An Environmentally Based Approach To Tourism Planning

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A thesis presented for the degree of Doctor of Philosophy

School of Biological and Environmental Sciences
Murdoch University
Western Australia
1993
I declare that this thesis is my own account of my research and contains as its main content work which has not previously been submitted for a degree at any university.

Ross K. Dowling
Dedicated to my mother

Ruby Emily Dowling

whose unfailing love and encouragement

have helped shape my life.
Sections of this dissertation have already been presented as conference papers or have been published in conference proceedings, book chapters or in national or international journals. They are:


In addition the Gascoyne Region Case Study research findings have been presented in the form of twelve reports submitted jointly to the Western Australian Department of Conservation and Land Management and the Western Australian Tourism Commission. These are listed in Appendix 1. Two of the reports contain descriptions and evaluations of the region's environment and tourism and underpin the summaries presented in this dissertation. They are:


ABSTRACT

This thesis examines the evolving relationship between the environment and tourism and argues for a new environmentally based regional tourism planning approach. In environmental planning the major aim is to foster environmental protection and conservation, whereas the goals of tourism planning are to engender tourism promotion and area development. This study seeks to determine whether or not the two approaches can be combined to institute both environmental conservation and tourism development, that is, to bring about sustainable tourism development. It is argued that the two can be integrated through a traditional tourism planning approach underpinned by environmental planning methods. The research then proposes a new environmentally based tourism planning model which is tested in Western Australia.

The evolution of the environment - tourism relationship is traced over the last four decades. The advent of mass tourism since World War II is related to growing global environmental awareness. Two aspects of the environment - tourism relationship are identified and described. The first is that the environment and tourism have symbiotic and even synergistic possibilities in which the relationship is mutually beneficial. The second is that they are in conflict and that tourism is destroying its very foundations. The conclusion is drawn that elements of both symbiosis and conflict are ever-present in the environment - tourism relationship. Therefore it is suggested that the symbiotic or ideal view be tempered by the realistic acceptance of tourism and the environment's potential and actual conflicts. This in itself leads to an integrative approach which minimizes adverse impacts and enhances positive outcomes through integrated planning and management.

Having established the integrative link between tourism and the environment, tourism and area development planning models are then briefly reviewed as well as those applicable to environmental conservation and protection planning. Parallels are drawn between the two planning approaches especially in relation to social and spatial components. It is then argued that the future of environment - tourism planning is based on environmental conservation, the incorporation of community and tourist views, and the recognition of functional differentiation. It is asserted that the planning of natural areas for tourism should begin from an
environmental base and work forwards towards the identification of tourism opportunities; include the views of community groups and tourists, especially in regard to the environment - tourism relationship; and conclude with a plan which embraces the spatial features of both environmental and tourism nodes, corridors and hinterlands.

A new regional sustainable development framework called the Environmentally Based Tourism (EBT) Planning Model is described. It is grounded in environmental conservation and seeks to advance environmentally compatible tourism through the identification of 'significant features', 'critical areas' and 'compatible activities'. Although incorporating aspects of the rational approach to planning, the role of people as part of the ecosystem is emphasized, and the opinions of tourists and the host community are included as an essential part of the process. Zoning is used to maintain environmental and tourism values and includes the following zones: sanctuary, nature conservation, outdoor recreation and tourism destination.

This thesis is explored on two levels: by the generation of the environmentally based tourism planning model and then through its application to a regional case study in Western Australia (WA). The model was tested in the Gascoyne Region of WA from 1989-1991. Extant environmental and tourism data were combined with face-to-face surveys of residents and tourists. Following analysis, the central conclusion is that the model is a useful tool in integrating environmental and tourism goals. Limitations of the study include the contextual integration of environmental and social values, the lack of comprehensive environmental data, and the attempt to bring together disparate planning approaches. However, overall the model helps bridge the rational - values oriented planning gap and assists in the identification of environment - tourism planning parameters. Finally, further research opportunities are identified especially in relation to the selection of appropriate data.
ACKNOWLEDGEMENTS

Many people have helped me over the last four years during the period of preparation and execution of this research. In recognition of their support and encouragement I would like to thank the following people:

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Chapter 1 Introduction

1.1 INTRODUCTION

The growing concern for conservation and the wellbeing of our environment over the last two decades has moved far beyond the realms of a concerned few into the wider public arena. At the same time there has been a corresponding upsurge in tourism all over the world leading to the phenomenon referred to as 'mass tourism'. With this unparalleled growth of the two it was inevitable that one day they would meet and interact. In natural areas where tourism either exists or is proposed there is the potential for both beneficial and adverse environmental and sociocultural impacts to occur. Thus there are two streams of thought regarding the environment - tourism relationship. The first is that the natural environment is harmed by tourism and hence the two are viewed as being in conflict. The second is that the two have the potential to work together in a symbiotic manner where each adds to the other.

The environment - tourism relationship has been the subject of this debate for the last two decades (for an overview see Dasmann et al. 1973; Budowski 1976; Bosselman 1978; Mathieson and Wall 1982; Pearce 1985; Romeril 1985a; 1989a+b; Farrell and McLellan 1987; Smith and Jenner 1989). The International Union for the Conservation of Nature and Natural Resources (IUCN; now known as the World Conservation Union) first raised the nature of the relationship when its Director General posed the question in Environmental Conservation in a paper entitled 'Tourism and environmental conservation: conflict, coexistence, or symbiosis?' (Budowski 1976). Thirteen years later the question appeared to remain
unanswered when a paper in *Tourism Management* posited 'Tourism and the environment - accord or discord?' (Romeril 1989a). Thus the environment - tourism relationship may be viewed from one of two standpoints - that it is either in conflict or symbiosis. Either point of view may be adopted and defended but it is argued here that no matter which standpoint is espoused the way to reduce conflict or increase compatibility is through planning which is grounded in environmental concepts and allows for sustainable development.

Environment - tourism planning is grounded in the concepts of the sustainable use of natural resources as fostered by the World Conservation Strategy (IUCN 1980) and the sustainable development strategy of the World Commission on Environment and Development (WCED 1987). This environmental - development link often includes tourism as a bridge. The base of this partnership is resource sustainability and tourism must be fully integrated with the resource management process. This will require the adoption of resource conservation values as well as the more traditional development goals. Central to the goals of environmental conservation and resource sustainability is the protection and maintenance of environmental quality. To achieve this primary goal requires planning which is grounded in environmental protection and enhancement yet fosters the realisation of tourism potential.

Thus environmental planning has widened its scope and now emphasizes people as part of its framework. At the same time planning for tourism has changed its stance from a purely economic position to the more neutral approach of 'tourism planning' which considers more fully both the community and its environment. Thus it is argued that the two planning approaches have moved from their original points on opposite
ends of a spectrum and are now situated relatively closer to each other nearer a middle point. Despite this shift, however, few environment-tourism planning frameworks or models have arisen from within the environmental disciplines solely for environmentally compatible tourism development.

What is required now is a new planning approach which is grounded in environmental principles and yet incorporates the essential elements of tourism development. The essential elements for such a plan would be for it to achieve environment-tourism compatibility, be strategic and iterative, regionally based, incorporate land use zoning, and be environmentally educative, that is, embrace the environmental ethic. In this way it would be grounded in the sustainable development approach, that is: be based on environmental protection, community wellbeing, tourist satisfaction and economic integration.

1.2 OBJECTIVES

From an examination of the literature and in order to address the above call for the exploration of the feasibility of an environmentally based tourism development planning approach, the following thesis is proposed:

'That an environmental survey method normally used for identifying environmentally significant areas can be integrated with a traditional area development tourism model to form an environmentally based tourism planning framework.'

In order to achieve this objective the following steps warrant further investigation:
1. To examine existing regional tourism planning frameworks and identify their environmental components as well as environmentally based planning approaches incorporating tourism aspects;

2. To design a practical and viable environmentally based planning framework for tourism in natural areas; and

3. To apply the planning framework in a field situation where there is a need for case studies on a world scale.

1.3 NATURE AND EXTENT OF THE STUDY

The research base for this thesis is derived partly from extant studies and partly through data collection and analysis. Starting with an examination and critical appraisal of the environment - tourism relationship, approaches to their planning are then described and critiqued. A gap in the knowledge is identified and a new model proposed. It is the Environmentally Based Tourism (EBT) Planning Framework, the methodology of which is outlined in Chapter 6.

Once generated the framework was then tested in the Gascoyne Region of Western Australia (WA). The region covers 141,000 square kilometres which is 5.6% of the total area of the state. It is an arid coastal area which is sparsely populated (approximately 13 000 people). Data collection was carried out by literature search for extant environmental information. Complementing this a social survey of the region's resident and tourist attitudes to the environment and tourism was carried out by face-to-face interviews using a six-page questionnaire. Considerable time was devoted to the collection and analysis of these questionnaires in order to ensure an adequate source of information to evaluate the respondents' attitudes.
This was important because the EBT framework emphasizes people as part of the ecosystem and strives for the integration of human values in the traditional rational planning approach. Realizing the importance of this principle is a prerequisite to understanding the EBT framework and its application in the Gascoyne Region.

1.4 LIMITATIONS

The limitations of the study are varied. They relate to both the model and its case study application in the Gascoyne especially in the context of current tourism planning which is usually cast within a broader economic framework by both policy and decision makers. Therefore, the following qualifications and recognition must be given to the findings:

1. The EBT framework is confined to the environmental aspects of tourism planning and has been devised to serve as a useful aid in addressing wider planning considerations. It does not embrace economic arguments and makes full recognition of the need for both environmental planning and tourism planning to be undertaken in the light of broader development goals and objectives.

2. The aspect of drawing together elements of a rational method as well as a 'values' approach obviously has shortcomings. A review of the literature clearly demonstrates the many problems involved in attempts to evaluate environmental criteria let alone a combination of social and environmental criteria. Thus at the outset it must be stated that much of the selection of data as well as its interpretation is subjective and therefore, given a different bias,
the overall results would be different. However, despite this it is contended that selecting different criteria or evaluating them in a different manner would probably not alter the general conclusions significantly.

3. Given that the environmental data base of the Gascoyne Region is not that well developed, compromises were made in the selection of criteria for evaluation. Given this qualification it is presumed that when applied to areas with a more complete data base the overall results should allow for more accurate conclusions to be drawn. However, the specific application of the model in this study should allow general conclusions about its application to other areas to be drawn.

4. During the time of the Gascoyne case study the general level of awareness of the environment and tourism was heightened. First, the residents of the region were grappling with the Australian Federal Government's decision to nominate part of the region as a World Heritage Area, and second, the number of tourists to the area was lower than projected because of the effects of the Australian Pilots' Strike and the general economic recession.

1.5 DEFINITION OF TERMS

The terms environment, tourism and planning are open to many interpretations. To avoid any confusions a glossary is presented as Appendix 2 to this dissertation which defines the meaning of key words. The full title associated with any acronyms or abbreviations used by the author is outlined in Appendix 3.
The definition of the word 'environment' used in this dissertation is taken from (Gilpin 1990). It is:

Environment - a concept which includes: all aspects of the surroundings of humanity, affecting individuals and social groupings. Environmental investigations are concerned, therefore, with people and their present and future activities in the surrounding atmosphere, water bodies and landscape.

