomes flatter.

There is a relationship between producers' surplus and economic profits and between producers' surplus and economic rent. It is possible to describe how market conditions will affect the size of profits or rents arising and thus give an indication of how market conditions will affect producers' surplus arising. The concepts of profits and rents and their relationship to producers' surplus are first discussed.

'Economic profit' is any returns made above returns to factors of production that reflect the opportunity cost of those factors. The opportunity cost of capital, for example, is the rate of return it would make if invested in a standard instrument such as government bonds. Profits are related to producers' surplus. Profits are total revenues minus total costs whereas producers' surplus is total revenues minus variable costs (or alternatively, profits plus fixed costs) (Varian 1993). It follows that the greater the profits the greater the producers' surplus, but also that producers' surplus may arise even if profits are zero.

Even in the long run, some factors of production may be in fixed supply - due to genuine scarcity or to legal restrictions on use. 'Economic rent' is the term given to the return to a factor of production fixed in supply. It is the rate at which the particular factor of production would rent for in a competitive market. For example, consider that the particular factor of production in fixed supply is natural environment sites for tourism (due to scarcity of suitable sites or government planning restrictions). The economic rent for those sites is the minimum amount it would be necessary to pay for a site being used for tourism in order to drive profits to zero (whether actual payment for use of the site is required or not). Economic rent to a fixed factor of production will be the same as producers' surplus to the extent that it is the only fixed factor. Under conditions where there is economic rent accruing, the potential distribution of rent may influence the behaviour of firms as they attempt to secure these benefits (Varian 1993).

The likely amount of producers' surplus generated in an industry, such as the tourist industry dependant on the Wet Tropics WHA, will be influenced by a number of factors, including the degree of competitiveness in markets, scarcity of resources and property rights regimes. Each of these factors are discussed briefly.

The degree of competitiveness in markets will affect the extent to which economic profits may be earned, and thus the amount of producers' surplus arising. Four types of market conditions and their relationships with profits are described briefly here. The conditions for competition can range between perfect competition and monopoly, and the in-between conditions can be described as monopolistic competition and oligopoly.

Under perfect competition, there are (a) a large number of buyers and sellers (b) an homogenous product (c) freedom of entry and exit from a market and (d) perfect information (of other parts of the market) (Baumol et al 1988). Under perfect competition, no economic profits are earned by firms as the ability of free entry and exit means that if firms begin to earn economic profits, other firms will enter the market and compete them away. The homogenous nature of the product means the demand curve faced by individual firms is horizontal. Industry supply and demand curves are sloping but relatively flat. The amount of producers' surplus arising will be limited as new firms can enter the market and keep the supply curve relatively flat.

By contrast, under conditions of monopoly, the monopolist earns economic profit. Monopolies are characterised by (a) a single seller of a homogenous product (b) no close substitutes (c) barriers to entry to the industry (Calvo & Waugh 1977). The barriers may include (i) legal restrictions (ii) patents (iii) control over source of input. In addition, technical superiority and economies of scale may give firms the ability to achieve monopoly status (Baumol et al 1988). Monopoly producers can restrict supply and force up price and profit. They can do this because they face a negative sloping demand curve, which is above their marginal revenue curve. The maximum profit can be earned by producing where marginal revenue equals marginal cost. Because the price is set at above the marginal cost curve, profits and producers' surplus for those units supplied are higher than in a competitive market (and consequently consumers' surplus is reduced).

Most actual market conditions fall somewhere in between these extremes. Monopolistic competition occurs under conditions only slightly different from perfect competition - where products are similar, but able to be differentiated. Tours provided by different tour companies can fall into this category. Monopolistic competition is often distinguished from perfect competition by advertising aimed at promoting the difference between products. Under conditions of monopolistic competition, economic profits may arise in the short run, as firms act like monopolies. However, freedom of entry and exit by firms that offer similar products which are substitutes, means that there will be no economic profits in the long run. The point where marginal revenue equals marginal cost, the point of efficient production for the industry, is also the point where in the long run, the negative sloping demand curve is tangential to the negative sloping portion of the average cost curve. This is not at the point where average cost is at a minimum as for perfect competition. Monopolistic competition is therefore often characterised by excess capacity.

Oligopolies are characterised by few sellers. Products may be homogenous (perfect oligopoly) or heterogenous (imperfect oligopoly). There is a variety of outcomes possible in markets with oligopoly conditions and no standard answer exists to the question of whether or not economic profits will arise. It depends on whether there is collusion between sellers, and in the absence of collusion, on chance outcomes of the strategies adopted by each seller. The strongest form of collusion is a cartel, where sellers collude to fix the price in order to earn economic profit. Oligopoly conditions occur where entry is difficult, hence there are few sellers. The extent to which firms in markets with oligopoly or monopoly conditions can act to maximise profits can be dependant on the contestability of the market. If the potential exists for other firms to enter and exit, this in theory, is an incentive for firms in the market to moderate their profit maximising behaviour (Baumol et al 1988).

Where factors of production are scarce in supply, economic rent will arise. The scarcity can result from genuine limits in the extent of the resource, such as attractions like Mossman Gorge. Scarcity can also arise where regulations limit access to resources. In protected areas there may be regulations limiting access, for environmental protection reasons, to types of sites in limited supply. The tour operators who have a right to visit sites where access is limited can benefit from the economic rent arising, if they are permitted by public or private owners of the resource to keep that rent themselves. Generally the benefit is realised on the sale of an access right such as a permit or on sale of the tour business. Owners will only reap the benefits for themselves if they charge for access, via a fee or auctioning or selling rights. The potential to secure economic rent will influence the behaviour of firms, termed 'rent seeking', as they try to secure the surplus. If economic rent is a feature of a resource using industry, it should be counted as a benefit, no matter to whom it is accruing.

The first few firms that utilise a resource that is in limited supply are able to secure economic rent. However, unless a system of property rights is established to provide secure and limited access to the resource, the rent may be dissipated by over investment. An open access resource will attract new entrants as long as economic profit is seen to be made. However, because none of the firms have secure rights of access to the resource, for every new entrant, the level of competition for access between all participating firms increases. This can lead to over investment - in equipment designed to make each operator more competitive - occurring quite rapidly across the industry. Over investment can lead to negative returns and therefore reduce the potential for the industry to generate economic rent or producers' surplus. If the over investment is accompanied by a level of use that exhausts renewable resources, it may not be possible for the previously earned amount of economic rent and producers surplus to be recovered, even if firms exit the industry (unless the price rises due to scarcity). It is possible for a resource to be open access in effect even if a permit system is in operation, if there is no attempt to limit the number of operators or their capacity. The effect of a property rights system is therefore to allow economic rent and therefore producers' surplus to arise, while a lack of defined property rights can lead to dissipation of economic rent.

Analysing market conditions can give an indication of whether or not profit or rent are likely to be accruing and therefore an idea of the possible situation as to producers' surplus accruing. However as it is possible for producers' surplus to accrue even if economic profits are zero, the only way to really determine the level of producers' surplus is to calculate it from empirical data.

The theory indicates that to calculate producer's surplus for an individual firm, it is necessary to model the marginal cost curve and then to sum the differences between marginal coat and market price up to the point where these become equal. In order to model the marginal cost curve, information is needed on the total cost of production for different quantities produced, as marginal cost is the change in total cost with each extra unit produced. Total costs should be measured in terms of economic costs, shadow priced if necessary.

While it is often possible to observe costs of production at the current level of production for a firm, it is more difficult to obtain data on production costs across the range that would be necessary to construct a marginal cost curve. To obtain an accurate estimate of producers' surplus for an industry would require construction of in industry supply curve via adding supply curves for individual firms or by estimating a typical supply curve with data for a number of similar firms. The entire exercise is obviously quite data intensive.

AF.2 COMMERCIAL TOURISM ASSOCIATED WITH THE WET TROPICS WHA

In this section, several sub-sectors of the commercial tourism industry supported by the Wet Tropics WHA are discussed in terms of the market conditions in each sector. A brief investigation of these sub-sectors was undertaken in order look for conditions that might indicate different outcomes with respect to producers' surplus for different sub-sectors of the industry, and assess the practicality of estimating producers' surplus for the sub-sectors. Information for this section was compiled from interviews conducted in 1994 and 1995 with commercial tour operators and Wet Tropics WHA land managers, and from some published sources.

The industry dependant on the Wet Tropics WHA can initially be divided between tours operating within the Wet Tropics WHA and operations outside the WHA. Tours can be classified into a number of sub-sectors, as will be shown. Operators outside the Wet Tropics WHA can be divided into any whose entire revenue is dependant on visitors to the Wet Tropics WHA and those where only a part of the revenue is so dependant. For the purposes of this exercise, the tour sector has been classified into five sub-sectors and all non tour operators are treated together. The description attempts to investigate the conditions for the presence of producers' surplus by reference to the degree of competition, scarcity of 'sites' and property rights regimes.

Small sized tours to the Daintree River and Cape Tribulation.
This market is characterised by the largest number of individual tours to any 'site' in the Wet Tropics WHA. Tours to the Daintree River and Cape Tribulation stop at a number of sites including Mossman Gorge, a Daintree River cruise and various sites along the road from the Daintree River to Cape Tribulation (many of which are in the Daintree National Park), as described in Chapter 4. In 1994, visitors had a choice of 30 different day trips offered daily and 4 day trips offered regularly, run by 28 companies. In addition 6 overnight tours were offered. The history of this tour market has been for rapid growth from the late 1980s.

In 1994, all tour operators entering a National Park required a permit from the Department of the Environment Heritage (DEH). There were limits placed on the size of vehicles that can be taken to National Park sites in this area, the upper limit was a 22 seater bus. Only since 1994 has the road to Cape Tribulation been improved with progressive sealing, facilitating the use of small busses which hold more passengers than the 4WD vehicles previously required. The 4WD vehicles which continued to be used ranged from a capacity of 4 to 14 passengers. Until March 1994, there were no limits placed on entry to the market for environmental reasons. Although a permit was required to operate a tour, these were issued as required, subject to assessment of the ability of the operator to provide what was promised (and compliance to Department of Transport requirements for safety etc.). The result of this approach to permit issue was that the total capacity permitted on these tours grew to around 484 000 passengers per annum. Actual use was 82 890 people visiting the Daintree River to Cape Tribulation area of the Daintree National Park on commercial tours in 1994 (DEH unpublished data, 1995).

In March 1994, there was a change in government policy on access due to concerns that actual use in peak season was close to some notion of carrying capacity, for both environmental reasons and because of perceived crowding at some sites. There was alarm over the realisation that the permitted level of use was much higher than actual use. A moratorium was placed on the issue of new permits. Restrictions extended to existing permits, allowing no increase in the total number of visitors, no additional visits to sites that have not been hardened, and no increase in the number of vehicles per permit unless this is of demonstrated benefit to management (G. Kelly, DEH, pers. comm. 1995). These conditions are still in place. A 'claw back' of capacity has been proposed, whereby capacity not demonstrated to have been used would be surrendered. Although the legislation states that permits are not transferable, they have generally been issued on sale of a business. Operators interviewed were of the opinion that permits were effectively transferable, one having gone to the extent of getting a legal opinion to that effect.

Until March 1994, the situation was very much monopolistic competition. Entry into the industry was easy, as the issue of permits was effectively not restricted and the investment required was relatively small. A tour business need only be comprised of one vehicle and one driver/guide, with support required for bookings, advertising and maintenance. The tour operators offered similar tours but attempted to differentiate. In their advertising brochures, operators attempted to say why their tour is different to, and better than, other tours, but actually each brochure listed a large number of features which were generically identical to all other tours. All operators promised an authentic and educational rainforest experience. Some operators promised relative luxury, some promised a 4WD adventure, some promised exclusive use of sites and some advertised a budget trip. There was some price differentiation dependant on the number of extras such as lunch and entry to interpretive centres included. Trips ranged in price from $59 to $145.

The conditions of such a market indicate that there will be no economic profit. Furthermore, the permits system up until March 1994 did not effectively establish property rights since permit issue was not restricted. Although the availability of sites in the area is ultimately restricted, the level of investment and competition due to the open access nature of the resource had the potential to dissipate any economic rent that may arise due to scarcity.

The researcher conducted in-depth interviews with a number of operators in 1994 and 1995. They told of very aggressive competition and low returns. It was obvious that some firms were making losses. The seasonally of the market meant that the capacity needed to meet peak season demand was not used in much of the year, and that was one cause of losses. The researcher collected cost of production information from some operators and had access to financial statements of some. This information confirmed that it was unlikely that economic profits were being made by any operators. It was obvious that some operators were in the industry for lifestyle reasons rather than strictly business considerations.

With a limit on access, since March 1994, the potential exists for an oligopoly to develop. In the longer run, the potential exists for economic rents to be earned. To the end of 1995, however, all the evidence was that the monopolistic competition situations still pertained and earnings were similar to before the moratorium. It is likely over time that the number of businesses will reduce with more successful operators taking over those who are struggling. There is some evidence of this happening already. If any price for expected future economic rent is being built into the price of businesses (and effectively permits) for sale, this is not being captured by government. Evidence was not able to be obtained for the price placed by operators on permitted capacity.

It seems that any potential economic profits and/or rents in recent years will have been dissipated due to competition and seasonal excess capacity.