(Gilpin 1990: 65)

Settling on a definition of tourism proved to be much harder. For a full account of the historical background, concepts and notions embraced by the term tourism, the reader is referred to Tourism Systems: An Interdisciplinary Perspective (Leiper 1990a). Definitions of tourism share a range of common elements. They include:

1. Tourism is the temporary, short-term travel of non-residents, along transit routes to and from a destination;
2. It may have a wide variety of impacts on the destination, the transit route and the source point of tourists;
3. It may influence the character of the tourist; and
4. It is primarily for leisure or recreation, although business is also important.

(Hall 1991: 6)

It is important to distinguish between tourism, leisure and recreation. The interrelationships amongst the three have been discussed by Boniface and Cooper (1987). They define leisure as the time available to an individual when work, sleep, and other basic needs have been met and recreation as any pursuit engaged upon during leisure time. Their definition of tourism is based on that of Mathieson and Wall (1982).

Tourism - the temporary movement of people to destinations outside their normal home and workplace, the activities
undertaken during the stay and the facilities created to cater for their needs.

Mathieson and Wall (1982: 1)

They argue that if leisure is a measure of time, and recreation embraces the activities undertaken during that time, then tourism is simply one of those activities. Conversely, a central part of the tourism experience usually focuses on leisure and recreational activities.

Planning is predicting and therefore requires some estimated perception of the future. Land use planning is the process by which decisions are made about the use of the land. In an introductory essay on Planning and Environmental Protection, O’Riordan and Turner (1983) refer to a report which examines the environmental sciences and planning.

In planning, a limitation to the practical use of most information produced by environmental scientists is that it includes only what is observed. Human values, ethics, and morals, are considered by scientists as factors which should not be included within the realms of science because they cannot be assessed objectively. Environmental scientists may form their own conclusions on those matters, but the scientific ethic dictates that they should not allow such considerations to interfere with the objective and impersonal nature of the research. In practice this is extremely difficult and can be argued to be impossible, which accounts for some of the variation in, and different interpretations of, particular environmental phenomena.

(Institute for Operational Research 1976: 25)

This view is also shared by Rose (1984) who argues that planning relies heavily on values even though it may depend on science in the form of research conclusions.

The definition of planning as used in this dissertation is related to its meaning in regard to land use. Thus planning is viewed as an ongoing
process of organising the future to achieve defined objectives. It involves both objective and subjective elements leading towards ultimate decision making.

Therefore, taken altogether environment - tourism planning refers to the ongoing practice of identifying and conserving an area's inherent environmental values whilst realizing its tourism potential through the process of compatible and sustainable development.

1.6 ORGANISATION OF THIS DISSERTATION

The thesis contains eleven chapters plus Appendices and a Bibliography. The first six chapters present the objectives, hypothesis, a review of the existing knowledge base and an outline of the methodology. The next four chapters contain an outline of the case study. The final chapter discusses the overall findings of the study, then presents the conclusions and their implications.
Chapter 2  The Environment - Tourism Relationship

Conservationists throughout the world should be made to understand that tourism, rather than being stopped, must be better planned and controlled.

Budowski 1976: 28

2.1 INTRODUCTION

The environment - tourism relationship has evolved through several phases over the last four decades (Hudman 1991). In the 1950s it was viewed as being one of coexistence (Zierer 1952). However, with the advent of mass tourism in the 1960s increasing pressure was put on natural areas for tourism developments. This trend, together with the growing environmental awareness and concern of the early 1970s, led to the relationship being perceived to be one of conflict (Akoglu 1971). During the next decade this view was endorsed by many others (eg. Cohen 1978, OECD 1980, Mathieson and Wall 1982). However, at the same time a new suggestion was emerging that the relationship could be one of symbiosis and thus be one which is beneficial to both the environment and tourism (eg. Budowski 1976, Pigram 1980, Romeril 1985a).

Over recent years the relationship has increasingly been viewed as one with considerable potential for either conflict or symbiosis. This new orientation to the environment - tourism relationship was referred to as integration (Dowling 1990). It differs from the symbiotic view with its inherent idealistic stance by recognizing the reality of the potential for environmental conflicts caused by natural area tourism developments. Thus the integrated view of the environment - tourism relationship advances that environmentally compatible tourism developments may be achieved by fostering sustainable development (Romeril 1989a, Farrell and

2.2 THE EARLY YEARS

Forty years ago the prevailing view was that tourism had few impacts on the natural environment. "A notable characteristic of the tourist industry and recreation industry is that it does not or should not lead to the destruction of natural resources" (Zierer 1952: 463). However, tourism's professional body, the International Union of Official Travel Organizations (IUOTO - predecessor of the World Tourism Organization, WTO), did recognize the possibility of adverse impacts. In 1954 it introduced into its General Assembly a section on the preservation of the tourist heritage which focussed on the protection of tourism 'capital' or resources from potentially adverse physical and social effects.

The advent of mass tourism which characterized the 1960s spawned widespread interest and research. The IUOTO demonstrated through various surveys that natural tourism resources were the primary factor that attracted tourists even in countries with an outstanding cultural heritage. This led to the first studies on what was termed the ecological impact of tourism and it convinced the IUOTO of the need to consider the environmental consequences of tourism development.

In Tahiti the association between tourism development and the environment was examined in the light of tourist induced environmental degradation (Beed 1961). Concern was expressed that the tourist invasion could induce ecological imbalance within the island's ecosystem if tourism was not carefully managed. Another study outlined the impact on fragile
sites by visitors destroying vegetation, collecting souvenir rock specimens, and causing trail erosion (Darling and Eichhorn 1967). On the other hand, studies of tourism developments in America (Waters 1966) and Africa (Makame 1968) asserted that tourism was beneficial for the environment. Later in the decade the IUCN began its first study of tourism and conservation when it met for its Tenth Technical Meeting on *Ecology, Tourism and Recreation* (IUCN 1967).

The advance of international tourism fostered high expectations regarding its potential role in economic growth and overall development for many countries. However, environmental concerns that were beginning to arise at this time, gained greater credence. On occasion the two would overlap, an early example being in the Caribbean where a strong rationale for conservation of nature and historical sites was fostered as an integral part of tourism (Carlozzi and Carlozzi 1968). They argued that bringing tourism development and conservation together would provide a major opportunity for achieving a measure of economic self-sufficiency in the Lesser Antilles.

As already noted, during the 1960s increasing public environmental awareness paralleled the advent of mass tourism. Therefore, it was inevitable that environmental protection and tourism development would interact and in many cases conflict. Early stirrings of widespread global environmental awareness and concern had been made on pollution (Carson 1962), overpopulation (Hardin 1968), resources (Ehrlich *et al.* 1970) and the environment (Nicholson 1970).

This awareness, which had already embraced the tourism industry, was highlighted by Akoglu (1971) in the same year in which the IUOTO
adopted an environmental tourist policy. Central to it was the recommendation that at the national level countries should establish an inventory of natural tourist resources. Implicit in the policy directive was the concept of classifying or zoning whereby areas with a particularly sensitive or fragile environment would be developed on a small-scale, if at all. Another key feature of the environmental tourist policy was the establishment of guidelines for the development of new tourist resorts. The IUOTO suggested that environmental considerations be incorporated in the commissioning of the design of any new tourist development so that buildings blended in with their surroundings and any adverse environmental impacts were minimized.

These policies were shared at the United Nations Conference on the Human Environment at Stockholm in 1972. During this meeting an important concept was formulated which would have far-reaching implications for the future. It was the birth of the Ecodevelopment Strategy which suggested that economic development should only take place if it was linked to environmental protection. A corollary to this strategy was the notion that any resulting natural area tourism development should be entirely compatible with local values and culture. These views were also endorsed by the World Bank (1972) which concluded that tourism planning should avoid disparities in the standards of amenities for visitors and the local population.

2.3 CONFLICT AND SYMBIOSIS

Although the environment - tourism relationship was initially viewed primarily as one with problems, early stirrings were occurring in regard to tourism being advocated as an agent of conservation. For example, in the
case of nature conservation, through the establishment of national parks in East Africa (Griffiths 1970, Pollock 1971, Myers 1972) as well as through cultural conservation in the case of Basque, Spain (Greenwood 1972). On the other hand, negative environmental impacts of tourism were being identified and described in England (Beck and Bryan 1971), the Great Barrier Reef, Australia (Clare 1971), the rural environment in Germany (Spiegel 1972), desert oases in the Sahara (Blake and Lawless 1972) and in Africa in relation to wildlife (Myers 1973 a+b).

By 1973 the environment - tourism debate had gained increased attention. Europa Nostra and The European Travel Commission (ENETC) met in Copenhagen at a conference entitled Tourism and Conservation Working Together. Both positive and negative factors in the interdependent relationship between the environment and tourism were articulated and it was concluded that:

1. The environment is the indispensable basis, the major attraction for tourism. Without an attractive environment, there would be no tourism;

2. The interests of tourism demand the protection of the scenic and historic heritage;

3. Tourism can directly assist active conservation and can prompt people to contribute towards conservation; and

4. Yet, despite these positive links, many conservationists feel that tourism can present a major threat to the environment - that countless hotels, roads and other facilities provided for the tourists ruin the beauties of the seacoast, disturb the peace of the country and rob the mountains of their serene grandeur - streets become choked with tourist traffic, and squares and marketplaces are turned into parks for visitors.

(ENETC 1973: 14)

During the same year Dasmann, Milton and Freeman (1973), all associated with the IUCN, published their seminal work Ecological Principles for
Economic Development in which a chapter was devoted specifically to the
development of tourism based on environmental considerations. They
addressed regional planning issues especially in regard to the nature and
role of tourism within parks. At the same time the problems of mass
tourism's adverse impacts on the natural environment were outlined by
Forster (1973) and in a case study of Uluru (Ayers Rock), Australia
(Ovington et al. 1973). The following year the Pacific Area Travel
Association (PATA) met in Japan and devoted its conference to the theme
of how tourism builds a better environment.

Over the next few years the diverging themes of the environment -
tourism relationship started to gain momentum with cases being argued
both for and against tourism developments in natural areas. Some argued
that tourism creates unacceptable costs - due to pollution (Young 1973,
Goldsmith 1974) and impacts on fauna (Mountfort 1974, 1975; Crittendon
1975) or flora (Liddle 1975, Edwards 1977, McCabe 1979). Since that time
many others have detailed environment - tourism conflicts in different
parts of the world. Just a few include the adverse impacts of: off-road
vehicles on the ecology in New Zealand (Crozier et al. 1977) and the USA
(Massachusetts - Godfrey and Godfrey 1980; Utah - Kay 1980; Alaska -
Slaughter et al. 1990) with a general overview by Webb and Wilshire
(1982), mountain climbers and hikers on the Mt Everest Region of Nepal
(Jefferies 1982, Pawson et al. 1984, Karan and Mather 1985, Cullen 1986,
Weber 1986), disturbance of African wildlife (Curry 1982, 1985; Sindiyo and
Pertet 1984) and the effects of tourism on coral reefs (Dahl and Lamberts
impacts of the ski industry on the Rio Hondo watershed in the USA
(Rodriquez 1987), the effects of recreationists on picnic sites in Hong Kong
(Jim 1987) as well as general statements - for Malaysia (Hong 1985), Canada (J. Butler 1986) and the Caribbean (Holder 1988).

On the other hand others indicated that tourism provided the incentive for the conservation of natural and cultural resources (Gunn 1973, Agarwal and Nangia 1974, Dower 1974, Nelson 1974). In addition two tourism professionals provided the strongest support for acknowledgement of the link between tourism and the natural environment. Haulot, the Commissioner General of Tourism in Belgium, and Krippendorf, the Director of the Swiss Tourism Association, both espoused the tourism - environment connection (Haulot 1974, Krippendorf 1975). Their books were the first on the theme of tourism and the environment and after consideration of a wide range of tourism’s effects on the environment they concluded that tourism developments in natural areas must embrace conservation.

1976 was a landmark year in the environment - tourism debate with a major paper by Budowski, the Director General of the IUCN, exploring the relationship between nature conservation and tourism (Budowski 1976). He suggested that the relationship is particularly important when tourism is partly or totally based on values derived from nature and its resources and added that the relationship could be one of conflict, coexistence or symbiosis. Budowski stated that conflict occurs when tourism induces detrimental effects on the environment and that the two are in coexistence particularly when there is little contact and each remains in isolation. He postulated that the environment and tourism are in symbiosis when each derives benefits from the other, that is, natural attributes are conserved whilst tourism development is attained.
Budowski indicated that the environment - tourism relationship at that time was more often one of conflict than coexistence. He challenged both conservationists and tourism developers to change their attitudes and work together suggesting that this would lead to the environment - tourism relationship becoming symbiotic. Budowski suggested that if this approach were followed then conservation and tourism would benefit mutually from each other. He said "tourism helps by lending support to those conservation programmes which will 'develop' educational, scientific, and recreational resources, with the objective that they in turn will attract more, and different kinds, of tourists" (Budowski 1976: 29).

The symbiotic approach was soon to be fostered in the Mediterranean where tourism was having a devastating effect on the natural, human-made and sociocultural environments especially along the coastal areas (Tangi 1977). To protect and preserve the region's environmental quality the United Nations Environment Programme (UNEP) sponsored a Mediterranean Action Plan and Regional Seas Programme which devised a number of tourism development strategies to overcome the adverse impacts of mass tourism. The approaches were described as alternative development strategies and included the following spatial, temporal and educational aspects:

1. Land use zoning for a range of uses from environmental protection to tourism development;

2. Fostering the dispersal of tourists by developing inland areas as tourist nodes;

3. Encouraging home-host and other forms of tourist accommodation;

4. Staggering holidays in order to lengthen the tourist season and reduce the concentration of tourist numbers;
5. Establishing environmental protection laws for tourist developments;

6. Encouraging nature-oriented tourism with environmentally trained guides; and

7. Establishing a 'tourism code of conduct' applicable to both tourists and the tourism industry.

(Tangi 1977: 340-341)

In the latter part of the decade an attempt was made to systematically assess the environmental impacts of tourism (Cohen 1978). The environment was described as 'the physical environment' with both natural and cultural components and impacts classified as being either positive or negative. The factors of the environmental impacts of tourists were described as depending upon the intensity of tourist site-use, the resiliency of the ecosystem, the time perspective of developers, and the transformational character of touristic developments. An evolutionary phase was proposed for natural areas in which the original tourist destinations become environmentally degraded through intensive use. Finally, Cohen stated that the environment - tourism relationship could be viewed in two ways either as protecting the environment for tourism or from tourism. He concluded that the latter approach was particularly important especially in developing countries.

During the same year the American Conservation Foundation put together a compilation of case studies of tourism in natural areas in eight different developed countries (Bosselman 1978). It outlined many of the problems associated with tourism's impacts on natural areas but concluded that tourism can be most beneficial if it makes the tourist more aware of the special qualities of places. While both Cohen and Bosselman were pointing out the potential environmental risks posed by tourism, their
alliance was being proposed by Gunn (1978). He endorsed Budowski's view that the environment - tourism relationship had evolved from coexistence to potential for conflict or symbiosis but went on to suggest their synergistic possibilities. To explore these further, Gunn advocated the need for an international alliance of tourism, recreation and conservation. A practical example occurred in North Auckland, New Zealand where increasing recreational and tourist pressure helped to establish a marine park (Ballantine and Gordon 1979).

The 1970s were a decade which can be best summarized as one in which the potential conflicts of tourism and the natural environment were realized. Parallel with this was an associated increase of interest in the relationship between the social and cultural environment and tourism. Research focussed on the tourist, the host, and the tourist - host relationship (Affeld 1975). Case studies were made in East Africa (Ouma 1970), Spain (Greenwood 1972), the Caribbean (Bryden 1973, Lundberg 1974, Perez 1975), Bali (Francillon 1975, McKean 1976), the Pacific Islands (Farrell 1977, Finney and Watson 1977) and Mexico (Hudman 1978). General overviews were provided by Young (1973), Jafari (1974), Turner and Ash (1975), Smith (1977), Pizam (1978) and De Kadt (1979). This social empowering of tourism ushered in an awareness that tourism development, with its predominantly economic emphasis and incipient environmental aspects, also had to embrace its social consequences which could be either negative (Thomason et al. 1979) or positive (Cohen 1979a).

The beginning of the new decade heralded a wave of interest in tourism and conservation issues and 1980 was a landmark year for the environment - tourism debate. The importance of the stewardship of resources and the inclusion of community views were both advocated for
tourism development planning by Romeril and Hughes-Evans (1980). In March UNEP and the WTO formally signed an agreement on tourism and the environment. In September at the World Tourism Conference in the Philippines the 'Manila Declaration on World Tourism' was generated. The philosophy of the declaration with respect to environment and tourism issues was made quite clear:

Tourism resources available in the various countries consist at the same time of space, facilities and values. These are resources whose use cannot be left uncontrolled without running the risk of their deterioration, or even their destruction. The satisfaction of tourism requirements must not be prejudicial to the social and economic interests of the population in tourist areas, to the environment or, above all, to natural resources which are the fundamental attraction of tourism, and historical and cultural sites. All tourism resources are part of the heritage of mankind. National communities and the entire international community must take the necessary steps to ensure their preservation.

(WTO 1980a: 2)

Also that year the Organization for Economic Cooperation and Development (OECD) published the results of a three year investigation by a 'Group of Experts on Environment and Tourism' (OECD 1980). The publication summarized the situation at the time as being one in which the environment and tourism were in conflict due to the adverse environmental impacts caused by tourism. The study's prediction for the future was that "tourism is involving more and more people and is becoming a virtual mass phenomenon whose uncontrolled expansion can be seriously damaging for the environment" (OECD 1980: 41).

While these environmental initiatives were being made by tourism (WTO) and development (OECD) organizations, the world's major environmental organizations, the IUCN, UNEP and the World Wildlife Fund (WWF; later to be known as the World Wide Fund for Nature),
joined forces to present a global conservation plan - The World Conservation Strategy (WCS; IUCN 1980). The strategy argued that development can only be sustained by conserving the living resources on which it depends as well as by the integration of development and conservation. Living resource conservation was defined as being specifically concerned with plants, animals and microorganisms, and with those non-living elements of the environment on which they depend. It was advanced that living resources have an important property which distinguishes them from non-living resources; that they are renewable if conserved and are degradable if not. The same argument was applied to water, soil and air resources. Living resource conservation, and hence the strategy, had three specific objectives:

1. To maintain essential ecological processes and life support systems such as soils, water and the recycling of nutrients;

2. To preserve the genetic diversity found in the world's organisms. This includes the preservation of wild plants and animals and the variety of domesticated crops and livestock; and

3. To ensure the sustainable use of species and ecosystems such as fish and other wildlife, forests and grazing lands.

(IUCN 1980: 1.7)

This policy took the earlier concept of 'ecodevelopment' linking environment and development and added the notion of the 'integration' of the two in order for the earth to be able to continue supporting humankind into the future. This was to shape the future direction of conservation for the remainder of the decade and gained increased importance when, during the same year, the Brandt Commission Report on North - South relations stated that development must include the care of the environment (Brandt Commission 1980). A number of
contributions were made to the environment - tourism debate by geographers. A conference on South Pacific Tourism stressed the interdependency of the relationship (Pearce 1980), the symbiotic link was advocated in Australia (Pigram 1980) and the USA (Holmes 1980), and in Canada a study was made of the social acceptance of tourism (Cheng 1980).

In 1982 UNEP and the WTO issued a joint declaration formalizing interagency cooperation for the purpose of protection, enhancement and improvement of the environment for the harmonious development of tourism (UNEP/WTO 1982). They suggested that the rational management of tourism could contribute to the protection and development of both the physical environment and cultural heritage as well as improving the overall quality of life. Attempts were being made in different parts of the world to achieve this tourism - environment compatibility. In Nepal Sagamartha (Mt. Everest) National Park was established largely to ameliorate the adverse environmental impacts of back-packing tourists. One of its main objectives was to promote tourist and visitor use suitable to the environment and park conditions in such a manner that it was compatible with the other objectives (Jefferies 1982). These include the conservation of nature, water, soil, religious and historic values. A further objective was the need for the scheme to generate economic benefits for the local population.

In Australia the Great Barrier Reef Marine Park which had been established in 1975 underwent classification in 1981 into zones in order to separate out areas for environmental protection and tourism use (Kelleher and Kenchington 1982). The plan established five zones incorporating general use (open and limited), tourism, scientific research and preservation. In addition there was provision for three types of protected
areas for the purposes of reef appreciation, seasonal breeding, and long-
term replenishment. In East Africa attempts were also being made to
make conservation and development compatible. While tourism
development was fostered consideration was being given to the protection
of coastal and marine areas visited by foreigners to ensure that essential
ecological processes were left undisturbed (Kundaeli 1983).

At the same time a major survey and summary of the environmental
impacts of tourism reached a different conclusion (Mathieson and Wall
1982). Taking up Budowski's (1976) theme of coexistence, conflict or
symbiosis they explored in detail the latter two views and concluded that
more often than not the two were in conflict as "there is little evidence to
indicate the widespread existence of a symbiotic relationship between
tourism and the environment" (Mathieson and Wall 1982: 101).

By now the environment - tourism debate was being widened to include
the sociocultural aspects which had been the focus of separate research in
the 1970s. A social-theory base for tourism was advanced by Travis (1982)
and a community based environmental approach advocated by Murphy
(1983). It was argued that tourism is essentially resource-based and by
ignoring social, as well as ecological implications, the industry was in
danger of undermining its very existence. It was suggested that benefits
would accrue for the industry and the destination community from the
development of a mutually symbiotic relationship.

UNEP and the WTO held a jointly sponsored workshop on 'The
Environmental Aspects of Tourism' in Madrid in July 1983. This meeting
canvassed the wider view of tourism and the environment but it also took
a significant step forward in its systematic identification of specific issues
requiring the attention of the two world bodies. This was further advanced by UNEP in the following year in a special issue of their newsletter (Industry and Environment 1984). In addition, a tourism and conservation workshop in Nova Scotia, Canada in June 1984 stressed the interrelatedness of tourism and the environment and argued for their better planning and management (Young 1985).