Coach tours of Kuranda and the Atherton Tablelands

Standard size coaches are employed by companies which provide tours of Kuranda and the Atherton Tablelands, often in association with the Kuranda Train or Skyrail. There are four companies which run standard size coaches and these companies all run several coaches. This sub-market has grown in tandem with overall visitor growth to the region. Some of the companies are local and have developed from a start with one vehicle while others are associated with national operations. All the companies have the ability to divert vehicles to other uses during the seasons with lower visitor numbers. All companies advertise to establish the difference between themselves and the other companies, but the products and prices are very similar. The price of these trips is lower than the Cape Tribulation trips and this is one basis on which this sub-market attracts customers.

There are no size limitations on vehicles that can be taken to Wet Tropics WHA on the routes taken on the Atherton Tablelands. In recent years, access to some sites has been rationed amongst tours to a specific time period, but there are no overall access limits. There exist a number of substitute sites to sites currently visited. Entry to the industry is not limited in any way by the land management agencies and a new operator with a coach could compete with existing businesses. It may be difficult for a new business without a capital base to compete across the range with the established companies with multiple coaches and established booking networks.

It is difficult to diagnose whether this market is monopolistic competition or an oligopoly. However it is still a contestable market and that would limit the likelihood of economic profits being earned. The researcher did not gain access to the financial statements of operators in this sector. It appears however that genuine competition is occurring and unlikely that economic profits are being earned. It is not possible to judge, from the information available, the level of producers' surplus that may be arising in this sub-sector.

Whitewater rafting

The whitewater rafting industry was established in the early 1980s on the Tully River by one company, but another soon set up on the Tully also. These two companies dominate the rafting market. They have exclusive commercial access to the Tully River which remains the premier rafting site. The number of passengers taken annually on the Tully River has expanded dramatically. The two main companies have expanded on to other rivers and two other companies run smaller operations on other rivers.

There is currently an upper limit placed by the Department of the Environment (DoE, formerly the DEH) on the number of passengers able to be taken on the Tully river on any day, and a moratorium on issuing permits to additional firms, pending the outcome of a study to set carrying capacity and access conditions. In particularly dry seasons, the number of passengers able to be taken on the Tully or the Barron rivers is limited by releases of water from the water storage facilities which are upstream of the rafting sites. Rafting companies pay for water releases where there is an opportunity cost in terms of power generation.

The rafting industry is clearly an oligopoly market. The two dominant companies offer virtually identical tours. Entry is limited by government policy on access. There are no real substitute sites to the Tully River that provide the quality of whitewater rafting. The two dominant companies have made sufficient returns over the years to expand their operations in size. Whether they are making economic profits is difficult to establish. The researcher did not gain access to financial data of the companies. There seems to be a high degree of competition between the two companies. Yet there is co-operation between the companies and land managers on matters such as developing strategic plans and the Wet Tropics Ecotourism Strategy. It is in the interests of these companies to have limits placed on visitor numbers both to retain amenity and not to open the market up further.

There is probably some economic profit being earned in this sub-sector and therefore producers' surplus will be arising but it is not possible to quantify the amount.

Kuranda Rail and Skyrail

The Kuranda railway winds through the rainforest from Cairns to the market town of Kuranda. It is run by Queensland Rail and has been primarily a tourist train for some decades. It provides a unique experience and in 1991 carried 276 806 upbound passengers. Until the opening of the privately owned Skyrail cable car in August 1995, the Kuranda rail had a monopoly on 'interesting ways to get to Kuranda'. The only competition was coach tours travelling by road, and many tours combined a one way rail journey with the other leg by coach.

The Skyrail itself provides a unique perspective of rainforest and has attracted large numbers of visitors since its opening. It has the capacity to carry over 800 000 people per year. The two services are complimentary to some extent as the opportunity exists to travel one way to Kuranda by train and the other way by Skyrail. The implications for coach companies are yet to be fully settled.

Both attractions represent considerable capital investment and entry into this market is therefore restricted. The approvals process required for infrastructure in the Wet Tropics WHA is an added barrier to new entrants. It is unlikely that governments will approve further developments similar to Skyrail in the near future. The opening of the Skyrail has broken the monopoly market of the Kuranda railway. The resulting situation is a oligopoly with potential for earning of economic profits. There is however a degree of risk that returns on the large capital investment in Skyrail and on the high running costs for the railway and Skyrail will not be sufficient to meet even normal returns. There is not likely to be a formal cartel arrangement between the public railway and the private cable car company as long as the performance of the railway is under public scrutiny. Queensland Rail has not been operating to restrict total capacity as extra trips are run in the seasons of high visitor numbers. Similarly, there is no evidence that there is any limit being placed on the supply of trips on Skyrail.

Although considerable potential exists for the generation of economic profits in this market, due to the oligopoly situation and the defacto property rights enjoyed by the railway and Skyrail. The researcher did not have access to information to allow an assessment of whether producers' surplus is in fact being generated, but it is likely that this would be so.

Other small tours

All the remaining tour types are included in this category. There are a number of other small tour operators offering a range of day and overnight trips, as described in Chapter 4. Entry to the industry is relatively easy in the sense that the investment required to run a small scale tour is relatively low. Generally, access to sites visited by these operators is not limited by land managers. However, nocturnal wildlife viewing tours do face restrictions on the total number of operators and the number of times each week that individual operators may visit sites. Restrictions were placed on nocturnal wildlife tours from early in the development of this tour type.

This groups of operations would generally tend towards market conditions of monopolistic competition, distinguished from perfect competition by differences in the tours offered. The nocturnal tours may be an exception due to restrictions on access, however, discussions with operators revealed that there is excess capacity for part of the year. It was not possible to assess the producers' surplus arising.

Non tour sector

The non tour sector consists of the diverse range of accommodation and service industries which provide some services to visitors to the Wet Tropics WHA. Some of businesses are very directly related to the commercial tour sector in that tour operators make direct payments to restaurants, interpretive centres and river cruises for services supplied to passengers on tours. The hire car sector is also directly associated with visits to the Wet Tropics WHA. Other services including accommodation, restaurants and retail outlets are supported by people who are visiting the Wet Tropics WHA. The degree to which businesses are dependant upon visitors to the Wet Tropics WHA may be related to proximity to the Wet Tropics WHA, for example businesses north of the Daintree River may be entirely dependant on visitors to the Wet Tropics WHA. However, businesses in Cairns are also supported by tourists who spend some of their visit to North Queensland in visiting the Wet Tropics WHA.

It was beyond the scope of this study to define the businesses which are completely or partially dependant on visitors to the Wet Tropics WHA, to determine which proportion of their business which could be attributed to the presence of the Wet Tropics WHA, and to estimate the producers' surplus accruing to these businesses. It can be observed that there have in the past been no restrictions on entry and exit to the non tour sector but that the capital required to build accommodation establishments in particular is relatively high. The Douglas Shire has recently moved to restrict the construction of new accommodation in the area north of the Daintree river and so economic rents may increase for that area in the future (Brannock Humphries 1994).

AF.3 CONCLUSIONS

For the purposes of this study of the Wet Tropics WHA, it was decided that industry supply curves for the various sub-sectors would be required if producers' surplus were to be estimated with any accuracy. This proved to be beyond the practical scope of this study. The observations presented above revealed that the situation in each industry sub-sector is likely to be different. It is likely that in those sectors where there is strong open competition for access, there may be no producers' surplus arising but that where entry is restricted, operators may be enjoying surpluses.

APPENDIX G

TRAVEL COST ANALYSIS OF AUSTRALIAN TOURISTS TO NORTH QUEENSLAND

This Appendix reports results of TCM analysis applied to the 'travel to North Queensland' component of travel by Australian tourists surveyed for this study. It was decided to look first at the pattern of travel to North Queensland in order to understand this stage of the travel which ultimately resulted in visits to the rainforest of the Wet Tropics WHA. It was considered that this strategy would allow the best approach to analysing travel to the Wet Tropics WHA to emerge. Another reason for looking at travel to North Queensland separately is that one policy option for raising revenue for management of the Wet Tropics WHA (and other natural environment features of North Queensland) is as a general charge on visitors to North Queensland, possibly via a bed tax or arrivals tax (but treated in this Appendix as an 'entry fee'). Thus the consumers' surplus and price elasticity of demand in relation to entry fees is of interest.

AG.1 PATTERNS OF TRAVEL TO NORTH QUEENSLAND

The sample of Australian tourists consisted of 559 records. Each represented a group of people travelling together. The travel pattern for the groups is shown on Table AG.1.

Table AG.1 Travel to North Queensland

Mode of transport to NQ	NQ is sole destination	NQ plus other destinations	Total	Total (%)
Drive to NQ	29	106	135	24.5
Fly to NQ	272	89	361	64.5
Other and multiple modes	16	47	63	11.0
Total	317	242	559	100.0

Based on initial testing of the data, the records for 'other and multiple modes' were excluded from the data set for all subsequent analysis. 'Other and multiple modes' includes travel by train, bus, cruise and yacht, and drive-fly combinations other than flying to Cairns from the airport nearest to home. It has been recommended that TCA be used only for a uniform travel mode (Hanley & Common 1987). By eliminating other and multiple modes, the TCA presented here gets closer to that ideal. The travel pattern to North Queensland is such that it would possibly be misleading to conduct analysis by just one mode. Investigation of drive to North Queensland and fly to North Queensland separately aims to estimate the demand functions for each of these two modes.

The following tables illustrate the travel patterns of those groups represented by the 496 records in the sample for groups which drive to North Queensland and fly to North Queensland.

Table AG.2 Origin of Australian tourists to North Queensland

State	Drive to NQ	Fly to NQ	Drive and Fly
New South Wales	30	118	148
Victoria	25	109	134
Queensland	52	33	85
South Australia	13	39	52
Western Australia	12	39	51
Tasmania	0	8	8
Northern Territory	1	4	5
ACT	2	11	13

Table AG.3 Length of stay in North Queensland (per cent)

Number of days in North Queensland	Drive to NQ	Fly to NQ	Drive and Fly
1 to 7	17.8	39.9	33.9
8 to 14	36.3	51.0	46.9
15 to 21	12.6	6.6	8.3
22 to 28	7.4	0.8	2.6
over 29	25.9	1.7	8.3

Table AG.4 Length of stay in North Queensland as a proportion of days spent at all main destinations (per cent)

Days in NQ as proportion of days spent at all destinations	Drive to NQ	Fly to NQ	Drive and Fly
up to 25%	21.5	1.7	7.1
up to 50%	26.6	9.7	14.5
up to 75%	20.0	6.9	10.3
up to 99%	10.4	6.4	7.4
100%	21.5	75.3	60.7

Table AG.5 Number of Australian tourists represented by the sample

Sample represents	Drive to NQ	Fly to NQ	Drive and Fly
Respondents	135	361	496
Adult tourists	301	734	1035
Adult and child tourists	386	820	1206
Visitor-days	8704	8577	16558

Table AG.6 Size of groups travelling to North Queensland

	Drive to NQ	Fly to NQ	Drive and Fly
Mean	2.85	2.27	2.43
Median	2.00	2.00	2.00
Mode	2.00	2.00	2.00

Table AG.7 Days stay in North Queensland

	Drive to NQ	Fly to NQ	Drive and Fly
Mean	22.55	10.46	13.73
Median	14.00	8.00	10.00
Mode	10.00	10.00	10.00

There is a distinct difference in the pattern of travel by those who drove and those who flew to North Queensland. A larger proportion of drivers were on extended trips with multiple destinations. Three-quarters of those who flew had North Queensland as their sole destination and 90% stayed two weeks or less.

Of the whole sample, 27.2% drove and 72.8% flew to North Queensland. Of the sample, 60% had North Queensland as their sole destination and 80% stayed for two weeks or less. Group size was most often two people, the mean group size was 2.43 people. Three quarters of those who drove to North Queensland visited other destinations on their trip, the proportion was reversed for those who flew to North Queensland. The tourists who visited multiple destinations are termed 'meanderers' in this study.

AG.2 Approach used for Travel Cost Analysis

The TCM is explained in detail in Chapter 8 and the approach described there was adopted for the North Queensland application. In constructing the travel demand function, the options considered for the term on the left hand of the equation were for it to be expressed as either visitor numbers to North Queensland or visitor-days spent in North Queensland. The term on the right hand side of the equation, travel cost, would need to be expressed in equivalent terms to that on the left hand side of the equation. In the case of visitor numbers, the travel cost would be expressed as travel cost for the total number of days spent in North Queensland. In the case of visitor-days, the travel cost would be expressed as travel cost per day spent in North Queensland.

The more conventional approach for the TCM is to use visitor numbers to a site as the measure of demand. This approach was tested first but, as will be seen below, did not result in a travel demand function that was acceptable for use in further analysis. Given this result, two directions were taken in analysis. One approach was to split the sample of people who travelled to North Queensland into sub-groups to test if there were significant relationships between travel cost and demand for: those who drove to North Queensland and those who flew to North Queensland; and those who had North Queensland as their sole destination and the meanderers. The other approach was to test all these possible relationships using visitor-days as the unit of demand.

This led to the generation of several hypotheses for testing, for both visitor numbers and visitor-days[1]:

1. The price elasticity of demand for Australian tourists to NQ is negative and significant.
2. The price elasticity of demand for Australian tourists driving to NQ is negative and significant.
3. The price elasticity of demand for Australian tourists flying to NQ is negative and significant.
4. The price elasticity of demand for Australian tourists whose sole destination is NQ is negative and significant.
5. The price elasticity of demand for Australian tourists who have multiple destinations including NQ is negative and significant.