2.4 FROM IDEALISM TO REALISM

By the mid 1980s the environment - tourism relationship was beginning to be more clearly understood. A review was made of the major issues and literature of the time by Dunkel (1984) and the positive aspects advanced (Organization of American States 1984). The importance of the environment to any aspect of development had been asserted through the World Conservation Strategy and close cooperation between the environment and tourism had been advocated (UNEP/WTO 1983) and initiated (Mlinaric 1985). Cooperation between conservation and tourism was advocated at a European Heritage Landscapes Conference held in 1985 by the Director of the Countryside Commission of the United Kingdom. He stressed their interrelatedness, pointed to the need for their future cooperation and argued that there were three reasons why conservation should seek the support of tourism. They were that tourism provides conservation with an economic justification, is a means of building support for conservation, and can bring resources to conservation (Phillips 1985).

A special edition of the 'International Journal of Environmental Studies' 25 (4) 1985 focussed on the topic and the relationship was described as moving closer together, with "Budowski's symbiotic ideal (being) much
more a reality now than it was in 1976" (Romeril 1985a: 217). The view that tourism can be a major agent for landscape conservation was also endorsed by Murphy (1986a) and Leslie (1986). At the same time the integration of the relationship was also being advanced for its benefits to both business (Murphy 1986b) and regional development (Pearce 1985b). Other aspects of the relationship were also being examined, notably the biological impacts of the environment both by and on tourists (Edington and Edington 1986) as well as aspects of the environmental carrying capacity of tourism (Industry and Environment 1986).

By the end of 1986 it was clear that the idealism of the environment-tourism relationship as advocated through symbiosis, was being tempered by the realism that in actual fact the underlying conflicts were still everpresent. This was demonstrated during a symposium held in Canada in March 1986 by the Alberta Chapter of the Canadian Society of Environmental Biologists. The symposium theme of 'Tourism and Environment: Conflict or Harmony?' was debated by leading Canadian researchers and academics with arguments being presented for both the viewpoints of conflict (eg. Landals 1986) and harmony (eg. Mackie 1986).

The shift from idealism to realism was encapsulated in a brief explanatory note several years later when the editor of Environmental Conservation, in attempting to clarify the use of the word symbiosis, wrote:

Commenting on this use of 'symbiosis', a Referee wrote: 'There appears to be an idealist view of symbiosis as a relationship which is benign, harmonious, and stable. In Nature, symbiosis may appear to be so, but in reality is more likely a mutual exploitation in which "tension" and change are bound to be inherent. This realist view might nevertheless be used to advantage here.'

(Editor's note quoted in Kenchington 1989: 230)
2.5 TOWARDS INTEGRATION

By the middle of the last decade the environment - tourism relationship had embraced aspects of the three states of coexistence, conflict and symbiosis. Since then it has been argued that all three relationships exist simultaneously depending on location and issue (Hall 1991). While the relationship in symbiosis has been sought after as the 'ideal', in reality it has been largely one of conflict (Smith and Jenner 1989). Therefore a new orientation for the relationship has been advanced in which both the environment and tourism are viewed as making a unified whole (Dowling 1990). This is the state of integration where the possibilities of coexistence, conflict and symbiosis are recognized, but environmentally appropriate tourism opportunities are advanced (Figure 1). Such activities and developments are fostered if they are environmentally compatible, minimize adverse impacts and maximize beneficial ones. This is the essence of sustainable development which was advocated in a major global statement by the World Commission on Environment and Development (WCED 1987). Entitled 'Our Common Future', and generally referred to as 'The Brundtland Report', it examined the world's critical environmental and development problems and concluded that only through the sustainable use of environmental resources will long-term economic growth be achieved (Brundtland 1987). Hence the term 'Sustainable Development', which had previously been coined, was now brought into wider use and the concept began to shape the nature of the future debate on the environment - tourism relationship.

This approach was proposed by a number of people writing on the theme of 'Tourism and the Physical Environment' (Annals of Tourism Research 1987). They suggested that the environment and tourism must be
Figure 1: The Environment - Tourism Relationship

**INTEGRATION**
overall advancement of tourism & environment

**TOURISM**


**THE ENVIRONMENT**


**DESPOILATION**
overall decline of tourism & environment

NOTE: 1. Symbiosis occurs in quadrant I
2. Conflict occurs in quadrant II - IV
3. Integration occurs when the symbiotic effects outweigh the possible conflicts so that tourism and the environment are advanced.
integrated in order to maintain environmental integrity and successful tourism development. They also advanced the notion that:

A symbiosis between tourism and the physical environment is the second strand of a dual braid of concern, the first being the contextual integration of both physical and social systems.

(Farrell and McLellan 1987: 13)

They further argued that:

The true physical environment is not the ecosystem, the central core of ecology. This is an environment (better still an analogue model) perceived by those occupying a subset of the scientific paradigm, and their viewpoint is not exactly the same as the abiotic vision of landscape perceived by the earth scientist or the more balanced landscape or region, the core of the geographer's study.

Farrell and McLellan (1987: 12)

Their reasoned appeal for a more holistic view is advanced with the need for the integration of community concern and involvement in tourism development as contended by Travis (1982), Murphy (1983, 1985), Farrell (1986) and Miller (1987). This integrative approach is one in which the "resource assets are so intimately intertwined with tourism that anything erosive to them is detrimental to tourism. Conversely, support of environmental causes, by and large, is support of tourism" (Gunn 1987: 245).

It is this view which has begun to shape natural area tourism development over recent years. One example is the regional approach to environmentally sound tourism development initiated through UNEP's Regional Seas Programme in the 1970s and later expanded to encompass eleven seas worldwide. During the development of all of the plans, tourism was identified as an important economic activity which required
careful planning to ensure sustainability. Aspects of environment-tourism planning incorporated in some of the plans included: the assessment of areas suitable for environmental protection or tourism development, the assessment of tourism's impacts, assessment of alternative tourism and the development of environmental guidelines (Gajraj 1988).

The close of the decade brought about a renewed concern for the environmental aspects of tourism. More research was advocated on the role of national parks and protected areas in regard to regional planning and development, indigenous people and tourism (Nelson 1988). A major study found that although tourism brings substantial economic benefits it is damaging the world's environment (Smith and Jenner 1989). Specific problems identified and described included pollution of beaches, damage to coral reefs, disturbance of wildlife, degradation of historic sites, air pollution, congestion, and negative social impacts on local culture and customs. The study concluded that "the tourism industry in its widest sense needs to take a lead in becoming more environmentally sensitive before it becomes one of the main targets of accusation that it is environmentally irresponsible" (Smith and Jenner 1989: 68).

Similar concerns were also expressed by Romeril (1989a+b). Whereas just four years before he had championed Budowski's environment - tourism symbiotic relationship (Romeril 1985) he now concluded that "the goal is to maintain a profitable and viable tourism industry without detriment to the environment, an objective which must surely become the norm in the 1990s" (Romeril 1989a: 208). In addition he stated that "the symbiotic ideal of Budowski and Romeril will remain a distant goal while such detrimental change is still seen by so many, who know the industry so
well, as the only inevitable outcome of the development of an emerging tourist industry" (Romeril 1989b: 111).

Romeril (1989a+b) suggested the increase of alternative or 'green' tourism as a possible future way towards environment - tourism integration, a proposal also suggested by CART - the Centre for Advancement of Responsive Travel (Millman 1989). However, alternative tourism is often used as a synonym for 'appropriate' tourism but questions were later raised as to whether or not this is so (Cohen 1989, Pigram 1990, Farrell and Runyan 1991, Järveluoma 1992). Butler (1990) stated that the assumption is often made that alternative forms of tourism will have fewer and less severe negative effects on destination areas and their populations without diminishing the positive economic effects. He then argued that this is not the case as the very nature of tourism makes it difficult to manage, control and determine capacity levels.

Today the integration of tourism and the environment is being carried out at different levels in a number of places for a variety of different reasons. They range in size from small-scale (eg. the Northern Mariana Islands, School of Travel Industry Management 1987; the Galápagos Islands - Kenchington 1989; Yankari Game Reserve, Nigeria - Olokessus 1990) to large-scale (Lake Baringo, Kenya - Burnett and Rowntree 1990) and include conservation (Brake 1988), cultural (Gayle and Jacobs 1987) heritage (Millar 1989), social (Brockelman and Dearden 1990) and spatial benefits (Jansen-Verbeke and Ashworth 1990). On a global scale this integrative approach is being fostered by principals of both conservation (McNeely and Thorsell 1989, McNeely 1990a+b) and development (GLOBE '90 1990).
The integrated or sustainable development approach to tourism was advocated through resource planning and management (Jackson 1988) and was the theme of three meetings held early in 1990. They consisted of workshops in Waterloo, Canada in January and in Malta in March with both culminating in the Tourism Stream of the GLOBE '90 conference held in Vancouver, Canada in March. This international conference brought together environmental and industry leaders to promote the concept of sustainable development and the 'Tourism Stream' prepared an action strategy with suggestions on how to achieve sustainable tourism. The recent updating of the World Conservation Strategy also advances the integration of conservation and development through the process of sustainable development and outlines general strategies to achieve this goal (IUCN 1991). Recent discussions have highlighted the responsibility tourism has to protect the environment both from the standpoint of conservation (Kitching 1992) as well as tourism (Savignac 1992).

2.6 THE NEED FOR PLANNING

It has been clearly established that there is a strong environmental - tourism link with both an increase in demand for natural area tourism (Bosselman 1978, Romeril 1989a, Smith and Jenner 1989), as well as the increasing role of tourism to advance conservation (Budowski 1976, Phillips 1985, Murphy 1986a). A summary of the literature on the environment - tourism relationship indicates that it has usually been viewed as either one of conflict or symbiosis. It is argued here that neither view is exclusive and therefore to minimize conflicts and foster symbiosis there is a need for an integrated approach to environmentally compatible tourism planning.
A plan is a detailed scheme or method for attaining an objective. Planning is the practical process by which the objective is achieved. Planning is a multidimensional activity and seeks to be integrative. It embraces environmental, social, economic, political, psychological, anthropological and technological factors. It is concerned with the past, present and future (Rose 1984). Therefore, like its objectives and structures, the methods and techniques of planning are diverse.

Planning involves people and as such relies heavily on values. Community values are critical to planning and include spatial and temporal dimensions. Spatial factors important in planning include the scale (site, local, regional, national or international), concentration of use versus dispersal, land tenure and use, as well as carrying capacity. Temporal factors incorporate both static views such as 'a snapshot in time' approach, as well as dynamic - where planning is viewed as an ongoing process. This latter approach can be expanded to be viewed as a continuous or iterative process (Lang 1986).

Two early attempts at planning for conservation and tourism were carried out in the mid 1960s. The first was a planning study of County Donegal, Northern Ireland which aimed at reconciling the 'conservation of natural resources' with the 'development of tourism and leisure opportunities' (McCarthy and Dower 1967). The study was viewed as being necessary due to the increasing pace of tourism development threatening the natural and cultural heritage upon which it was based. This paradox and link between conservation and development was seen as a struggle for the countryside in general and parks in particular. The planning process included traditional surveys of demand (tourists) and supply (natural and amenity resources) followed by a 'measurement of capacity' in which the
demand and supply factors were compared. This was the critical phase in which the goals of resource protection and tourist development had to be balanced. A resource base was identified as including natural attributes such as features (beaches, hills etc) and activities (fishing, hill-walking etc) as well as physical items such as accommodation, water supply and road capacity. Comparisons of supply and demand indicated a surplus or shortfall of resources allowing a statement of options to be drawn up. This in turn led to the preparation of an 'amenity budget' in which conservation of resources and tourism developments were planned on an annual basis at three levels - county, planning area and individual resources. This planning approach was one of the first to incorporate regional and strategic aspects.

The second early planning study was carried out in the Lesser Antilles of the Caribbean (Carlozzi and Carlozzi 1968). In order to achieve and maintain a measure of economic self-sufficiency in the region they advocated the traditional material advantages of tourism growth but based them on the conservation of nature and historical sites. To achieve this aim of economic gain through environmental protection and conservation they suggested that the planning process should include:

1. An inventory of natural and historical assets;
2. Land acquisition of beaches to preserve public access;
3. Restoration and stabilization of historic sites;
4. Construction of access roads and facilities for potential park sites;
5. Formation of foundations and trusts in view of the specific nature and small-scale of site preservation;
6. Technical assistance in park and recreation planning, restoration, museum design, interpretive programmes and scientific research; and

7. Citizen education in environmental and historical site conservation; and formation of a Caribbean international park system, aimed at establishing common standards and coordinating park development.

(Carlozzi and Carlozzi 1968: 146)

By the mid to late 1970s the number of tourists and magnitude of their impacts on the natural environment had led to major publications stressing the need for planning. Haulot (1974) advanced the need to coordinate both the economic and physical aspects of tourism planning in order to redress the problems of litter, waste and pollution. Additional reasons suggested by Gunn (1979a) included the need to avoid increased congestion and the erosion of fragile resource assets. A major report noted that "tourism is thus involving more and more people and becoming a virtual mass phenomenon whose uncontrolled expansion can be seriously damaging for the environment" (OECD 1980: 41). It proposed a balance between environmental conservation and tourist growth and outlined different planning approaches to achieve this, such as developing new attractions, spreading holidays more evenly throughout the year, and developing nature tourism and open-air recreational activities. Another aspect of tourism planning was raised by Mathieson and Wall (1982) who suggested that planners should avoid the usual approach of directing their work towards the needs of tourists and instead consider the welfare of a destination area's hosts. To achieve this they suggested that there be more public involvement in tourism planning especially through public participation programmes.

The consequences of unplanned tourism development and therefore the need for planning have been outlined by Mill and Morrison (1985: 285-
They suggest that tourism planning is an essential activity for every destination area and its basic aim is "to avoid negative physical, human, marketing, organizational and other impacts that can occur when planning is not practiced" (p290). Impacts to be avoided include both physical and human elements. Physical elements are those that cause damage or permanent alteration of the physical environment and historical or cultural landmarks and resources; overcrowding and congestion; pollution; and traffic problems. Undesirable human impacts to be avoided include friction among individual tourism operators, resentment of tourists by residents and the lack of education and training of tourism personnel. They suggest that tourism activity in a destination area is generated through the existence of unique attractions. These are both natural and cultural and may include beaches, natural scenery, parks, historical buildings and landmarks, unique cultural characteristics, local events and activities. To maintain tourism as a long-term economic activity planning must conserve and enhance these specific factors by maintaining and promoting an area's natural features and resources; local cultural and social fabric; local architecture, historical monuments and landmarks. In addition damage to natural features and resources; overcrowding, congestion and traffic problems; pollution and loss of cultural identities must be avoided (Mill and Morrison 1985).

An international survey of 97 parks and reserves in 38 countries indicated that 75% of the protected areas incorporate tourism as a major objective in planning and management (Zube and Busch 1990). For tourism to be developed in natural areas it is essential that any development planning framework not only incorporates environmental principles but be based on them.
2.7 SUMMARY

To conclude, the nature of the environment - tourism relationship at present can be best summarized as being one which is in equipoise. The view that tourism and the environment is a symbiotic or even synergistic panacea must be tempered by the fact that the relationship is still one of conflict in many parts of the world. Therefore it is through their integration that conflicts can be minimized and symbiotic possibilities advanced. This view has been advocated by the IUOTO in the 1960s, Haulot and Krippendorf in the 1970s, Romeril in the 1980s and is the basis of the current sustainable development thrust. Whilst in the past, natural area tourism development to enhance economic growth has been described as being either in coexistence, conflict or having symbiotic possibilities, the emerging view is that continued tourism development will only be sustained by the recognition of the interdependencies that exist among environmental and economic issues and policies. This is the concept of 'sustainable development' which is recognized by both those who describe the conflicts (Smith and Jenner 1989) as well as those who advocate a symbiotic approach (Romeril 1989a+b). It has been advanced that "an aware and completely changed industry can sustain tourism. In terms of modern thinking and ecodevelopment, if tourism is sustained significant steps have then been taken toward maintaining environmental integrity. A healthy environmental integrity means the possibility of successful tourism, which, when managed properly, becomes a resource in its own right" (Farrell and McLellan 1987: 13).
Chapter 3  Tourism Planning

The tragedy is that despite the many joint initiatives, conferences, workshops and publications, polarization to a lesser or greater extent remains and progress towards environmentally sound tourism planning remains slow.

Romeril 1989b: 110

3.1  INTRODUCTION

In the previous chapter the relationship between the environment and tourism was examined. It was demonstrated that the relationship has evolved through a series of phases from one of coexistence to a later one embracing aspects of both symbiosis and conflict. It was then advanced that whereas the symbiotic stance represents an ideal view of the relationship, in reality conflicts between the environment and tourism occur. Therefore it was argued that the environment - tourism relationship should be viewed as one of integration - a combination of conflict and symbiosis. However, in the integrated approach conflicts are minimized and symbiotic possibilities are fostered. To achieve this goal the conclusion was made that the planning of tourism in natural areas is essential.

This chapter examines tourism planning especially in relation to its environmental aspects. It commences with an overview of the tourism system then identifies, describes and reviews the various approaches to, goals and levels of tourism planning. In addition there is a brief survey of tourism plans which have been undertaken in various parts of the world and in a number of special environments. This is followed by a review of existing tourism planning models as well as the criteria used in their evaluation. From the foregoing survey of tourism planning a number of principles are then identified and described. The chapter concludes that
whereas in the past traditional tourism planning was driven by economic goals, over recent years tourism planners have begun to recommend the need to include environmental and social considerations. It is then argued that while aspects of either environmental or social elements have been included in some recent tourism planning approaches there is merit in further investigating tourism planning approaches to include both environmental and social aspects as critical components. This reversal of the usual economic-social-environmental approach to tourism planning is further investigated in the following two chapters.

3.2 THE TOURISM SYSTEM

The tourism system has been described and modelled from several different perspectives. All include elements of demand and supply linked by the interconnecting strand of travel. Gunn (1988a) has proposed a simple approach called the Functioning Tourism System which consists of a number of interrelated components. Demand consists of the tourist market and incorporates people's interest in and ability to travel. Supply components include transportation, attractions, services and information/promotion. Transportation consists of the volume and quality of all modes of transport. Attractions are the quality resources which have been developed for satisfying visitors. Services include the variety and quality of food, lodging and other products, and information/promotion is essential to entice the tourist to visit the products offered. Other writers have described the components of the tourism system in a similar manner with only minor differences in functions. For example, Mill and Morrison (1985) combine attractions and services into a 'destination' component, whereas Pearce (1989) separates accommodation from services and replaces information/promotion with
infrastructure. An origin-destination approach emphasizes the interdependence of the generating and receiving environments (Leiper 1981). Mathieson and Wall (1982) argue that tourism should be divided into three general components including a dynamic dimension (consisting of demand and travel), a static element (characteristics of tourists and destinations) and consequential component (impacts).

A tourism system model which embraces many of the elements of the existing models but which focuses on tourism's environmental aspects is outlined in Figure 2. It is based on the traditional view of a system incorporating inputs, processes, outputs and feedback. The inputs include elements of demand or markets, that is, the prospective tourist's motivation for and ability to travel, as well as supply, that is, the destination resource with its attractions, services, information and hosts. Processes include economic, social and environmental interactions which may have positive and/or negative outputs (impacts). Feedback allows for the planning of appropriate controls, capacities, policies and strategies for tourism growth whilst minimizing adverse impacts. It is this model which serves as a backdrop for the examination of environmental aspects of existing tourism planning approaches.

3.3 TOURISM PLANNING APPROACHES

Tourism is a diffuse and complex activity consisting of a wide range of elements which may be developed in a variety of contexts by a broad spectrum of agencies and developers each having different aspirations and capabilities. It involves both the diversity of tourist demand as well as the supply of multiple resources which might be developed for tourism. Tourism touches upon many sectors of society, is related to the economy
Figure 2  The Tourism System

**Inputs:**
- Demand
- ORIGIN
  - markets
  - Transportation
- Supply
  - Destination
- Tourists
  - Preference (motivations)
  - Availability
  - Information/Promotion
  - Attractions
  - Services
  - Community Receptivity
  - Hosts
  - Infrastructure
  - Stage
  - Policies

**Ingredients:**
- natural
- cultural
- heritage
- interests
- transportation within
- facilities
- accommodation
- catering
- shopping
- development
- national
- regional
- local

**Processes:**
- economic (transfer of money)
- social (tourists-hosts)

**Interactions:**
- Environmental (Outdoor recreational activities)

**Outputs:**
- Positive
  - area investment
  - rewards for owners
  - value for money
  - tourist satisfaction
  - host-tourist understanding
  - environmental education
  - conservation of significant features
  - IMPACTS

- Negative
  - economic — costs to community
  - social — increased congestion, crime, the demobilisation effect etc.
  - environmental — degradation of environment, litter, pollution etc.

**Feedback:**
Controls/capacities/policies/strategies
in general, and may impact on society and the environment.

Pearce (1989) argues that unplanned, uncontrolled tourism growth when taken to the extreme can destroy the very resource on which it is built. By extension, Hall (1991) asserts that demands for tourism planning are a response to the effects of unplanned tourism development. Tourism planning is usually considered to be planning for tourism. This traditional view focuses on planning for tourist developments. It lays great emphasis on providing destination attractions and facilities in order to attract tourists and increase economic development. This type of tourism planning has been equated with economic advantage through increased income, greater employment opportunities and overseas earnings. According to Getz (1987) this form of planning is called 'boosterism' and it will always be advanced by politicians and tourism developers either to promote growth and/or profit through the exploitation of resources.

However, Getz (1986) throws a different light on tourism planning by suggesting it should be viewed as a process based on research and evaluation which seeks to optimize the potential contribution of tourism to human welfare and environmental quality. In this approach tourism planning is regarded as an integrated activity which incorporates economic, social and environmental components, spatial (accessibility) concerns, and temporal (evolutionary stage) implications. In addition it recognizes the basic components of a demand (market) side and a supply (destination) side linked by transportation and communications. Demand is a reflection of what the tourist wants and is willing to pay for at any given time. This is met through the supply of accessible attractions and services. Planning for tourism takes into account these factors and its
overall planning aim is to accomplish a better demand-supply match and hopefully avoid disbenefits.