AG.2.1 Visitor numbers: formulae for analysis

The number of visitors from each zone is the product of the average group size (adults plus children) for the zone and the number of groups in the sample for each zone. The measure V_i/P_i is the observed number of visits per unit of population (P_i) from zone i. The equation for the travel demand function is:

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[1] To test hypotheses 1 to 5, the form for the test is:

H_O: $\beta_1 = 0$

H_A: $\beta_1 < 0$

$V_i/P_i = \alpha + \beta_1 C_i + \beta_2 X_{1i} + \beta_3 X_{2i} + ...$

Where C_i represents NQ_i, the cost of travel to North Queensland. This was calculated for the entire number of days spent in North Queensland, whether visiting rainforest or not. The formulae used were:

Travel cost to North Queensland, per visitor

Travel cost without time, without proportional factor
NQ = (dh*dc + hc + n*al)/g + a

Travel cost without time, with proportional factor
NQ = ((dh*dc + hc + n*al)/g + a)*pf

Travel cost with time, without proportional factor
NQ = (dh*dc + hc + n*al)/g + a + dt + ft

Travel cost with time, with proportional factor
NQ = ((dh*dc + hc + n*al)/g + a + dt + ft)*pf

The variables in this and following equations are listed in the Table AG.8. The approach to calculating variables is given Appendix H.

Table AG.8 Variables used in equations

Symbol	Description of variable
NQ	The cost of travelling to North Queensland
dh	Distance driving from home, return
dc	Driving cost per km (includes fuel cost). Two versions of driving cost are used. dc1 in the cost of driving using the full per km cost of owning an running a vehicle. dc2 is the marginal cost of tyre wear, maintenance and fuel.
hc	Hire car costs
n	Number of nights spent enroute while driving.
al	Accommodation costs last night.
g	Number of adults and children in the group travelling to NQ.
a	Airfare. Two versions of airfare are used. a1 in the equivalent economy class airfare. a2 is the actual airfare paid.
dt	Monetary cost of time spent driving to NQ.
ft	Monetary cost of time spent flying to NQ.
DD	Destination days, days spent at a main destination
daysnq	days spent in North Queensland
pf	proportional factor = daysnq / DD, see below

For meanderers, who made up 40% of the sample, travel cost to North Queensland had to be adjusted to account for visits to other destinations along the way. A proportional factor 'pf' was calculated to represent the number of days spent in North Queensland as a percentage of all days spent at main destinations on this trip. The number of days spent at main destinations was calculated by subtracting the number of days spent driving to North Queensland (or to the airport nearest to home) from total days of the trip. The number of days spent driving was calculated as the return distance from home divided by 700 km, which was the assumed distance travelled each day.

This can be stated as follows:

pf = days spent in NQ / days spent at a main destination (DD)
DD = days on entire trip - days spent driving
days spent driving = return distance from home('dh') / 700 km/day.

Where North Queensland is the sole destination, pf is equal to 1, for meanderers, the pf is less than 1.

This proportional factor was calculated in the absence of good data on the number of days spent at destinations and the number of days spent driving on the whole tour. While this information was sought in the survey, this question often got a poor response due to recall difficulties. The high number of missing values recorded led to creation of this alternative proportional factor.

The direction of any error in the estimation of the proportional factor will be to an underestimate of travel cost to North Queensland for meanderers[2]. This is consistent with the approach taken in this study to take lower rather than higher estimates where there is a choice.

Analysis was conducted both with and without use of the proportional factor. Without the proportional factor, the measure of travel cost is the absolute cost of return travel from home to North Queensland. Travel cost is the same with and without the proportional factor for three-quarters of those who flew and one-quarter of those who drove, that is the 60% of the whole sample who visited North Queensland as their sole destination. Separate analysis of the respondents whose sole destination was North Queensland and meanderers is reported below.

AG.2.2 Visitor-days: formulae for analysis

The measure of visitor-days to North Queensland is obtained by multiplying visitor numbers by the mean number of days spent in North Queensland for each zone. The measure Vd_i/P_i is the observed number of visitor-days per unit of population (P_i) from zone i. The equation for the travel demand function, with visitor-days as the dependant variable is:

$$Vd_i/P_i = \alpha + \beta_1 C_i + \beta_2 X_{1i} + \beta_3 X_{2i} + \ldots$$

Where C_i represents $NQ/daysnq_i$,the cost of travel to North Queensland, per visitor-day. This was calculated as the travel cost to North Queensland (see immediately above) divided by the mean number of days spent in North Queensland for each zone (daysnq).

Travel cost to North Queensland, per visitor-day

Travel cost without time, without proportional factor
NQ/daysnq = [(dh*dc + hc + n*al)/g + a1] / daysnq

Travel cost without time, with proportional factor
NQ/daysnq = [((dh*dc1 + hc + n*al)/g + a1)*pf] / daysnq

Travel cost with time, without proportional factor
NQ/daysnq = [(dh*dc1 + hc + n*al)/g + a1 + dt + ft] / daysnq

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2 Possible underestimation arises from two sources. First, this is likely to be an overestimation of days spent at main destinations as tourists on extended driving holidays are likely to have spent more days driving between destinations than has been allowed for, by travelling distances of less than 700 km per day.. Secondly, the travel cost calculated is the absolute cost of return travel to North Queensland only, and this is likely to be an underestimate of the total costs of travel for those who visited other destinations in addition to North Queensland.

Travel cost with time, with proportional factor
NQ/daysnq = [((dh*dc1 + hc + n*al)/g + a1 + dt + ft)*pf] / daysnq

In addition to the four approaches to calculating travel cost, four combinations of driving and flying costs were tested. There are no hard and fast rules about what choices to make in allocating costs when using the TCM. The use of four approaches to the formulae for travel cost and four combinations of cost items illustrates that variability that can arise within the analysis. The four combinations of driving and flying costs are shown in Table AG.9. Actual airfares paid showed some variation due to the presence of discount fares and a small number of zero fares due to use of 'frequent flyers' bonuses. It was thought useful to also test standard economy class airfares in case the variation in actual airfares prevented the calculation of useful travel demand functions. As will be seen, it was generally the case that similar results were obtained for both airfare alternatives.

Two versions of driving costs were used, the higher being the full per kilometre costs of owning and running a vehicle. The lower cost is the marginal cost of running a vehicle, including tyre wear, repair and maintenance and fuel. The higher cost is the relevant cost where a vehicle is kept solely for the purposes of recreation travel. The lower cost is the relevant cost where a vehicle is kept for daily use and also used for recreation travel. Information was not sought from respondents on the main use of their vehicles.

Table AG.9 Four combinations of driving and flying costs, identified as Travel cost to NQ 1 to 4

Travel cost to NQ 1	Higher driving cost (dc1) and standard economy class airfares
Travel cost to NQ 2	Lower driving cost (dc2) and standard economy class airfares
Travel cost to NQ 3	Higher driving cost (dc1) and actual airfares paid
Travel cost to NQ 4	Lower driving cost (dc2) and actual airfares paid

Following inspection of the data, a dummy variable was generated for travel from Statistical Divisions in Western Australia. The use of this variable was essential in analysis for the subgroup of those who drove to North Queensland to achieve a coefficient for travel cost that is negative and significant. It can be speculated that sites in tropical Western Australia are substitutes to North Queensland for the people from Western Australia.

AG.3 Results for Travel Demand Functions

Travel demand functions were generated, using multiple regression analysis, for all 16 versions of travel cost (four formulae by Travel cost to NQ 1 to 4), for each group and sub-group, for visitor numbers and for visitor-days.

The major finding is that it has been possible to derive useful travel demand functions for all visitors to North Queensland when using visitor-days as the unit of demand. Hypothesis 1, that the price elasticity of demand for Australian tourists to North Queensland is negative and significant, was accepted. This result was not obtained when using visitor numbers as the measure of demand. The results obtained for visitor-days had price elasticities of demand in the range of -0.7 to -0.9.

The examination of the relationship between travel cost and demand for different sub-groups, for the two alternative dependant variables, gave mixed results. All hypotheses were rejected for sub-groups with visitor numbers as the dependant variable. Hypothesis 2 was rejected for visitor-days because although a negative and significant β_1 was obtained for the travel demand functions, the R^2 was too low to be acceptable. For those who flew to North Queensland, in most cases no inverse relationship between travel cost and demand could be proven and so Hypothesis 3 was rejected for visitor-days. For the sub-group of travellers with North Queensland as their sole destination, the absolute cost of travel to North Queensland is also the actual cost of travel, and it was likely that the most direct relationship between travel cost and demand for travel to that destination would be observed here. A negative and significant β_1 was obtained for both visitor numbers and visitor-days for the absolute cost of travel. However, the results for visitor numbers were associated with very low R^2 values and so Hypothesis 4 was rejected for that group on that basis, but accepted for visitor-days. A mixed result was found with meanderers; for visitor-days, Hypothesis 5 was accepted, while it was rejected for visitor numbers.

Table AG.10 Summary of results of hypothesis testing using visitor numbers and visitor-days as measures of demand, travel to North Queensland

	Visitor numbers	Visitor-days
Hypothesis 1 (All visitors)	Rejected	Accepted
Hypothesis 2 (Drive to NQ)	Rejected	Rejected
Hypothesis 3 (Fly to NQ)	Rejected	Rejected
Hypothesis 4 (Sole destination)	Rejected	Accepted
Hypothesis 5 (Meanderers)	Rejected	Accepted

The contribution of the opportunity cost of travel time to explanation of the demand for visits to North Queensland was mixed and showed no particular trends. In some cases, the equations which included the cost of time had higher R^2 values and in other cases, the R^2 was lower than the results without time costs. The same mixed pattern was observed for β_1 coefficients. There were no cases where the addition of travel time costs caused markedly different results.

The application of the proportional factor to absolute cost of travel created larger differences in results. The use of the proportional factor generally resulted in lower elasticities and lower R^2 values as it had the effect of reducing travel cost.

Very few of the other variables tested made any contribution to the travel demand functions. The only variable that appears regularly in the travel demand functions is the dummy variable for travel from Western Australia. The indicator of importance of visiting rainforest as an attraction to North Queensland shows a positive relationship to demand in some cases.

AG.4 Calculating an Entry Fee Demand Function

The remaining analysis was conducted using visitor-days for the group of all visitors to North Queensland. Specifically, two versions of travel cost for that group were chosen for further analysis. The versions chosen were Travel cost 4 with proportional factor, with and without time costs.

The equations obtained for the travel demand function were used to calculate a demand schedule for entry to a recreation site in the face of hypothetical entry fees. While the interest here has been in investigating the elasticities of demand for visits to North Queensland, a calculation of consumers' surplus for 'entry into North Queensland' has been made from the travel demand functions obtained. The relevance of values obtained are discussed later in comparison with values derived for the Wet Tropics WHA.

The method of calculating the schedule of demand under hypothetical entry fees from the travel demand function and calculating consumers' surplus is described in Chapter 8. The entry fee demand schedules are shown in Table AG.11.

AG.4.1 Consumers' surplus results

Consumers' surplus was calculated by summing the area under segments of the schedule. Consistent with the approach taken for the Wet Tropics WHA, the consumers' surplus was calculated using cut-off points of $2000, $500 and $100. The mean consumers' surplus per visitor-day was calculated by dividing the total by the number of visitor-days observed for the sample. The results for the sample are given in Table AG.12.

Table AG.11 Predicted demand for entry to North Queensland at hypothetical entry fees, all visitors to North Queensland, visitor-days, Travel cost 4 with proportional factor

Entry fee (dollars)	Without time cost Visitor-days predicted	Without time cost % of predicted visitor-days at $0 entry fee	With time cost Visitor-days predicted	With time cost % of predicted visitor-days at $0 entry fee
0	10999	100	11382	100
1	10669	97	11058	97
2	10376	94	10764	95
5	9646	88	10014	88
10	8722	79	9047	79
15	8015	73	8298	73
20	7445	68	7689	67
50	5395	49	5487	48
100	3859	35	3843	34
200	2579	23	2493	22
300	1989	18	1882	17
400	1641	15	1528	13
500	1408	13	1294	11
1000	862	8	759	7
1500	643	6	551	5
2000	520	5	438	4

Table AG.12 Results of consumers' surplus estimations, total and mean for sample, for visitor-days, all visitors to North Queensland, Travel cost 4 with proportional factor (dollars)

	Without time cost	With time cost
$2000 cut-off		
Total for sample	2 720 502	2 550 321
Mean* per visitor-day	164	154
$500 cut-off		
Total for sample	1 486 002	1 462 321
Mean* per visitor-day	90	88
$100 cut-off		
Total for sample	601 752	615 171
Mean* per visitor-day	36	37

*Based on 16,570 visitor-days represented by the sample

AG.4.2 Price elasticity of demand results

The price elasticity of demand for entry into North Queensland is given by the β coefficient in the double log entry fee demand function estimated to describe the data in the demand schedules, see Table AG.13.

Table AG.13 Double log regression results, $2000 cut-off

	β	Adjusted R^2
Without time cost	- 0.418	0.913
With time cost	- 0.446	0.908

AG.5 DISCUSSION AND CONCLUSIONS

A relationship between visitor-days and the cost of travel, of the form expected, was demonstrated for travel to North Queensland. The travel demand function estimated was used to construct a schedule of demand under hypothetical entry fees and to estimate consumers' surplus and the price elasticity of demand for 'entry to North Queensland'.