A number of recent approaches to tourism planning have advocated that economic development cannot be an exclusive goal. The approaches assert that there must be social and environmental planning components which lay additional emphasis on the potential contribution to human welfare and environmental quality (Gunn 1979a, 1988a; Braddock 1982; Murphy 1985; Getz 1987; and Inskeep 1988, 1991a). These approaches advocate tourism planning as embracing the following goals: tourist satisfaction, rewards for owners, the conservation of resources and community integration. These are the goals of the Regional Strategic Planning Process which strives for a balance of economic, social and environmental concerns (Gunn 1988a). Another important concept in contrast to traditional tourism planning is that it is not just solely planning of the destination zone. Rather it requires the planning of a number of elements including attraction clusters, the service community, circulation corridors and travel linkages between the service area and attractions. This form of tourism planning may be carried out on a number of different scales - local, regional, national and international. In addition, sectoral planning may occur of one or more tourism sectors, for example, coastal, mountain areas or social tourism (WTO 1980a).

Inskeep (1991a) has identified a number of planning concepts which he suggests are an integral part of any tourism planning process. They are that tourism planning should be a continuous process, systems oriented, integrated within the overall planning of an area, include environmental and community considerations, and be pragmatic in application. Firstly, Inskeep views tourism planning as being continuous, incremental and
flexible. Although still based on an adopted policy and plan, he regards tourism planning as a continuous process with adjustments made as needed based on monitoring and feedback, but within the framework of maintaining the basic objectives and policies of tourism development. This concept is also advocated by Gunn (1988a) but he adds that as an adjunct to continuous planning there is merit in devising a specific regional strategic plan for tourism development. He suggests that such a plan, developed and updated every few years, provides for specific objectives. Gunn asserts that a regional strategic plan allows for a blend of community input and regional policies to be incorporated so that tourism development may achieve its greatest potential.

Inskeep (1991a) advances a systems approach because he suggests that tourism is viewed as an interrelated system and should be planned as such, utilizing systems analysis techniques. This concept has also been advocated by Getz (1986) and Hall (1991). The third major planning concept identified by Inskeep is that tourism should be integrated within the overall planning of an area. This view is shared by Pearce (1989) who suggests that tourism should be integrated with other forms of social and economic development and therefore planned accordingly. Inskeep's fourth major concept is that tourism should be planned, developed, and managed in such a manner that its natural and cultural resources are not depleted or degraded but are maintained as viable resources on a permanent basis for continuous future use. To achieve these goals he suggests that there should be maximum involvement of the local community in the planning and decision-making process of tourism and to the extent feasible and desirable, maximum community participation in the actual development and management of tourism and its socioeconomic benefits. This view was earlier advanced by Murphy (1985)
who advocated the involvement of local communities in the tourism planning process and emphasized the need for local control over the development process. Gunn (1988a) declares that community involvement in tourism planning is essential not only to protect and enhance community values but also for the long-term wellbeing of any tourism development itself.

Finally, Inskeep (1988, 1991a) advocates a pragmatic approach to tourism planning and suggests that any approach must be able to be implemented easily. He asserts that any tourist development policy, plan or recommendation should include an action program or strategy which clearly identifies how it will be achieved.

Inskeep's (1991a) first tourism planning concept incorporates a measure of tension in that it advocates tourism planning as a continuous process but upholds the need for master tourism plans. Inskeep (1988) suggests that the components of a tourism plan should be viewed within the wider setting of the natural and socioeconomic environment, tourist markets, and community use of tourist attractions and facilities (Figure 3). Within the tourism system the components of a destination resource, which he regards as forming an essential part of a tourism plan, include tourist attractions and activities, accommodation, other tourist facilities and services, transportation, other infrastructure, and institutional elements.

Tourist attractions and activities are all the natural, cultural and special features and related activities of an area that attract tourists to visit it. Accommodation includes hotels and other types of facilities and their related services where tourists stay overnight during their travels. Other tourist facilities and services necessary for tourism development include a
range of items and travel operations such as eating establishments, retail outlets, financial facilities, tourist information offices and personal services. Transportation facilities and services include transportation access by air, land or sea both to and within a tourist region. Other infrastructure items include water supply, electric power, waste disposal and telecommunications. Finally the institutional elements necessary to develop and manage tourism include human resource planning, education programs, marketing strategies, public and private sector tourism organizational structures, tourism-related legislation and regulations, public and private sector investment policies and economic, environmental and sociocultural programs and impact controls. It is all of
the above elements which encompass the goals of recent tourism planning approaches. These goals are now surveyed in order to understand the underlying thrust of modern tourism planning approaches.

3.3.1 Planning Goals

The goals of tourism plans will inevitably determine their role for environmental protection or conservation. Less than a decade ago Murphy (1983) argued that most tourism goals and planning were oriented toward business interests and economic growth. This was echoed three years later by Getz (1986) who asserted that a review of tourism models suggested that tourism planning is predominantly project and development orientated.

However, the goals of tourism planning are changing. The major goal of one approach, the Products' Analysis Sequence for Outdoor Leisure Planning (PASOLP), is to integrate tourism planning into a region or country's wider political, economic, social and environmental context (Baud-Bovy 1982). A comprehensive list of thirteen aims of planning tourism development includes several oriented to the environment. These are - to minimize erosion of the very resources on which tourism is founded and to protect those which are unique, and to ensure that as far as practicable the image presented by the destination is matched by the extent of environmental protection and facilities provided (Lawson and Baud-Bovy 1977).

The planning goals of both McIntosh (1977) and Gunn (1979a) have always included environmental aspects but have changed over time to incorporate social aspects. For example, the original goals of McIntosh
(1977) encompassed tourism development within a community framework. They include:

1. To provide a framework for raising the living standard of local people through the economic benefits of tourism;

2. To develop an infrastructure and provide recreation facilities for both visitors and residents;

3. To ensure that the types of development within visitor centres and resorts are appropriate to the purposes of these areas; and

4. To develop a programme that is consistent with the cultural, social and economic philosophy of the government and people of the host area.

(McIntosh 1977: 151)

In a later edition of McIntosh's (1977) book McIntosh and Goeldner (1990) added a fifth goal 'optimizing visitor satisfaction' which becomes the plan's zenith point and is Gunn's (1979a) first tourism planning goal. The goals of Gunn (1979a) originally included user satisfactions, increased rewards to ownership and development and the protection of environmental resource assets. Murphy (1983: 182) later noted that "while Gunn's first two goals were distinctly business oriented his final goal recognizes the symbiotic relationship between a successful tourism industry and a protected environment" - the early stirrings of a renewable resource philosophy. Gunn (1988a) later added a fourth goal of 'local adaptation' in which tourism is integrated into the total social and economic life of a community. No doubt the inclusion of this goal is in part a reflection of the advocacy of tourism as a community industry by Murphy (1983, 1985).
The major goal of Mill and Morrison's (1985) model is to preserve and enhance unique destination attractions in order to maintain tourism as a long-term economic activity. To achieve this primary goal they list five subsidiary aims which are:

1. To identify alternative approaches to tourism marketing and development;
2. To adapt to the unexpected in economic and other external situations;
3. To maintain uniqueness of product;
4. To create the desirable in destination marketing and organization; and
5. To avoid the undesirable such as negative economic, social or environmental impacts.

(Mill and Morrison 1985: 289)

In summary, the goals of area development tourism planning models are shifting away from an emphasis on economic considerations to include community concerns (Gunn 1988a, McIntosh and Goeldner 1990) and environmental aspects, for example, protection of resources (Gunn 1988a) and reduction of adverse impacts (Mill and Morrison 1985).

3.3.2 Levels of Planning

Tourism planning can occur at a variety of levels including intranational - involving two or more countries from the same region (Pearce 1989), national, regional, local, and site scale (WTO 1980b). National tourism planning incorporates economic, social and environmental aspects and details policies, strategies and phases commensurate with overall national planning goals. A physical structure plan includes identification of the
major tourist attractions, designation of tourist regions, transportation access to and within a country, as well as touring patterns. National plans also recommend development, design, and facility standards and the institutional elements to effectively implement and operate tourism. Such plans are usually based on projections of demand and represent five or ten year policies which are subject to periodic review.

The regional level of planning identifies appropriate regional policies and strategies, the major tourist access points, and the internal transportation network, primary and secondary tourist attraction features, specific resort and other tourism sites, types of urban tourism development needed, and regional tour patterns (Inskeep 1988). It also usually incorporates economic, social and environmental factors. Location analysis is required to decide which localities within a region are to be developed for tourism. Development must fit into the overall regional planning framework so that it is integrated within the regional planning process. One method is to follow a hierarchical approach with a large town forming the major gateway to the region. The regional centre is developed for tourism as the major one providing higher order services and functions. It should be close to the bulk of the region's attractions and should project a strong promotional image. The centre should also be the hub of the transport network. Social factors include the need for public participation in the preparation of a regional tourism plan. These factors form part of the community approach advocated by Murphy (1985). Environmental concerns at the regional level include the need for adequate zoning to encourage the concentration or dispersal of tourist activity. Areas of concentration should be those with highly resistant environments or should have been hardened to protect the environment. Dispersal allows
for the distribution of small-scale developments throughout the region so as to reduce environmental pressures in any particular spot.

Based on the tourism development areas designated in the national or regional plan, planners formulate land use plans for specific places. Tourism must comply with the land use regulations as set down by the local council. Consideration must be given to the overall elements of supply, that is, attractions, transport, accommodation and services. There is a need to develop the area harmoniously with an adequate balance between and among different sectors in terms of capacity, quality and style as well as compatibility of different functions (Pearce 1989). At the site scale the planning of tourist resorts, hotels and associated facilities includes locational analysis, financial feasibility, environmental assessment and site planning. This last factor includes architectural and engineering design as well as landscaping.

A comprehensive regional approach to tourism planning must be made if the fragmented industry and its market are to be coordinated into a meaningful tourism product and experience (Murphy 1985). While this strong relationship exists for tourism in regard to regional planning, an even stronger one exists for environment - tourism planning approaches. Of all the various levels of planning it has been suggested that "regional planning provides the best opportunity for achieving environmental protection goals" (WTO/UNEP 1983: 36). They add that this can be accomplished through the use of zoning strategies and regulations which can be used to encourage the concentration of tourist activity in some areas and/or dispersion in others. Thus extreme pressures are restricted to resilient environments and fragile environments can be given the most rigid protection measures. Also, in this manner, nature conservation
interests can be accorded their appropriate priority where it is the prime land use designation.

Travis (1980) argues that regional environment - tourism planning is critical in that it is action oriented rather than the more policy related approaches at a national level. This action oriented view has also been fostered by Edward Inskeep for the last two decades. He is a tourism planner with the United Nations Development Programme (UNDP), World Bank and the World Tourism Organization, who has worked as a consultant in over thirty countries. He states that some governments and private sector developers realize that most forms of tourism and various components of the natural and cultural environment are inseparably related. It is essential not only to have national environment-tourism guidelines but also regional policies and strategies to help guide tourism developments (Inskeep 1987). One of the most basic strategies is that tourism should be developed in a carefully planned and controlled manner which sets conditions on growth and brings optimum sociocultural benefits without adverse environmental or cultural impacts. An environmentally oriented regional tourism policy includes:

1. Using tourism to promote conservation;

2. Strategic market segmentation of conservation conscious tourists; and

3. Industry growth at a pace commensurate with the needs of adequate planning, implementation and monitoring of changes.

(Inskeep 1987: 122)

These policies have been expressed in tourism development plans and strategies prepared by the UNDP and WTO for Indonesia (1981), Western
Samoa (1984) and Bhutan (1986). Many other regional planning approaches to tourism and the environment have been propounded. Amongst them are plans for islands (e.g. The Channel Islands; Romeril 1985b), coastal areas (The Costa Brava; Morris and Dickinson 1987), marine parks (Seribu, Indonesia; Salm 1985) and wetlands (Jamaica; Bacon 1987). All foster the symbiotic possibilities of the environment - tourism relationship.

The policies have also formed part of UNEP's 'Action Plans' as part of their Regional Seas Programme. Plans have been developed so far for the Mediterranean, Kuwait, West and Central Africa, South-East Pacific, Red Sea and Gulf of Aden, Wider Caribbean, Eastern Africa, South Pacific, East Asia and South Asia. Each plan is unique to each region, focussing on the particular environmental challenges posed. Part of all of the plans is to foster environmentally compatible tourism development (Gajraj 1988).

In conclusion, of all the levels of tourism planning it is the regional level which appears to offer the best opportunity for achieving both tourism and environmental protection goals. In the following section a range of case studies is listed to illustrate the spatial distribution and range of environments in which tourism planning for natural areas has occurred at the national and regional levels.

3.3.3 Sustainable Planning

Since the introduction of World Conservation Strategy (IUCN 1980) with its emphasis on 'ecodevelopment' there has been a strong move towards recognising the interdependencies that exist among environmental and economic issues. This led to the Brundtland Commission's 'sustainable
development' concept which equates development with environmental and social responsibility. This approach was advanced over a decade ago by Travis (1980) who suggested that taking actions which ensure the long-term maintenance of tourist resources (be they natural or human-made is good economics, as it can mean long-term economic returns from their use. This was endorsed by Romeril in his study of tourism and the environment symbiosis when he concluded that "tourism's strong dependence on quality natural resources makes such a goal (of sustainable development) not just a desired ideal but an economic necessity" (Romeril 1985a: 217). While it was being argued that it made good economic sense to look after the environment, it was also advocated that "the environment should no longer be viewed primarily in negative terms as a constraint, but as a resource and an exciting opportunity for compatible human use" (Pigram 1986: 2).

The call for the application of the sustainable development approach to tourism has been reflected in its suggested incorporation into planning procedures. Among one of the first advocates were Mathieson and Wall (1982) who had compiled their treatise on tourism's economic, physical and social impacts. They stated "planning for tourist development is a complex process which should involve a consideration of diverse economic, environmental and social structures" (Mathieson and Wall 1982: 178). The same conclusion was drawn by Murphy (1985) in his advocacy of a community approach to tourism planning. He concluded that tourism planning needs to be restructured so that environmental and social factors may be placed alongside economic considerations. Getz (1986) approached the situation from his investigation of tourism planning models and indicated that reference to theoretical models will remind
tourism planners not to act in isolation from other social, economic and environmental planning.

During the late 1980s the sustainable development approach to tourism planning was advanced by a number of authors including (Inskeep 1987, 1988; Gunn 1987, 1988a; Pearce 1989; Romeril 1989 a+b). Inskeep (1988) suggested that tourism planning cannot be carried out in isolation but must be integrated into the total resource analysis and development of the area with possible land and water conflicts resolved at any early stage. He noted that recently prepared tourism plans gave much emphasis to socioeconomic and environmental factors and to the concept of controlled development.

Pearce (1989) indicated that the recognition of tourism's composite nature and multiplicity of players involved in its development are critical in planning for tourism. This was endorsed by Romeril (1989a) who stated that a strong emphasis of many strategies is their integrated nature where tourism is one of a number of sector and land-use options. In deciding national and regional policies, a matrix of all sectors of activity are assessed and evaluated - positive and negative economic effects, positive and negative social effects, positive and negative environmental effects, etc. Thus tourism and environmental resource factors are not taken in isolation, nor at the remote end of a decision making process.

The underlying concept of sustainable tourism development is the equating of tourism development with ecological and social responsibility. Its aim is to meet the needs of present tourists and host regions while protecting and enhancing environmental, social and economic values for the future. Sustainable tourism development is envisaged as leading to
management of all resources in such a way that it can fulfil economic, social, and aesthetic needs while maintaining cultural integrity, essential ecological processes, biological diversity and life support systems.

The goals of sustainable tourism are:

1. To develop greater awareness and understanding of the significant contributions that tourism can make to environment and the economy;
2. To promote equity in development;
3. To improve the quality of life of the host community;
4. To provide a high quality of experience for the visitor, and
5. To maintain the quality of the environment on which the foregoing objectives depend.

(GLOBE 90 1990: 2)

Achieving the fifth goal of environmental conservation includes providing for intergenerational equity in resource conservation (Witt and Gammon 1991). It also includes avoiding all actions that are environmentally irreversible, undertaking mitigation or rehabilitation actions where the environment is degraded, promoting appropriate environmental uses and activities, and cooperating in establishing and attaining environmentally acceptable tourism.

Sustainable development approaches to environment - tourism planning have included a range of scales and environments. For example, a 'tourism resource sustainable development planning approach' has been applied to an international resort region in Whistler, British Columbia, Canada (Careless 1990) while on a much larger scale UNDP has applied it to the Adriatic coast (Mlinaric 1985). Fundamental to the latter plan was
Specific environments such as coasts, islands and mountains are also well covered (Farrell and McLellan 1987, Saenger 1990). It has been noted that of all the types of ecosystems which people like to be in for their outdoor recreation, certain preferences emerge and overriding them all is the attraction of water (Simmons 1981). General coastal environment - tourism studies have been carried out (eg. Miller and Ditton 1986, D. Pearce 1988) as well as on specific coastlines, such as Washington, USA (Miller 1987); British Columbia, Canada (Murphy 1988b); the UK Heritage Coasts (Edwards 1987, Romeril 1988) and Scotland (Turnbull 1990). In addition there are many general coastal management strategies which include tourism such as the ones for Western Australia (Chape and Chalmers 1984) and the Caribbean (Williams 1988). Others have been made for coral reefs (for example, in Indonesia, Salm 1985; and Australia, Kozlowski et al. 1988, Kelleher 1990).

Considerable work has been completed on islands including: the Canary Islands (Baud-Bovy 1964), Patmos Island, Greece (Spanoudis 1982), Hawaii, USA (Farrell 1982), the Channel Islands, UK (Romeril 1983, 1985b), the Caribbean - Antigua and St Lucia (Jackson 1986) and Dominica (Burnett and Uysal 1991, Weaver 1991), Heron Island, Australia (Rosier et al. 1986), Easter Island, Chile (Marsh 1986) and the Galápagos Islands, Ecuador (Marsh 1986, Kenchington 1989). Mountains and alpine areas have also been the focus of many general studies (Hamill 1975, Brugger and Messerli 1984, Singh and Kaur 1985a). Specific studies have been carried out in the Swiss Alps (Krippendorf 1984), Bavarian Alps (Groetzbach 1985), Southern Alps, NZ (Pearce 1985b) and the Himalayas, India (Singh and Kaur 1985b, 1988).
Case studies of the coastal islands and mountains are disproportionately higher than for other areas because these form the major tourist destination zones. However, tourism is not just confined to these regions and environment - tourism planning studies have been made of wetlands (Caribbean, Bacon 1987), lakes (South Island NZ, Pearce 1978) as well as a host of recreational studies within parks (both generally, eg. Hawkins et al. 1980, and specifically, eg. Paul and Rimmawi 1992). Relatively little environment - tourism planning research has been carried out in the arctic and alpine tundra, savanna regions, or the tropical rainforests. However, in some of these regions are located the greatest tourism destination zones of the world, for example, the Mediterranean coast and the southern part of the USA. In the arid and semi arid zones few planning studies have been made although environment - tourism research has been carried out on some aspects of the relationship including the impacts of motorcycles (Kay 1980) and using tourism as a tool for conservation (Brake 1988).

Travis (1980) asserts that it is clear that there is not one style, but many styles of tourism planning and Jafari (1982) suggests that theoretical generalizations about tourism and its impacts might not be attainable in the near future. Jafari concludes that what is needed is a large number of systematically researched local studies from which similarities and differences can be obtained. Getz (1986) adds that such case studies should combine aspects of theory (research, modelling and evaluation) to understand the tourism system as well as problem-solving processes (goal formulation, evaluation and implementation) in the control of the tourism system.
A similar view is shared by Inskeep (1988) who asserts that tourism has become a major global activity, and that the planning of tourism is emerging as a specialized type of development planning. Planners have accumulated considerable experience of methodological approaches to tourism planning and a number of techniques, principles and models have evolved. However, Inskeep argues that:

"Continued research and experimentation are needed, especially to determine optimum forms of tourism development for particular types of areas." and "Various environmental impacts have been documented although more research is needed, especially in ecologically sensitive environments such as tropical islands, marine areas, mountains and deserts."

(Inskeep 1988: 368)

The assertions made by Travis (1980), Jafari (1982), Getz (1986) and Inskeep (1988) are that there is a need for a number of regional case studies which embrace both theoretical and process aspects of tourism planning models. Such models are now investigated especially in relation to their environmental components.