The use of visitor numbers as the alternative dependant variable resulted in travel demand functions being able to be estimated for some versions of trave cost, but not all versions of travel cost considered, and so use of this dependant variable was rejected. The exercise of trying to estimate travel demand functions for the different sub-groups of travellers did not generate useful results.

The estimates obtained for mean consumers' surplus were similar to those obtained for travel to the Wet Tropics WHA. Consumers' surplus results are discussed further in Chapter 8.

The price elasticity of demand for entry fees, of about -0.4 to -0.5 were also similar to results for the Wet Tropics WHA. The interpretation of results concerning price elasticity of demand is that overall the imposition of a daily 'entry fee to North Queensland' such as a bed tax would have the effect of reducing demand. At elasticities of -0.4 to -0.5, as found for visitor-days for all visitors to North Queensland, a 1% increase in price would result in close to 0.5% decrease in demand. As it was not possible to estimate a travel demand function for visitor numbers to North Queensland, it was not possible to estimate the price elasticity of demand for a 'one-off entry fee' such as an arrivals tax.

APPENDIX H

TRAVEL COST METHOD APPLIED TO AUSTRALIAN TOURISTS TO THE WET TROPICS WHA

This Appendix contains background data for Chapter 8.

Table AH.1 Calculation of variables for TCM applied to visits by Australian tourists to Wet Tropics WHA

Symbol	Description of variable	Basis for calculation
dh	Distance driving from home, return	Road distances calculated from road maps based on information from survey on origin of trip and (for those who drove to NQ) location of stay last night in NQ, or (for those who flew to NQ) town of nearest airport
dc1	Driving cost 1	Full per km running costs including fuel based on information from survey on model and year of vehicle. Running cost data from NRMA (1994)
dc2	Driving cost 2	Marginal per km running costs; tyres, service and repairs and fuel
hc	Hire car costs	Calculated from daily hire costs from survey
n	Number of nights spent enroute while driving	Calculated as: dh (km)/700 (km/day), after Stoeckl (1994)
al	Accommodation costs last night	Costs nominated in the survey, costs last night used as a proxy for costs enroute
g	Number of adults and children in the group travelling to NQ	Data from survey
income	Annual household income	Annual household income nominated by the survey respondent
hour	Hourly wage rate	Calculated from income data using method after Stoeckl (1994)
dt	Monetary cost of time spent driving	calculated
ft	Monetary cost of time spent flying.	calculated
a1	Economy class airfares	Economy class equivalent to actual airfares paid
a2	Actual airfares	Actual airfares paid. Class of airfare paid nominated in the survey, airfares taken from Ansett Travel Planner (1994)
d	Driving distance on day trip to Wet Tropics WHA	Calculated from route described by respondent
rc1	Running cost 1	Full running cost of private vehicle; driving cost 1 without fuel
rc2	Running cost 2	Marginal cost of running private vehicle; driving cost 2 without fuel
pc	Petrol (or diesel) cost	Based on NRMA fuel consumption data for model and year of vehicle. NRMA used a price similar to that prevailing in Cairns at the time, 69.5 c/litre
h	Hire car cost	Daily hire car cost nominated in survey
t	Cost of commercial tour	Total cost for group travelling together on day trip, nominated in survey
gdt	Number of adults and children travelling together on day trip	Data from survey
an	Number of people sharing accommodation cost	Nominated by respondents

Table AH.2 TCM applied to Australian tourists to the Wet Tropics WHA, observations for 45 zones

Zone	State	Statistical Division	Population	No. of Records	Visitor days WT WHA
1	NSW	Sydney	3 538 749	107	969
2		Hunter	513 693	6	45
3		Illawarra	337 487	10	57
4		Richmond Tweed	179 776	5	46
5		Mid North Coast	420 753	4	127
6		Northern	180 897	4	84
7		North Western	114 804	2	27
8		Central West	165 675	2	12
9		South Eastern	178 863	2	6
10		Murrumbidgee	143 012	2	24
11		Murray	107 483	3	22
12	Victoria	Melbourne	3 022 439	106	869
13		Barwon	218 006	11	120
14		South Western	97 872	3	17
15		Central Highlands	134 001	2	22
16		Northern Mallee	80 061	2	16
17		Loddon Campsie	169 523	2	146
18		Goulburn	152 242	5	37
19		East Gippsland	64 646	1	4
20		Central Gippsland	161 156	2	12
21	Queensland	Brisbane	1 334 017	46	425
22		Moreton	513 831	20	331
23		Wide Bay Burnett	195 259	3	27
24		Darling Downs	185 553	2	24
25		Fitzroy	167 739	6	60
26		Central West	13 799	2	35
27		Mackay	113 787	6	56
28	South Australia	Adelaide	1 023 597	46	416
29		Outer Adelaide	89 251	1	2
30		Yorke Lower North	41 854	3	10
31		Murray Lands	65 279	2	21
32	Western Australia	Perth	1 143 249	39	296
33		South West	134 613	7	180
34		Lower Great southern	45 537	1	4
35		Midlands	48 213	1	10
36		Central	64 085	1	2
37		Pilbara	48 616	1	12
38		Kimberley	29 613	1	10
39	Tasmania	Greater Hobart	181 832	4	22
40		Southern	35 322	1	2
41		Northern	127 037	2	13
42		Mersey Lyell	107 984	1	6
43	Northern Territory	Darwin	78 400	2	3
44		NT balance	96 069	3	27
45	ACT	Canberra	278 904	14	186

Table AH.2 TCM applied to Australian tourists to the Wet Tropics WHA, observations for 45 zones (cont.)

Zone	WT A3	WT A3t	WT A4	WT A4t	WT B3	WT B3t	WT B4	WT B4t
1	138	171	131	164	133	166	126	159
2	183	220	180	218	183	220	180	218
3	100	124	95	119	95	119	90	114
4	75	91	63	79	57	73	45	62
5	76	98	71	92	55	76	49	71
6	88	120	83	115	84	116	79	110
7	110	137	105	132	197	133	102	129
8	204	222	128	147	198	216	122	141
9	140	117	139	176	120	157	119	156
10	148	179	147	178	133	165	132	163
11	173	203	166	197	165	196	159	189
12	118	152	112	146	115	149	108	142
13	114	142	106	133	105	132	96	124
14	88	116	85	113	82	110	78	106
15	54	93	46	84	50	88	41	79
16	83	107	74	98	68	92	59	83
17	66	85	61	80	56	75	51	70
18	152	180	132	160	146	174	126	154
19	183	228	177	222	183	228	177	222
20	465	511	220	265	411	456	166	211
21	103	132	94	122	93	122	84	112
22	70	87	64	82	61	79	56	74
23	152	198	119	165	114	161	82	128
24	76	93	59	77	54	72	38	55
25	101	135	80	113	83	116	62	95
26	50	77	41	69	35	63	27	54
27	83	126	64	107	64	107	45	88
28	130	161	115	146	123	154	108	140
29	294	332	294	332	294	332	294	332
30	159	190	158	188	159	190	158	188
31	87	134	67	114	74	121	54	101
32	124	152	115	144	119	148	110	139
33	68	102	61	95	62	95	55	89
34	104	154	100	150	104	154	100	150
35	158	183	158	183	158	183	158	184
36	189	221	185	216	189	221	185	216
37	222	296	106	181	173	247	57	131
38	119	160	110	151	40	81	31	73
39	112	141	112	141	112	141	112	141
40	215	229	214	227	215	229	214	227
41	129	156	129	156	118	145	118	145
42	163	182	163	182	163	182	163	182
43	191	227	191	227	191	227	191	227
44	109	151	99	141	102	144	92	133
45	92	123	88	119	86	117	82	113

Table AH.2 TCM applied to Australian tourists to the Wet Tropics WHA, observations for 45 zones (cont.)

Zone	WT C3	WT C3t	WT C4	WT C4t	WT D3	WT D3t	WT D4	WT D4t
1		127	87	120	89	122	82	115
2	121	159	118	156	121	159	118	156
3	67	91	63	86	62	86	58	81
4	69	85	57	73	51	67	39	55
5	49	70	43	65	27	49	22	43
6	58	89	53	84	54	85	49	80
7	35	62	30	57	32	58	27	54
8	193	211	117	135	187	205	111	129
9	109	146	109	146	89	126	88	125
10	119	150	117	149	104	135	103	134
11	141	171	134	165	133	164	127	157
12	82	116	76	110	79	113	72	106
13	82	109	73	101	72	99	64	91
14	68	96	65	92	62	90	58	86
15	30	68	21	59	25	63	16	54
16	80	103	71	94	65	88	56	79
17	57	76	52	72	47	66	43	62
18	105	133	85	114	99	127	79	107
19	145	190	139	184	145	190	139	184
20	438	483	192	238	383	429	139	184
21	70	98	60	89	60	88	50	79
22	45	63	39	57	37	55	31	49
23	152	198	119	165	114	161	82	128
24	58	75	41	59	36	54	20	37
25	75	108	54	87	57	90	35	69
26	42	69	33	60	27	54	19	46
27	63	106	44	87	44	87	25	68
28	97	128	82	114	90	122	76	107
29	244	283	244	283	244	283	244	283
30	119	149	117	148	119	149	117	148
31	83	130	63	110	70	117	50	97
32	94	122	85	113	89	117	80	109
33	51	84	44	78	44	78	37	71
34	64	114	60	110	64	114	60	110
35	126	151	126	151	126	151	126	151
36	133	165	129	160	133	165	129	160
37	216	290	100	175	167	241	51	125
38	112	153	103	144	33	74	24	65
39	81	110	81	110	81	110	81	110
40	164	177	162	176	164	177	162	176
41	101	129	101	129	91	118	91	118
42	133	152	133	152	133	152	133	152
43	141	177	141	177	141	177	141	177
44	59	101	49	91	52	94	42	83
45	67	98	63	94	61	92	57	88

Table AH.2 TCM applied to Australian tourists to the Wet Tropics WHA, observations for 45 zones (cont.)

Zone	Age	Activities	Visited NQ before	Education	Income	Occupation	NQ important
1	44	4.72	.36	.41	49 308	.50	.93
2	38	5.17	.00	.33	72 000	.67	.67
3	38	4.80	.50	.00	36 500	.50	.70
4	61	4.40	1.00	.00	11 250	.00	.80
5	47	3.50	.75	.50	42 500	.50	.75
6	32	5.00	.50	.25	53 333	.50	1.00
7	35	6.00	.50	.50	55 000	.50	1.00
8	30	5.00	.50	.00	20 000	.00	1.00
9	60	4.00	.50	.50	60 000	.50	.50
10	40	5.00	.00	.50	65 000	.50	1.00
11	28	4.33	.00	.67	30 000	.33	1.00
12	44	4.58	.40	.47	51 197	.62	.83
13	48	4.82	.18	.27	45 500	.36	1.00
14	32	5.33	.67	.33	42 500	.33	1.00
15	35	4.50	.50	.50	60 000	1.00	1.00
16	45	5.00	1.00	.00	30 000	.00	1.00
17	35	6.50	.50	.00	40 000	.00	1.00
18	47	3.60	.20	.00	38 000	.60	.80
19	45	7.00	.00	.00	70 000	1.00	1.00
20	35	4.00	.50	.50	50 000	1.00	1.00
21	41	4.42	.58	.24	43 977	.59	.78
22	40	4.30	.55	.45	31 500	.45	.80
23	48	4.50	.67	.33	46 666	.00	.33
24	45	3.50	1.00	.00	37 500	.00	.50
25	38	3.67	.83	.50	50 000	.50	1.00
26	30	6.00	1.00	.00	45 000	.00	1.00
27	45	4.17	1.00	.33	63 333	.33	.83
28	41	4.58	.37	.34	45 666	.48	.96
29	55	3.00	.00	1.00	50 000	1.00	1.00
30	48	6.33	.00	.33	30 000	.33	.67
31	35	5.00	.00	1.00	60 000	.50	1.00
32	47	4.74	.18	.33	38 333	.36	.87
33	40	4.29	.29	.71	57 142	.57	.86
34	45	2.00	1.00	1.00	80 000	.00	1.00
35	45	5.00	.00	.00	40 000	.00	1.00
36	55	6.00	.00	.00	50 000	.00	1.00
37	45	5.00	1.00	.00	80 000	.00	1.00
38	35	6.00	1.00	.00	70 000	.00	1.00
39	52	4.00	.00	.50	47 500	.50	.75
40	45	5.00	.00	.00	20 000	.00	1.00
41	45	6.00	.50	.00	50 000	1.00	1.00
42	45	7.00	.00	.00	30 000	1.00	1.00
43	30	3.00	.50	.00	30 000	.00	.50
44	35	5.00	.33	.67	63 333	.67	.67
45	45	4.77	.14	.50	49 642	.50	.79

Table AH.3 Travel Demand Function results, 16 travel cost options, Australian tourists to the Wet Tropics WHA

Travel Cost	α	β_1 of $\ln C_i$ (Cost)	β of $\ln A_i$ (Age)	β of $\ln B_i$ (Visited Before)	Adjusted R^2
WTA3	9.542 (4.297)	-1.450 (-6.041	-1.140 (-2.031)		0.496
WTA3t	11.294 (4.666)	-1.634 (-5.725)	-1.269 (-2.216)		0.471
WTA4	6.120 (5.541)	-1.657 (-7.049)			0.525
WTA4t	8.115 (5.560)	-1.970 (-6.697)			0.499
WTB3	8.424 (3.928)	-1.243 (-6.112)	-1.147 (-2.055)		0.501
WTB3t	10.519 (4.570)	-1.499 (-5.971)	-1.278 (-2.277)		0.490
WTB4	7.130 (5.399)	-1.818 (-6.952)		-0.541 (-3.056)	0.554
WTB4t	9.524 (5.454)	-2.215 (-6.619)		-0.427 (-2.488)	0.531
WTC3	3.509 (3.407)	-1.141 (-5.027)			0.355
WTC3t	9.493 (3.806)	-1.320 (-4.779)	-1.286 (-2.090)		0.390
WTC4	3.853 (4.045)	-1.260 (-5.799)			0.425
WTC4t	6.310 (4.648)	-1.684 (-5.871)			0.432
WTD3	2.925 (3.521)	-1.048 (-5.540)			0.402
WTD3t	9.154 (3.902)	-1.285 (-5.309)	-1.277 (-2.161)		0.436
WTD4	2.526 (3.495)	-1.003 (-5.825)			0.428
WTD4t	5.179 (4.573)	-1.484 (-6.044)			0.446

Table AH.4 Entry Fee Demand Function results, 3 travel cost options, Australian tourists to the Wet Tropics WHA, double log functions, $2000 cut-off point

Travel Cost	α	β of ln F_X (Entry fee)	Adjusted R^2
WTB4	9.033 (22.298)	- 0.755 (-9.077)	0.853
WTA3t	9.092 (26.280)	- 0.576 (-8.107)	0.822
WTD4	8.826 (39.157)	- 0.482 (-10.416)	0.884

APPENDIX I
SCENARIO RESULTS

1. Baseline, 3.4 million visitor-days											
Variable	Value	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total visitor days VD		3400	3400	3400	3400	3400	3400	3400	3400	3400	3400
Australian tourists VD		1054	1054	1054	1054	1054	1054	1054	1054	1054	1054
CS Australian tourists	$ 49	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646
Local residents VD		1632	1632	1632	1632	1632	1632	1632	1632	1632	1632
CS Local residents	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total consumers' surplus		$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646
Visitors on tours VD		1122	1122	1122	1122	1122	1122	1122	1122	1122	1122
Producers' surplus	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross economic benefits		$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646
Management costs MCOW		$5 780	$4 113	$5 084	$5 137	$4 491	$4 008	$4 108	$4 008	$4 008	$4 008
Conditional Net Economic Benefits		$45 866	$47 533	$46 562	$46 509	$47 155	$47 638	$47 538	$47 638	$47 638	$47 638
Discount Rate	0.080										
Conditional Net Present Value		$315 853									
Management Budget MBW		$5 180	$3 401	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969
Shortfall SW		-$ 600	-$ 712	-$3 115	-$3 168	-$2 522	-$2 039	-$2 139	-$2 039	-$2 039	-$2 039
NPV of shortfall		-$13 283									

2. Baseline, 1.7 million visitor-days

Variable	Value	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total visitor days VD		1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Australian tourists VD		527	527	527	527	527	527	527	527	527	527
CS Australian tourists	$ 49	$25 823	$25 823	$25 823	$25 823	$25 823	$25 823	$25 823	$25 823	$25 823	$25 823
Local residents VD		816	816	816	816	816	816	816	816	816	816
CS Local residents	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total consumers' surplus		$25 823	$25 823	$25 823	$25 823	$25 823	$25 823	$25 823	$25 823	$25 823	$25 823
Visitors on tours VD		561	561	561	561	561	561	561	561	561	561
Producers' surplus	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross economic benefits		$25 823	$25 823	$25 823	$25 823	$25 823	$25 823	$25 823	$25 823	$25 823	$25 823
Management costs MCOW		$5 780	$4 113	$5 084	$5 137	$4 491	$4 008	$4 108	$4 008	$4 008	$4 008
Conditional Net Economic Benefits		$20 043	$21 710	$20 739	$20 686	$21 332	$21 815	$21 715	$21 815	$21 815	$21 815
Discount Rate	0.080										
Conditional Net Present Value		$142 579									
Management Budget MBW		$5 180	$3 401	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969
Shortfall SW		-$ 600	-$ 712	-$3 115	-$3 168	-$2 522	-$2 039	-$2 139	-$2 039	-$2 039	-$2 039
NPV of shortfall		-$13 283									

3. man strat 1, low growth

Variable	Value	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total visitor days VD		3400	3524	3655	3794	3942	4098	4264	4441	4629	4829
Australian tourists VD		1054	1083	1112	1143	1174	1207	1240	1274	1309	1346
Consumers' surplus Australian tourists	$ 49	$51 646	$53 067	$54 488	$56 007	$57 526	$59 143	$60 760	$62 426	$64 141	$65 954
Local residents VD		1632	1663	1695	1727	1760	1793	1827	1862	1897	1933
Consumers' surplus Local residents	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total consumers' surplus		$51 646	$53 067	$54 488	$56 007	$57 526	$59 143	$60 760	$62 426	$64 141	$65 954
Visitors on tours VD		1122	1163	1206	1252	1301	1352	1407	1466	1528	1594
Producers' surplus	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross economic benefits		$51 646	$53 067	$54 488	$56 007	$57 526	$59 143	$60 760	$62 426	$64 141	$65 954
Management costs MCOW		$5 880	$4 213	$7 291	$7 526	$7 070	$7 322	$7 684	$6 896	$7 084	$7 284
Conditional Net Economic Benefits		$45 766	$48 854	$47 197	$48 481	$50 456	$51 821	$53 076	$55 530	$57 057	$58 670
Discount Rate	0.080										
Conditional Net Present Value		$341 046									
Management Budget MBW		$5 180	$3 401	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969
Shortfall SW		-$ 700	-$ 812	-$5 322	-$5 557	-$5 101	-$5 353	-$5 715	-$4 927	-$5 115	-$5 315
NPV of shortfall		-$27 516									

4. man strat 1, med growth

Variable	Value	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total visitor days VD		3400	3590	3797	4022	4269	4540	4837	5163	5523	5919
Australian tourists VD		1054	1107	1164	1224	1287	1355	1426	1502	1582	1668
Consumers' surplus Australian tourists	$ 49	$51 646	$54 243	$57 036	$59 976	$63 063	$66 395	$69 874	$73 598	$77 518	$81 732
Local residents VD		1632	1673	1715	1757	1801	1846	1893	1940	1988	2038
Consumers' surplus Local residents	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total consumers' surplus		51646	54243	$57 036	$59 976	$63 063	$66 395	$69 874	$73 598	$77 518	$81 732
Visitors on tours VD		1122	1185	1253	1327	1409	1498	1596	1704	1823	1953
Producers' surplus	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross economic benefits		$51 646	$54 243	$57 036	$59 976	$63 063	$66 395	$69 874	$73 598	$77 518	$81 732
Management costs MCOW		$5 880	$4 213	$7 433	$7 754	$7 397	$7 764	$8 257	$7 618	$7 978	$8 374
Conditional Net Economic Benefits		$45 766	$50 030	$49 603	$52 222	$55 666	$58 631	$61 617	$65 980	$69 540	$73 358
Discount Rate	0.08										
Conditional Net Present Value		$378 229									
Management Budget MBW		$5 180	$3 401	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969
Shortfall SW		-$ 700	-$ 812	-$5 464	-$5 785	-$5 428	-$5 795	-$6 288	-$5 649	-$6 009	-$6 405
NPV of shortfall		-$29 974									

5. man strat 1, high growth

Variable	Value	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total visitor days VD		3400	3651	3930	4242	4590	4980	5417	5910	6465	7092
Australian tourists VD		1054	1137	1228	1327	1435	1553	1682	1823	1976	2144
Consumers' surplus Australian tourists	$ 49	$51 646	$55 713	$60 172	$65 023	$70 315	$76 097	$82 418	$89 327	$96 824	$105 056
Local residents VD		1632	1682	1735	1786	1844	1901	1960	2021	2083	2148
Consumers' surplus Local residents	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total consumers' surplus		51646	55713	$60 172	$65 023	$70 315	$76 097	$82 418	$89 327	$96 824	$105 056
Visitors on tours VD		1122	1205	1297	1400	1515	1643	1788	1950	2133	2340
Producers' surplus	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross economic benefits		$51 646	$55 713	$60 172	$65 023	$70 315	$76 097	$82 418	$89 327	$96 824	$105 056
Management costs MCOW		$5 880	$4 213	$7 566	$7 974	$7 718	$8 204	$8 837	$8 365	$8 920	$9 547
Conditional Net Economic Benefits		$45 766	$51 500	$52 606	$57 049	$62 597	$67 893	$73 581	$80 962	$87 904	$95 509
Discount Rate	0.08										
Conditional Net Present Value		$430 497									
Management Budget MBW		$5 180	$3 401	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969
Shortfall SW		-$ 700	-$ 812	-$5 597	-$6 005	-$5 749	-$6 235	-$6 868	-$6 396	-$6 951	-$7 578
NPV of shortfall		-$32 493									

6. man strat 2, low growth

Variable	Value	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total visitor days VD		3400	3524	3655	3794	3942	4098	4264	4441	4629	4829
Australian tourists VD		1054	1083	1112	1143	1174	1207	1240	1274	1309	1346
Consumers' surplus Australian tourists	$ 49	$51 646	$53 067	$54 488	$56 007	$57 526	$59 143	$60 760	$62 426	$64 141	$65 954
Local residents VD		1632	1663	1695	1727	1760	1793	1827	1862	1897	1933
Consumers' surplus Local residents	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total consumers' surplus		$51 646	$53 067	$54 488	$56 007	$57 526	$59 143	$60 760	$62 426	$64 141	$65 954
Visitors on tours VD		1122	1163	1206	1252	1301	1352	1407	1466	1528	1594
Producers' surplus	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross economic benefits		$51 646	$53 067	$54 488	$56 007	$57 526	$59 143	$60 760	$62 426	$64 141	$65 954
Management costs MCOW		$5 880	$4 326	$8 214	$8 519	$8 133	$8 455	$8 885	$7 471	$7 659	$7 859
Conditional Net Economic Benefits		$45 766	$48 741	$46 274	$47 488	$49 393	$50 688	$51 875	$54 955	$56 482	$58 095
Discount Rate	0.08										
Conditional Net Present Value		$336 484									
Management Budget MBW		$5 180	$3 401	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969
Shortfall SW		-$ 700	-$ 925	-$6 245	-$6 550	-$6 164	-$6 486	-$6 916	-$5 502	-$5 690	-$5 890
NPV of shortfall		-$32 078									

7. man strat 2, med growth

Variable	Value	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total visitor days VD		3400	3590	3797	4022	4269	4540	4837	5163	5523	5919
Australian tourists VD		1054	1107	1164	1224	1287	1355	1426	1502	1582	1668
Consumers' surplus Australian tourists	$ 49	$51 646	$54 243	$57 036	$59 976	$63 063	$66 395	$69 874	$73 598	$77 518	$81 732
Local residents VD		1632	1673	1715	1757	1801	1846	1893	1940	1988	2038
Consumers' surplus Local residents	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total consumers' surplus		$51 646	$54 243	$57 036	$59 976	$63 063	$66 395	$69 874	$73 598	$77 518	$81 732
Visitors on tours VD		1122	1185	1253	1327	1409	1498	1596	1704	1823	1953
Producers' surplus	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross economic benefits		$51 646	$54 243	$57 036	$59 976	$63 063	$66 395	$69 874	$73 598	$77 518	$81 732
Management costs MCOW		$5 880	$4 326	$8 356	$8 747	$8 460	$8 897	$9 458	$8 193	$8 553	$8 949
Conditional Net Economic Benefits		$45 766	$49 917	$48 680	$51 229	$54 603	$57 498	$60 416	$65 405	$68 965	$72 783
Discount Rate	0.08										
Conditional Net Present Value		$373 666									
Management Budget MBW		$5 180	$3 401	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969
Shortfall SW		-$ 700	-$ 925	-$6 387	-$6 778	-$6 491	-$6 928	-$7 489	-$6 224	-$6 584	-$6 980
NPV of shortfall		-$34 536									

8. man strat 2, high growth											
Variable	Value	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total visitor days VD		3400	3651	3930	4242	4590	4980	5417	5910	6465	7092
Australian tourists VD		1054	1137	1228	1327	1435	1553	1682	1823	1976	2144
Consumers' surplus Australian tourists	$ 49	$51 646	$55 713	$60 172	$65 023	$70 315	$76 097	$82 418	$89 327	$96 824	$105 056
Local residents VD		1632	1682	1735	1786	1844	1901	1960	2021	2083	2148
Consumers' surplus Local residents	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total consumers' surplus		$51 646	$55 713	$60 172	$65 023	$70 315	$76 097	$82 418	$89 327	$96 824	$105 056
Visitors on tours VD		1122	1205	1297	1400	1515	1643	1788	1950	2133	2340
Producers' surplus	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross economic benefits		$51 646	$55 713	$60 172	$65 023	$70 315	$76 097	$82 418	$89 327	$96 824	$105 056
Management costs MCOW		$5 880	$4 326	$8 489	$8 967	$8 781	$9 337	$10 038	$8 940	$9 495	$10 122
Conditional Net Economic Benefits		$45 766	$51 387	$51 683	$56 056	$61 534	$66 760	$72 380	$80 387	$87 329	$94 934
Discount Rate	0.08										
Conditional Net Present Value		$425 934									
Management Budget MBW		$5 180	$3 401	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969
Shortfall SW		-$ 700	-$ 925	-$6 520	-$6 998	-$6 812	-$7 368	-$8 069	-$6 971	-$7 526	-$8 153
NPV of shortfall		-$37 056									

9. man strat 1, med growth, 1.7 million visitor-days

Variable	Value	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total visitor days VD		1700	1795	1898	2011	2135	2270	2418	2582	2761	2960
Australian tourists VD		527	553.691496	582	612	644	677	713	751	791	834
Consumers' surplus Australian tourists	$ 49	$25 823	$27 131	$28 517	$29 985	$31 542	$33 193	$34 943	$36 800	$38 769	$40 858
Local residents VD		816	836.4	857	879	901	923	946	970	994	1019
Consumers' surplus Local residents	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total consumers' surplus		25823	27130.8833	$28 517	$29 985	$31 542	$33 193	$34 943	$36 800	$38 769	$40 858
Visitors on tours VD		561	592.319508	626	664	704	749	798	852	911	977
Producers' surplus	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross economic benefits		$25 823	$27 131	$28 517	$29 985	$31 542	$33 193	$34 943	$36 800	$38 769	$40 858
Management costs MCOW		$5 880	$4 213	$5 534	$5 743	$5 263	$5 494	$5 838	$5 037	$5 216	$5 415
Conditional Net Economic Benefits		$19 943	$22 918	$22 982	$24 242	$26 280	$27 699	$29 105	$31 763	$33 553	$35 443
Discount Rate	0.08										
Conditional Net Present Value		$176 863									
Management Budget MBW		$5 180	$3 401	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969
Shortfall SW		-$ 700	-$ 812	-$3 565	-$3 774	-$3 294	-$3 525	-$3 869	-$3 068	-$3 247	-$3 446
NPV of shortfall		-$18 547									

10. man strat 2, med growth, 1.7 million visitor-days

Variable	Value	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total visitor days VD		1700	1795	1898	2011	2135	2270	2418	2582	2761	2960
Australian tourists VD		527	553.691496	582	612	644	677	713	751	791	834
Consumers' surplus Australian tourists	$ 49	$25 823	$27 131	$28 517	$29 985	$31 542	$33 193	$34 943	$36 800	$38 769	$40 858
Local residents VD		816	836.4	857	879	901	923	946	970	994	1019
Consumers' surplus Local residents	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total consumers' surplus		25823	27130.8833	$28 517	$29 985	$31 542	$33 193	$34 943	$36 800	$38 769	$40 858
Visitors on tours VD		561	592.319508	626	664	704	749	798	852	911	977
Producers' surplus	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross economic benefits		$25 823	$27 131	$28 517	$29 985	$31 542	$33 193	$34 943	$36 800	$38 769	$40 858
Management costs MCOW		$5 880	$4 326	$6 457	$6 736	$6 326	$6 627	$7 039	$5 612	$5 791	$5 990
Conditional Net Economic Benefits		$19 943	$22 805	$22 059	$23 249	$25 217	$26 566	$27 904	$31 188	$32 978	$34 868
Discount Rate	0.08										
Conditional Net Present Value		$172 300									
Management Budget MBW		$5 180	$3 401	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969
Shortfall SW		-$ 700	-$ 925	-$4 488	-$4 767	-$4 357	-$4 658	-$5 070	-$3 643	-$3 822	-$4 021
NPV of shortfall		-$23 110									

11. man strat 1, med growth, 10% pa reduction due to crowding

Variable	Value	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total visitor days VD		3400	3590	3797	4022	4269	4540	4837	5163	5523	5919
- with crowding		3060	3231	3417	3620	3842	4086	4353	4647	4971	5327
Australian tourists VD		1054	1107	1164	1224	1287	1355	1426	1502	1582	1668
- with crowding		949	996	1048	1102	1158	1220	1283	1352	1424	1501
Consumers' surplus Australian tourists	$ 49	$46 481	$48 819	$51 332	$53 978	$56 757	$59 756	$62 887	$66 238	$69 766	$73 559
Local residents VD		1632	1632	1632	1632	1632	1632	1632	1632	1632	1632
- with crowding		1469	1469	1469	1469	1469	1469	1469	1469	1469	1469
Consumers' surplus Local residents	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total consumers' surplus		46481	48819	51332	53978	56757	59756	62887	66238	69766	73559
Visitors on tours VD		1122	1185	1253	1327	1409	1498	1596	1704	1823	1953
- with crowding		1010	1067	1128	1194	1268	1348	1436	1534	1641	1758
Producers' surplus	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross economic benefits		$46 481	$48 819	$51 332	$53 978	$56 757	$59 756	$62 887	$66 238	$69 766	$73 559
Management costs MCOW		$5 880	$4 213	$7 053	$7 352	$6 970	$7 310	$7 773	$7 102	$7 426	$7 782
Conditional Net Economic Benefits		$40 601	$44 606	$44 279	$46 627	$49 787	$52 446	$55 113	$59 137	$62 341	$65 777
Discount Rate	0.08										
Conditional Net Present Value		$337 952									
Management Budget MBW		$5 180	$3 401	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969
Shortfall SW		-$ 700	-$ 812	-$5 084	-$5 383	-$5 001	-$5 341	-$5 804	-$5 133	-$5 457	-$5 813
NPV of shortfall		-$27 688									

12. man strat 1, med growth, 50% reduction due to crowding at 5m vd

Variable	Value	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total visitor days VD		3400	3590	3797	4022	4269	4540	4837	5163	5523	5919
- with crowding		3400	3590	3797	4022	4269	4540	4837	2582	2762	2960
Australian tourists VD		1054	1107	1164	1224	1287	1355	1426	1502	1582	1668
- with crowding		1054	1107	1164	1224	1287	1355	1426	751	791	834
Consumers' surplus Australian tourists	$ 49	$51 646	$54 243	$57 036	$59 976	$63 063	$66 395	$69 874	$36 799	$38 759	$40 866
Local residents VD		1632	1632	1632	1632	1632	1632	1632	1632	1632	1632
- with crowding		1632	1632	1632	1632	1632	1632	1632	816	816	816
Consumers' surplus Local residents	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total consumers' surplus		51646	54243	$57 036	$59 976	$63 063	$66 395	$69 874	$36 799	$38 759	$40 866
Visitors on tours VD		1122	1185	1253	1327	1409	1498	1596	1704	1823	1953
with crowding		1122	1185	1253	1327	1409	1498	1596	852	912	977
Producers' surplus	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross economic benefits		$51 646	$54 243	$57 036	$59 976	$63 063	$66 395	$69 874	$36 799	$38 759	$40 866
Management costs MCOW		$5 880	$4 213	$7 433	$7 754	$7 397	$7 764	$8 257	$5 037	$5 217	$5 415
Conditional Net Economic Benefits		$45 766	$50 030	$49 603	$52 222	$55 666	$58 631	$61 617	$31 763	$33 543	$35 452
Discount Rate	0.08										
Conditional Net Present Value		$324 176									
Management Budget MBW		$5 180	$3 401	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969
Shortfall SW		-$ 700	-$ 812	-$5 464	-$5 785	-$5 428	-$5 795	-$6 288	-$3 068	-$3 248	-$3 446
NPV of shortfall		-$25 827									

13. man strat 1, med growth, 4 million visitor-days limit

Variable	Value	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total visitor days VD		3400	3590	3797	4022	4269	4540	4837	5163	5523	5919
- with env limits		3400	3590	3797	4000	4000	4000	4000	4000	4000	4000
Australian tourists VD		1054	1107	1164	1224	1287	1355	1426	1502	1582	1668
- with env limits		1054	1107	1164	1217	1217	1217	1217	1217	1217	1217
Consumers' surplus Australian tourists	$ 49	$51 646	$54 243	$57 036	$59 648	$59 648	$59 648	$59 648	$59 648	$59 648	$59 648
Local residents VD		1632	1673	1715	1757	1801	1846	1893	1940	1988	2038
- with env limits		1632	1673	1715	1747	1747	1747	1747	1747	1747	1747
Consumers' surplus Local residents	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total consumers' surplus		51646	54243	$57 036	$59 648	$59 648	$59 648	$59 648	$59 648	$59 648	$59 648
Visitors on tours VD		1122	1185	1253	1327	1409	1498	1596	1704	1823	1953
- with env limits		1122	1185	1253	1320	1320	1320	1320	1320	1320	1320
Producers' surplus	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross economic benefits		$51 646	$54 243	$57 036	$59 648	$59 648	$59 648	$59 648	$59 648	$59 648	$59 648
Management costs MCOW		$5 880	$4 213	$7 433	$7 732	$7 128	$7 224	$7 420	$6 455	$6 455	$6 455
Conditional Net Economic Benefits		$45 766	$50 030	$49 603	$51 916	$52 520	$52 424	$52 228	$53 193	$53 193	$53 193
Discount Rate	0.08										
Conditional Net Present Value		$342 046									
Management Budget MBW		$5 180	$3 401	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969
Shortfall SW		-$ 700	-$ 812	-$5 464	-$5 763	-$5 159	-$5 255	-$5 451	-$4 486	-$4 486	-$4 486
NPV of shortfall		-$26 667									

14. man strat 2 , med growth, 4 million visitor-days limit

Variable	Value	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total visitor days VD		3400	3590	3797	4022	4269	4540	4837	5163	5523	5919
- with env limits		3400	3590	3797	4000	4000	4000	4000	4000	4000	4000
Australian tourists VD		1054	1107	1164	1224	1287	1355	1426	1502	1582	1668
- with env limits		1054	1107	1164	1217	1217	1217	1217	1217	1217	1217
Consumers' surplus Australian tourists	$ 49	$51 646	$54 243	$57 036	$59 648	$59 648	$59 648	$59 648	$59 648	$59 648	$59 648
Local residents VD		1632	1673	1715	1757	1801	1846	1893	1940	1988	2038
- with env limits		1632	1673	1715	1747	1747	1747	1747	1747	1747	1747
Consumers' surplus Local residents	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total consumers' surplus		$51 646	$54 243	$57 036	$59 648	$59 648	$59 648	$59 648	$59 648	$59 648	$59 648
Visitors on tours VD		1122	1185	1253	1327	1409	1498	1596	1704	1823	1953
- with env limits		1122	1185	1253	1320	1320	1320	1320	1320	1320	1320
Producers' surplus	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross economic benefits		$51 646	$54 243	$57 036	$59 648	$59 648	$59 648	$59 648	$59 648	$59 648	$59 648
Management costs MCOW		$5 880	$4 326	$8 356	$8 725	$8 191	$8 357	$8 621	$7 030	$7 030	$7 030
Conditional Net Economic Benefits		$45 766	$49 917	$48 680	$50 923	$51 457	$51 291	$51 027	$52 618	$52 618	$52 618
Discount Rate	0.08										
Conditional Net Present Value		$337 484									
Management Budget MBW		$5 180	$3 401	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969
Shortfall SW		-$ 700	-$ 925	-$6 387	-$6 756	-$6 222	-$6 388	-$6 652	-$5 061	-$5 061	-$5 061
NPV of shortfall		-$31 229									

15. man strat 1, med growth, 5 million visitor-days limit

Variable	Value	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total visitor days VD		3400	3590	3797	4022	4269	4540	4837	5163	5523	5919
- with env limits		3400	3590	3797	4022	4269	4540	4837	5000	5000	5000
Australian tourists VD		1054	1107	1164	1224	1287	1355	1426	1502	1582	1668
- with env limits		1054	1107	1164	1224	1287	1355	1426	1455	1455	1455
Consumers' surplus Australian tourists	$ 49	$51 646	$54 243	$57 036	$59 976	$63 063	$66 395	$69 874	$71 274	$71 274	$71 274
Local residents VD		1632	1673	1715	1757	1801	1846	1893	1940	1988	2038
- with env limits		1632	1673	1715	1757	1801	1846	1893	1879	1879	1879
Consumers' surplus Local residents	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total consumers' surplus		51646	54243	$57 036	$59 976	$63 063	$66 395	$69 874	$71 274	$71 274	$71 274
Visitors on tours VD		1122	1185	1253	1327	1409	1498	1596	1704	1823	1953
- with env limits		1122	1185	1253	1253	1253	1253	1253	1650	1650	1650
Producers' surplus	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross economic benefits		$51 646	$54 243	$57 036	$59 976	$63 063	$66 395	$69 874	$71 274	$71 274	$71 274
Management costs MCOW		$5 880	$4 213	$7 433	$7 754	$7 397	$7 764	$8 257	$7 455	$7 455	$7 455
Conditional Net Economic Benefits		$45 766	$50 030	$49 603	$52 222	$55 666	$58 631	$61 617	$63 819	$63 819	$63 819
Discount Rate	0.08										
Conditional Net Present Value		$369 782									
Management Budget MBW		$5 180	$3 401	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969
Shortfall SW		-$ 700	-$ 812	-$5 464	-$5 785	-$5 428	-$5 795	-$6 288	-$5 486	-$5 486	-$5 486
NPV of shortfall		-$29 198									

16. man strat 2, med growth, 5 million visitor-days limit

Variable	Value	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total visitor days VD		3400	3590	3797	4022	4269	4540	4837	5163	5523	5919
- with env limits		3400	3590	3797	4022	4269	4540	4837	5000	5000	5000
Australian tourists VD		1054	1107	1164	1224	1287	1355	1426	1502	1582	1668
- with env limits		1054	1107	1164	1224	1287	1355	1426	1455	1455	1455
Consumers' surplus Australian tourists	$ 49	$51 646	$54 243	$57 036	$59 976	$63 063	$66 395	$69 874	$71 274	$71 274	$71 274
Local residents VD		1632	1673	1715	1757	1801	1846	1893	1940	1988	2038
- with env limits		1632	1673	1715	1757	1801	1846	1893	1879	1879	1879
Consumers' surplus Local residents	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total consumers' surplus		$51 646	$54 243	$57 036	$59 976	$63 063	$66 395	$69 874	$71 274	$71 274	$71 274
Visitors on tours VD		1122	1185	1253	1327	1409	1498	1596	1704	1823	1953
- with env limits		1122	1185	1253	1327	1409	1498	1596	1650	1650	1650
Producers' surplus	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross economic benefits		$51 646	$54 243	$57 036	$59 976	$63 063	$66 395	$69 874	$71 274	$71 274	$71 274
Management costs MCOW		$5 880	$4 326	$8 356	$8 747	$8 460	$8 897	$9 458	$8 030	$8 030	$8 030
Conditional Net Economic Benefits		$45 766	$49 917	$48 680	$51 229	$54 603	$57 498	$60 416	$63 244	$63 244	$63 244
Discount Rate	0.08										
Conditional Net Present Value		$365 219									
Management Budget MBW		$5 180	$3 401	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969
Shortfall SW		-$ 700	-$ 925	-$6 387	-$6 778	-$6 491	-$6 928	-$7 489	-$6 061	-$6 061	-$6 061
NPV of shortfall		-$33 761									

17. Baseline, $2 fee

Variable	Value	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total visitor days VD		3400	3400	3400	3400	3400	3400	3400	3400	3400	3400
- with fees	0.977	3322	3322	3322	3322	3322	3322	3322	3322	3322	3322
Australian tourists VD		1054	1054	1054	1054	1054	1054	1054	1054	1054	1054
- with fees		1030	1030	1030	1030	1030	1030	1030	1030	1030	1030
CS Australian tourists, without fees	$ 49	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646
Local residents VD		1632	1632	1632	1632	1632	1632	1632	1632	1632	1632
- with fees		1594	1594	1594	1594	1594	1594	1594	1594	1594	1594
CS Local residents, without fees	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total CS, without fees		$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646
VD Aust and Local, without fees		2686	2686	2686	2686	2686	2686	2686	2686	2686	2686
VD Aust and Local, with fees		2624	2624	2624	2624	2624	2624	2624	2624	2624	2624
Deadweight loss DWL		$ 62	$ 62	$ 62	$ 62	$ 62	$ 62	$ 62	$ 62	$ 62	$ 62
WTP=CS without fees - DWL		$51 584	$51 584	$51 584	$51 584	$51 584	$51 584	$51 584	$51 584	$51 584	$51 584
Fee revenue Aust and Local		$5 248	$5 248	$5 248	$5 248	$5 248	$5 248	$5 248	$5 248	$5 248	$5 248
CS with fees		$46 336	$46 398	$46 398	$46 398	$46 398	$46 398	$46 398	$46 398	$46 398	$46 398
Visitors on tours VD		1122	1122	1122	1122	1122	1122	1122	1122	1122	1122
- with fees		1096	1096	1096	1096	1096	1096	1096	1096	1096	1096
Producers' surplus	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross economic benefits		$51 584	$51 584	$51 584	$51 584	$51 584	$51 584	$51 584	$51 584	$51 584	$51 584
Management costs MCOW		$5 780	$4 113	$5 084	$5 137	$4 491	$4 008	$4 108	$4 008	$4 008	$4 008
Conditional Net Economic Benefits		$45 804	$47 471	$46 500	$46 447	$47 093	$47 576	$47 476	$47 576	$47 576	$47 576
Discount Rate	0.080										
Conditional Net Present Value		$315 438									
Management Budget MBW		$5 180	$3 401	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969
Fee revenue FR		$6 311	$6 311	$6 311	$6 311	$6 311	$6 311	$6 311	$6 311	$6 311	$6 311
NPV of fee revenue		$42 350									
Excess		$ 531	$2 198	$1 227	$1 174	$1 820	$2 303	$2 203	$2 303	$2 303	$2 303
NPV of Excess		$11 654									

18. man strat 1 med growth, $2 fee

Variable	Value	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total visitor days VD		3400	3590	3797	4022	4269	4540	4837	5163	5523	5919
- with fees	0.977	3322	3507	3710	3929	4171	4436	4726	5044	5396	5783
Australian tourists VD		1054	1107	1164	1224	1287	1355	1426	1502	1582	1668
- with fees		1030	1082	1137	1196	1257	1324	1393	1467	1546	1630
CS Australian tourists, without fees	$ 49	$51 646	$54 243	$57 036	$59 976	$63 063	$66 395	$69 874	$73 598	$77 518	$81 732
Local residents VD		1632	1632	1632	1632	1632	1632	1632	1632	1632	1632
- with fees		1594	1594	1594	1594	1594	1594	1594	1594	1594	1594
CS Local residents, without fees	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total CS, without fees		$51 646	$54 243	$57 036	$59 976	$63 063	$66 395	$69 874	$73 598	$77 518	$81 732
VD Aust and Local, without fees		2686	2739	2796	2856	2919	2987	3058	3134	3214	3300
VD Aust and Local, with fees		2624	2676	2732	2790	2852	2918	2988	3062	3140	3224
Deadweight loss DWL		$ 62	$ 63	$ 64	$ 66	$ 67	$ 69	$ 70	$ 72	$ 74	$ 76
WTP=CS without fees - DWL		$51 584	$54 180	$56 972	$59 910	$62 996	$66 326	$69 804	$73 526	$77 444	$81 656
Fee revenue Aust and Local		$5 248	$5 352	$5 463	$5 581	$5 704	$5 837	$5 975	$6 124	$6 280	$6 448
CS with fees		$46 336	$48 828	$51 508	$54 330	$57 292	$60 490	$63 828	$67 402	$71 164	$75 208
Visitors on tours VD		1122	1185	1253	1327	1409	1498	1596	1704	1823	1953
- with fees		1096	1158	1224	1296	1377	1464	1559	1665	1781	1908
Producers' surplus	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross economic benefits		$51 584	$54 180	$56 972	$59 910	$62 996	$66 326	$69 804	$73 526	$77 444	$81 656
Management costs MCOW		$5 880	$4 213	$7 346	$7 661	$7 299	$7 660	$8 146	$7 499	$7 851	$8 238
Conditional Net Economic Benefits		$45 704	$49 967	$49 626	$52 249	$55 697	$58 667	$61 658	$66 027	$69 593	$73 418
Discount Rate	0.080										
Conditional Net Present Value		$378 303									
Management Budget MBW		$5 180	$3 401	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969
Fee revenue FR		$6 311	$6 664	$7 048	$7 466	$7 925	$8 428	$8 979	$9 584	$10 252	$10 987
NPV of fee revenue		$53 980									
Excess		$ 431	$2 451	-$ 297	-$ 195	$ 626	$ 768	$ 833	$2 085	$2 401	$2 750
NPV of Excess		$7 118									

19. man strat 2, med growth, $2 fee

Variable	Value	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total visitor days VD		3400	3590	3797	4022	4269	4540	4837	5163	5523	5919
- with fees	0.977	3322	3507	3710	3929	4171	4436	4726	5044	5396	5783
Australian tourists VD		1054	1107	1164	1224	1287	1355	1426	1502	1582	1668
- with fees		1030	1082	1137	1196	1257	1324	1393	1467	1546	1630
CS Australian tourists, without fees	$ 49	$51 646	$54 243	$57 036	$59 976	$63 063	$66 395	$69 874	$73 598	$77 518	$81 732
Local residents VD		1632	1632	1632	1632	1632	1632	1632	1632	1632	1632
- with fees		1594	1594	1594	1594	1594	1594	1594	1594	1594	1594
CS Local residents, without fees	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total CS, without fees		$51 646	$54 243	$57 036	$59 976	$63 063	$66 395	$69 874	$73 598	$77 518	$81 732
VD Aust and Local, without fees		2686	2739	2796	2856	2919	2987	3058	3134	3214	3300
VD Aust and Local, with fees		2624	2676	2732	2790	2852	2918	2988	3062	3140	3224
Deadweight loss DWL		$ 62	$ 63	$ 64	$ 66	$ 67	$ 69	$ 70	$ 72	$ 74	$ 76
WTP=CS without fees - DWL		$51 584	$54 180	$56 972	$59 910	$62 996	$66 326	$69 804	$73 526	$77 444	$81 656
Fee revenue Aust and Local		$5 248	$5 352	$5 463	$5 581	$5 704	$5 837	$5 975	$6 124	$6 280	$6 448
CS with fees		$46 336	$48 891	$51 573	$54 395	$57 359	$60 558	$63 899	$67 474	$71 238	$75 284
Visitors on tours VD		1122	1185	1253	1327	1409	1498	1596	1704	1823	1953
- with fees		1096	1158	1224	1296	1377	1464	1559	1665	1781	1908
Producers' surplus	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross economic benefits		$51 646	$54 243	$57 036	$59 976	$63 063	$66 395	$69 874	$73 598	$77 518	$81 732
Management costs MCOW		5880	4326	8269	8654	8362	8793	9347	8074	8426	8813
Conditional Net Economic Benefits		$45 766	$49 917	$48 767	$51 322	$54 701	$57 602	$60 527	$65 524	$69 092	$72 919
Discount Rate	0.080										
Conditional Net Present Value		$374 192									
Management Budget MBW		$5 180	$3 401	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969
Fee revenue FR		$6 311	$6 664	$7 048	$7 466	$7 925	$8 428	$8 979	$9 584	$10 252	$10 987
NPV of fee revenue		$53 980									
Excess		$ 431	$2 338	-$1 220	-$1 188	-$ 437	-$ 365	-$ 368	$1 510	$1 826	$2 175
NPV of Excess		$2 556									

20. Baseline, $5 fee

Variable	Value	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total visitor days VD		3400	3400	3400	3400	3400	3400	3400	3400	3400	3400
- with fees	0.943	3206	3206	3206	3206	3206	3206	3206	3206	3206	3206
Australian tourists VD		1054	1054	1054	1054	1054	1054	1054	1054	1054	1054
- with fees		994	994	994	994	994	994	994	994	994	994
CS Australian tourists, without fees	$ 49	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646
Local residents VD		1632	1632	1632	1632	1632	1632	1632	1632	1632	1632
- with fees		1539	1539	1539	1539	1539	1539	1539	1539	1539	1539
CS Local residents, without fees	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total CS, without fees		$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646	$51 646
VD Aust and Local, without fees		2686	2686	2686	2686	2686	2686	2686	2686	2686	2686
VD Aust and Local, with fees		2533	2533	2533	2533	2533	2533	2533	2533	2533	2533
Deadweight loss DWL		$ 383	$ 383	$ 383	$ 383	$ 383	$ 383	$ 383	$ 383	$ 383	$ 383
WTP=CS without fees - DWL		$51 263	$51 263	$51 263	$51 263	$51 263	$51 263	$51 263	$51 263	$51 263	$51 263
Fee revenue Aust and Local		$12 664	$12 664	$12 664	$12 664	$12 664	$12 664	$12 664	$12 664	$12 664	$12 664
CS with fees		$38 599	$38 982	$38 982	$38 982	$38 982	$38 982	$38 982	$38 982	$38 982	$38 982
Visitors on tours VD		1122	1122	1122	1122	1122	1122	1122	1122	1122	1122
- with fees		1058	1058	1058	1058	1058	1058	1058	1058	1058	1058
Producers' surplus	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross economic benefits		$51 263	$51 263	$51 263	$51 263	$51 263	$51 263	$51 263	$51 263	$51 263	$51 263
Management costs MCOW		$5 780	$4 113	$5 084	$5 137	$4 491	$4 008	$4 108	$4 008	$4 008	$4 008
Conditional Net Economic Benefits		$45 483	$47 150	$46 179	$46 126	$46 772	$47 255	$47 155	$47 255	$47 255	$47 255
Discount Rate	0.080										
Conditional Net Present Value		$313 285									
Management Budget MBW		$5 180	$3 401	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969
Fee revenue FR		$15 229	$15 229	$15 229	$15 229	$15 229	$15 229	$15 229	$15 229	$15 229	$15 229
NPV of fee revenue		$102 191									
Excess		$9 449	$11 116	$10 145	$10 092	$10 738	$11 221	$11 121	$11 221	$11 221	$11 221
NPV of Excess		$71 495									

21. man strat 1, med growth, $5 fee

Variable	Value	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total visitor days VD		3400	3590	3797	4022	4269	4540	4837	5163	5523	5919
- with fees	0.943	3206	3385	3581	3793	4026	4281	4561	4869	5208	5582
Australian tourists VD		1054	1107	1164	1224	1287	1355	1426	1502	1582	1668
- with fees		994	1044	1098	1154	1214	1278	1345	1416	1492	1573
CS Australian tourists, without fees	$ 49	$51 646	$54 243	$57 036	$59 976	$63 063	$66 395	$69 874	$73 598	$77 518	$81 732
Local residents VD		1632	1632	1632	1632	1632	1632	1632	1632	1632	1632
- with fees		1539	1539	1539	1539	1539	1539	1539	1539	1539	1539
CS Local residents, without fees	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total CS, without fees		$51 646	$54 243	$57 036	$59 976	$63 063	$66 395	$69 874	$73 598	$77 518	$81 732
VD Aust and Local, without fees		2686	2739	2796	2856	2919	2987	3058	3134	3214	3300
VD Aust and Local, with fees		2533	2583	2637	2693	2753	2817	2884	2955	3031	3112
Deadweight loss DWL		$ 383	$ 390	$ 398	$ 407	$ 416	$ 426	$ 436	$ 447	$ 458	$ 470
WTP=CS without fees - DWL		$51 263	$53 853	$56 638	$59 569	$62 647	$65 969	$69 438	$73 151	$77 060	$81 262
Fee revenue Aust and Local		$12 664	$12 914	$13 183	$13 466	$13 763	$14 084	$14 418	$14 777	$15 154	$15 560
CS with fees		$38 599	$41 329	$43 853	$46 510	$49 300	$52 311	$55 456	$58 821	$62 364	$66 173
Visitors on tours VD		1122	1185	1253	1327	1409	1498	1596	1704	1823	1953
- with fees		1058	1117	1182	1251	1329	1413	1505	1607	1719	1842
Producers' surplus	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross economic benefits		$51 646	$54 243	$57 036	$59 976	$63 063	$66 395	$69 874	$73 598	$77 518	$81 732
Management costs MCOW		$5 880	$4 213	$7 217	$7 525	$7 154	$7 505	$7 981	$7 324	$7 663	$8 037
Conditional Net Economic Benefits		$45 766	$50 030	$49 819	$52 451	$55 909	$58 890	$61 893	$66 274	$69 855	$73 695
Discount Rate	0.080										
Conditional Net Present Value		$379 531									
Management Budget MBW		$5 180	$3 401	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969
Fee revenue FR		$15 229	$16 081	$17 008	$18 016	$19 122	$20 336	$21 666	$23 126	$24 739	$26 513
NPV of fee revenue		$130 253									
Excess		$9 349	$11 868	$9 791	$10 491	$11 968	$12 831	$13 685	$15 803	$17 076	$18 476
NPV of Excess		$84 169									

22. man strat 2, med growth, $5 fee

Variable	Value	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total visitor days VD		3400	3590	3797	4022	4269	4540	4837	5163	5523	5919
- with fees	0.943	3206	3385	3581	3793	4026	4281	4561	4869	5208	5582
Australian tourists VD		1054	1107	1164	1224	1287	1355	1426	1502	1582	1668
- with fees		994	1044	1098	1154	1214	1278	1345	1416	1492	1573
CS Australian tourists, without fees	$ 49	$51 646	$54 243	$57 036	$59 976	$63 063	$66 395	$69 874	$73 598	$77 518	$81 732
Local residents VD		1632	1632	1632	1632	1632	1632	1632	1632	1632	1632
- with fees		1539	1539	1539	1539	1539	1539	1539	1539	1539	1539
CS Local residents, without fees	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total CS, without fees		$51 646	$54 243	$57 036	$59 976	$63 063	$66 395	$69 874	$73 598	$77 518	$81 732
VD Aust and Local, without fees		2686	2739	2796	2856	2919	2987	3058	3134	3214	3300
VD Aust and Local, with fees		2533	2583	2637	2693	2753	2817	2884	2955	3031	3112
Deadweight loss DWL		$ 383	$ 390	$ 398	$ 407	$ 416	$ 426	$ 436	$ 447	$ 458	$ 470
WTP=CS without fees - DWL		$51 263	$53 853	$56 638	$59 569	$62 647	$65 969	$69 438	$73 151	$77 060	$81 262
Fee revenue Aust and Local		$12 664	$12 914	$13 183	$13 466	$13 763	$14 084	$14 418	$14 777	$15 154	$15 560
CS with fees		$38 599	$41 329	$43 853	$46 510	$49 300	$52 311	$55 456	$58 821	$62 364	$66 173
Visitors on tours VD		1122	1185	1253	1327	1409	1498	1596	1704	1823	1953
- with fees		1058	1117	1182	1251	1329	1413	1505	1607	1719	1842
Producers' surplus	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross economic benefits		$51 646	$54 243	$57 036	$59 976	$63 063	$66 395	$69 874	$73 598	$77 518	$81 732
Management costs MCOW		$5 880	$4 326	$8 140	$8 518	$8 217	$8 638	$9 182	$7 899	$8 238	$8 612
Conditional Net Economic Benefits		$45 766	$49 917	$48 896	$51 458	$54 846	$57 757	$60 692	$65 699	$69 280	$73 120
Discount Rate	0.080										
Conditional Net Present Value		$374 969									
Management Budget MBW		$5 180	$3 401	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969
Fee revenue FR		$15 229	$16 081	$17 008	$18 016	$19 122	$20 336	$21 666	$23 126	$24 739	$26 513
NPV of fee revenue		$130 253									
Excess		$9 349	$11 755	$8 868	$9 498	$10 905	$11 698	$12 484	$15 228	$16 501	$17 901
NPV of Excess		$79 606									

24. man strat 2, med growth, $5 fee, 1.7 million visitor-days

Variable	Value	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total visitor days VD		1700	1795	1898	2011	2135	2270	2418	2582	2761	2960
- with fees	0.943	1603	1693	1790	1897	2013	2141	2281	2435	2604	2791
Australian tourists VD		527	554	582	612	644	677	713	751	791	834
- with fees		497	522	549	577	607	639	672	708	746	786
CS Australian tourists, without fees	$ 49	$25 823	$27 131	$28 517	$29 985	$31 542	$33 193	$34 943	$36 800	$38 769	$40 858
Local residents VD		1632	1632	1632	1632	1632	1632	1632	1632	1632	1632
- with fees		1539	1539	1539	1539	1539	1539	1539	1539	1539	1539
CS Local residents, without fees	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total CS, without fees		$25 823	$27 131	$28 517	$29 985	$31 542	$33 193	$34 943	$36 800	$38 769	$40 858
VD Aust and Local, without fees		2159	2186	2214	2244	2276	2309	2345	2383	2423	2466
VD Aust and Local, with fees		2036	2061	2088	2116	2146	2178	2211	2247	2285	2325
Deadweight loss DWL		$ 308	$ 311	$ 315	$ 320	$ 324	$ 329	$ 334	$ 340	$ 345	$ 351
WTP=CS without fees - DWL		$25 515	$26 819	$28 201	$29 666	$31 218	$32 864	$34 609	$36 460	$38 424	$40 507
Fee revenue Aust and Local		$10 180	$10 306	$10 439	$10 580	$10 730	$10 889	$11 057	$11 236	$11 425	$11 626
CS with fees		$15 336	$16 825	$18 078	$19 405	$20 812	$22 304	$23 886	$25 564	$27 344	$29 232
Visitors on tours VD		561	592	626	664	704	749	798	852	911	977
- with fees		529	559	591	626	664	706	753	803	859	921
Producers' surplus	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross economic benefits		$25 823	$27 131	$28 517	$29 985	$31 542	$33 193	$34 943	$36 800	$38 769	$40 858
Management costs MCOW		5880	4213	5426	5628	5141	5365	5701	4889	5059	5246
Conditional Net Economic Benefits		$19 943	$22 918	$23 090	$24 357	$26 402	$27 828	$29 243	$31 910	$33 710	$35 612
Discount Rate	0.080										
Conditional Net Present Value		$177 514									
Management Budget MBW		$5 180	$3 401	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969
Fee revenue FR		$3 046	$3 216	$3 401	$3 604	$3 825	$4 067	$4 333	$4 626	$4 948	$5 303
NPV of fee revenue		$26 051									
Shortfall		-$2 834	-$ 997	-$2 025	-$2 025	-$1 316	-$1 297	-$1 367	-$ 264	-$ 111	$ 57
NPV of shortfall		-$9 258									

25. man strat 1, med growth, $15 fee

Variable	Value	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total visitor days VD		3400	3590	3797	4022	4269	4540	4837	5163	5523	5919
- with fees	0.842	2863	3023	3197	3387	3594	3823	4073	4347	4650	4984
Australian tourists VD		1054	1107	1164	1224	1287	1355	1426	1502	1582	1668
- with fees		887	932	980	1031	1084	1141	1201	1265	1332	1404
CS Aust tourists, without fees	$ 49	$51 646	$45 673	$48 024	$50 500	$53 099	$55 905	$58 834	$61 970	$65 270	$68 818
Local residents VD		1632	1673	1715	1757	1801	1846	1893	1940	1988	2038
- with fees		1374	1409	1444	1479	1516	1554	1594	1633	1674	1716
CS Local residents, without fees	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total CS, without fees		$51 646	$45 673	$48 024	$50 500	$53 099	$55 905	$58 834	$61 970	$65 270	$68 818
VD Aust and Local, without fees		2686	2780	2879	2981	3088	3201	3319	3442	3570	3706
VD Aust and Local, with fees		2262	2341	2424	2510	2600	2695	2795	2898	3006	3120
Deadweight loss DWL		$3 183	$1 098	$1 137	$1 177	$1 220	$1 264	$1 311	$1 360	$1 410	$1 464
WTP=CS without fees - DWL		$48 463	$44 575	$46 887	$49 322	$51 879	$54 640	$57 523	$60 610	$63 860	$67 354
Fee revenue Aust and Local		$33 924	$11 704	$12 121	$12 550	$13 000	$13 476	$13 973	$14 491	$15 030	$15 602
CS with fees		$14 539	$33 969	$35 904	$37 950	$40 099	$42 428	$44 861	$47 479	$50 240	$53 216
Visitors on tours VD		1122	1185	1253	1327	1409	1498	1596	1704	1823	1953
- with fees		945	998	1055	1117	1186	1261	1344	1435	1535	1644
Producers' surplus	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross economic benefits		$48 463	$44 575	$46 887	$49 322	$51 879	$54 640	$57 523	$60 610	$63 860	$67 354
Management costs MCOW		5880	4213	6833	7119	6722	7047	7493	6802	7105	7439
Conditional Net Economic Benefits		$42 583	$40 362	$40 054	$42 204	$45 157	$47 594	$50 030	$53 808	$56 755	$59 916
Discount Rate	0.080										
Conditional Net Present Value		$311 981									
Management Budget MBW		$5 180	$3 401	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969
Fee revenue FR		$40 795	$143 582	$151 861	$160 860	$170 739	$181 577	$193 456	$206 494	$220 892	$236 730
NPV of fee revenue		$1074 882									
Excess		$34 915	$139 369	$145 028	$153 741	$164 016	$174 531	$185 963	$199 692	$213 787	$229 292
NPV of excess		$1031 106									

26. man strat 1, med growth, $35 fee

Variable	Value	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total visitor days VD		3400	3590	3797	4022	4269	4540	4837	5163	5523	5919
- with fees	0.660	2244	2369	2506	2655	2818	2996	3192	3408	3645	3907
Australian tourists VD		1054	1107	1164	1224	1287	1355	1426	1502	1582	1668
- with fees		696	731	768	808	849	894	941	991	1044	1101
CS Aust tourists, without fees	$ 49	$51 646	$35 800	$37 644	$39 584	$41 622	$43 821	$46 117	$48 575	$51 162	$53 943
Local residents VD		1632	1673	1715	1757	1801	1846	1893	1940	1988	2038
- with fees		1077	1104	1132	1160	1189	1218	1249	1280	1312	1345
CS Local residents, without fees	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total CS, without fees		$51 646	$35 800	$37 644	$39 584	$41 622	$43 821	$46 117	$48 575	$51 162	$53 943
VD Aust and Local, without fees		2686	2780	2879	2981	3088	3201	3319	3442	3570	3706
VD Aust and Local, with fees		1773	1835	1900	1967	2038	2113	2191	2272	2356	2446
Deadweight loss DWL		$15 982	$2 363	$2 447	$2 534	$2 625	$2 721	$2 821	$2 926	$3 035	$3 150
WTP=CS without fees - DWL		$35 664	$33 437	$35 197	$37 050	$38 997	$41 100	$43 296	$45 649	$48 127	$50 793
Fee revenue Aust and local		$62 047	$9 174	$9 501	$9 837	$10 190	$10 563	$10 953	$11 359	$11 781	$12 230
CS with fees		-$26 382	$26 626	$28 143	$29 747	$31 431	$33 257	$35 164	$37 216	$39 381	$41 713
Visitors on tours VD		1122	1185	1253	1327	1409	1498	1596	1704	1823	1953
- with fees		741	782	827	876	930	989	1053	1125	1203	1289
Producers' surplus	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Gross economic benefits		$51 646	$35 800	$37 644	$39 584	$41 622	$43 821	$46 117	$48 575	$51 162	$53 943
Management costs MCOW		5880	4213	6142	6387	5946	6220	6612	5863	6100	6362
Conditional Net Economic Benefits		$45 766	$31 587	$31 502	$33 198	$35 676	$37 600	$39 504	$42 712	$45 062	$47 582
Discount Rate	0.080										
Conditional Net Present Value		$257 548									
Management Budget MBW		$5 180	$3 401	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969	$1 969
Fee revenue FR		$74 613	$112 547	$119 036	$126 090	$133 833	$142 329	$151 640	$161 860	$173 146	$185 561
NPV of fee revenue		$882 022									
Excess		$68 733	$108 334	$112 894	$119 703	$127 888	$136 109	$145 028	$155 997	$167 046	$179 199
NPV of excess		$842 405									

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