3.4 MODELS OF TOURISM PLANNING

Tourism planning involves matching tourism demand with destination resources. Pearce (1989) defines tourism demand as the quantity of a good or a service that tourists are willing to buy at a specific price. Characteristics of tourism demand include market conditions at the point of origin as well as the tourist's motivation and ability to travel. Analysis of this demand is usually carried out by market segmentation in which the needs and preferences of particular segments of the market are matched to specific destinations or products. Getz (1986) has surveyed over 150 tourism planning models (Figure 4). He recognised two basic types -
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<th>Figure 4 Tourism Planning Models</th>
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<td>After Getz (1986)</td>
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<tr>
<th>1. THEORETICAL</th>
<th>2. PLAN &amp; MGT PROCESSES</th>
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<tr>
<td><strong>Whole Systems Models</strong></td>
<td><strong>Problem Solving Models</strong></td>
</tr>
<tr>
<td>Wolle 1964</td>
<td>A. Area Development</td>
</tr>
<tr>
<td>Leiper 1981</td>
<td>Bargur and Arbel 1975</td>
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<td>Van Doorn 1982</td>
<td>Arnott 1978</td>
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<td>Mathieson and Wall 1982</td>
<td>Lawson and Baud-Bovy 1977</td>
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<td>McIntosh and Goeldner 1985</td>
<td>Gunn 1979</td>
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<td>Mill and Morrison 1985</td>
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<td><strong>Sub Systems Models</strong></td>
<td>Cheng and Liu 1992</td>
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<td></td>
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<tr>
<td>A. Spatial/Temporal</td>
<td>B. Project Development</td>
</tr>
<tr>
<td>Christaller 1964</td>
<td>Kaiser and Helber 1978</td>
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<tr>
<td>Plog 1972</td>
<td></td>
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<td>Pollard 1974</td>
<td>C. Management and Marketing</td>
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<td>Rajotte 1975</td>
<td>Doswell and Gamble 1979</td>
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<td>Miossec 1976</td>
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<td>MacCannell 1976</td>
<td>D. Planning as a Conceptual System</td>
</tr>
<tr>
<td>Hills and Lundgren 1977</td>
<td>Mathews 1978</td>
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<td>Smith 1980</td>
<td>Getz 1983</td>
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<td>Butler 1980</td>
<td>Murphy 1985</td>
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<td>Britton 1980</td>
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<td>Young 1983</td>
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<tr>
<td><strong>B. Travel Motivations/Behaviour</strong></td>
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<td>Plog 1972</td>
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<td>Clawson and Knetsch 1976</td>
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<td>Pearce 1982</td>
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<td>Iso-Ahoia 1982</td>
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<td>Fridgen 1984</td>
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<td><strong>C. General Impact Models</strong></td>
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<td>Council of Europe 1978</td>
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<td>Duffield and Long 1981</td>
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<td><strong>D. Economic Impacts</strong></td>
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<tr>
<td>Lundgren 1973</td>
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<td>Duffield and Long 1981</td>
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<td>Pearce 1981</td>
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<td><strong>E. Social/Cultural Impacts</strong></td>
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<td>White 1974</td>
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<td>Doxey 1975</td>
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<td>Smith 1977</td>
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<td>Jafari 1982</td>
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<td>Kariel and Kariel 1982</td>
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<td>Knox 1982</td>
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<td>Getz 1983</td>
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<td><strong>F. Ecological Impacts</strong></td>
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<td>Wall and Wright 1977</td>
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<td>Pearce 1985</td>
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**3. FORECASTING MODELS**

| A. Econometric                     |
| Loeb 1982                          |
| B. Time Series                     |
| Wandner and Van Erden 1980         |
| C. Physical Based                  |
| Parks Canada 1976                  |
| D. Electrical Analogue             |
| Ellis and Van Doren 1966           |
theoretical and process models both of which can vary in terms of spatial scale (from site, region, national to international).

Theoretical models seek to conceptualise some aspects of the functioning of the tourism system. They can model either the whole tourism system or parts of it and can be further subdivided according to whether they are descriptive, explanatory or predictive. Descriptive models define the tourism system's components. Explanatory models show how a system works, with or without specifying causal relationships. Predictive models rely on a knowledge of causal relationships to permit forecasting. Getz asserts that models - first descriptive, then explanatory and finally predictive in nature are building blocks to theories. Process models seek to optimize planning or management processes and are more pragmatic in their orientation. They can be further subdivided into subjective, problem-solving and conceptual classes.

In his conclusion Getz suggests that tourism planning is predominantly project and development orientated based on problem-solving planning processes, and is often narrowly defined and lacks comprehensiveness. He argues that there should be a greater link between theoretical and process models and advocates an integrated systems approach which incorporates both aspects. Getz postulates the need to adopt this approach which shifts away from the traditional emphasis of tourism development and instead incorporates a more rational evaluation of costs and benefits so that controls or limits to growth are recognised. Duffield (1978) has also raised this question in a paper 'The Capacity of our Resources: When do we Stop Promoting Growth?'. Getz (1986: 32) concludes that in fact "it would cease to be appropriate to speak of 'area tourism development' or 'planning for tourism' (but) rather more general and neutral terms such as 'tourism
planning' should be promoted". To understand how tourism and the environment can be planned it is necessary to briefly review the existing planning models.

3.4.1 Theoretical Models

Theoretical models can be subdivided according to the way they model the whole tourism system or parts of it. Whole system models attempt to define the whole field of tourism studies and include the models of Leiper (1981) and Mathieson and Wall (1982) noted earlier in Section 3.2. Other whole system models include a model of outdoor recreation (Wolfe 1964) and another similar to Leipers but with the addition of a policy dimension (Van Doorn 1982). Many subsystems have been generated and these are grouped into two classes. The first include spatial/temporal approaches as well as motivational and behavioural models. These combine descriptive and explanatory elements. The second are impact models which are based on predictive elements.

Spatial/temporal models explore the structural evolution of tourist regions through time and space (Miossec 1976, 1977; Butler 1980; Gormsen 1981). Motivational and behavioural models explore social or psychological explanations for tourist desires and behaviours (Plog 1973, Pearce 1982, Iso-Ahola 1982). Impact models try to determine causal mechanisms. Getz (1986) subdivides these models into different types according to their approach, for example, general impacts (Duffield and Long 1981a) economic (Lundgren 1973), social/cultural (Doxey 1975) and ecological (Wall and Wright 1977, Pearce 1985a).
3.4.2 Process Models

Getz (1986) asserts that the second major type of tourism models are those oriented towards planning and management processes and it is these models which predominate in the tourism planning literature. Most are traditional process models based on the problem-solving sequence of determining goals, generating alternatives, evaluation of alternatives, choice and implementation. The majority of tourism process models are those which provide a descriptive approach to an area's tourism development as it is assumed that this is the overriding goal. Major area development models include the 'PASOLP' approach (Baud-Bovy 1982), the 'Regional Strategic Planning Process' (Gunn 1979a, 1988a) and 'The Tourism Planning Model' (Mill and Morrison 1985). Aspects of some of these approaches have been summarized by Dutton (1990).

Baud-Bovy's (1982) PASOLP approach encompasses socioeconomic, political, sociocultural and environmental factors. It stresses integrated and continuous planning incorporating a monitoring system for plan revision. The central part of the approach is an elaboration and analysis of tourism products taking into consideration:

1. The established and potential resources of an area;
2. The specific requirements of each tourism market, flow, and category of present or potential tourists;
3. The country's structures, policies and socio-economic constraints; and
4. The existence of competing destinations.

(Baud-Bovy 1982: 312)
The analyses compute the feasibility and costs/benefits of the alternative tourism products reviewed. These are compared with the area or country's objectives for economic development allowing identification of the priority tourism products. The PASOLP approach was designed to overcome one basic tourism planning deficiency - the problems and difficulties arising during the implementation of the plan. Thus the environmental attributes of a region or country are viewed as resources to be developed for tourism. They are included as part of the technical services or infrastructure and tourism is viewed as a possible advocacy for environmental protection or conservation.

Gunn's (1988a) Regional Strategic Planning forms part of an overall tourism planning approach on three levels. They are continuous planning through collaboration between and among agencies and organizations, regional strategic planning, and local tourism planning. Regional strategic planning provides generalized information and guidelines to foster tourism growth and development, especially the identification of potential destination zones. It is based on a tourism development dependency hierarchy in which regional tourism development depends upon an increased number of tourists through heightened demand and expanded markets, as well as an expanded supply through resource development. The environment is viewed as a resource base to be developed where able and Gunn (1988a: 221) asserts "if a region has an abundance of usable surface water, esthetic and game laden forests, interesting topography, buildable soils, and favorable climate, it has greater potential for tourism development than one without these assets". His approach to planning is typical of the area development tourism planning approaches. It provides tourism oriented recommendations and guidelines as a foundation for regional policy and implementation. The
process includes five steps. They are: setting objectives, research, synthesis-conclusions, concepts and recommendations (Figure 5).

The first step is to set objectives to be achieved within a specific time. Gunn (1988a) asserts that the objectives should be broad enough to be comprehensive but precise enough so that they can be accomplished within a given time frame. The second step provides basic data important to tourism planning. Information sought is on physical and program factors. The former consists of natural resources including water and waterlife; vegetative cover and wildlife; climate and atmosphere; and topography, soils and geology. Cultural resources include history, archaeology, legend and lore; aesthetics; existing attractions, industries and institutions; as well as service centres and transportation. The resources are evaluated by a delphi approach to provide consensus on the relative importance of the attributes followed by map overlays to display graphically those locations that have the greatest tourism potential.

Program resources include evaluation of markets, information, promotion, governmental policies and development factors. The third step of synthesis brings together the many fragments of information collected during the research. It includes deriving meaning from the facts and ends with descriptive conclusions that are general enough to be comprehensive but specific enough to lay the foundation for conceptualizing solutions and making recommendations. Gunn (1988a: 229) indicates that the next step is one of concepts "in which creativity and ideation have full sway". In this step citizens and professionals study the research data and conclusions and then look forward to the resolution of problems and improvement of tourism. The final step includes recommendations on the future of tourism in the area. It identifies
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<td>SETTING OBJECTIVES</td>
<td>RESEARCH</td>
<td>SYNTHESIS-CONCLUSIONS</td>
<td>CONCEPTS</td>
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### 1. Setting Objectives
- Planning Objectives
  - Planning action
  - Planning document for both public and private sector

### 2. Research
- Research of Physical Factors
  - Natural Cultural Resources

### 3. Synthesis-Conclusions
- Synthesis of physical data
  - Conclusions from research
- Synthesis of program data

### 4. Concepts
- Physical Development Concepts
- Program Development Concepts

### 5. Recommendations
- Physical Development
- Program Development
- Policy and Organization
- Priority Action Steps
potential destination zones and sets policies for them. It also sets out the sequence of staging developments as well as the handling of any adverse economic, social or environmental impacts.

The Tourism Planning Model is a step by step destination development approach (Mill and Morrison 1985) similar to that of Gunn (1988a). However, it varies in its objective setting phase which arises out of the study rather than determining its process. It consists of five phases: 1 - background analysis; 2 - detailed research and analysis; 3 - synthesis; 4 - goal-setting, strategy selection and objective-setting; and 5 - plan development. Each phase in the planning process involves a different type of activity involving different participants, outputs and results. Environmental attributes are categorized as either natural features or historical and cultural features. Natural features include landscapes, scenery, unique features, flora and fauna. Historical and cultural features are buildings, sites, themes, communities and subcommunities. Maps are prepared to identify the location of key resources and these are ranked or graded according to the scope of appeal of the tourism resources in the destination area.

A model proposed by Inskeep (1988, 1991a) is a Comprehensive Tourism Development Framework for both national and regional levels. The model is based on a number of planning concepts which he has identified as being both contemporary and practical. In his view tourism planning in the 1990s should:

1. Be continuous, incremental and flexible;

2. Be systems oriented as tourism is viewed as an interrelated system;
3. Be comprehensive and take account of community aspirations and environmental constraints;
4. Be integrated into the overall planning of the area; and
5. Be realistic and implementable.

(Inskeep 1991: 29)

Inskeep (1988) advocates these elements as part of an area development planning process which is similar to Gunn's framework but also includes an additional phase of monitoring the implementation and reviewing its impacts. It consists of seven steps - study preparation; determination of objectives; survey; analysis and synthesis; policy and plan formulation; recommendations; and implementation and monitoring. Its environmental stream surveys environmental characteristics and quality, provides an analysis and synthesis of environmental impacts of, and quality for tourism, provides environmental policy, and recommends environmental impact and quality controls.

A general Model for the Tourism Planning and Development Process is outlined by McIntosh and Goeldner (1990). They advocate that proper planning of the physical, legal, promotional, financial, economic, market, management, social and environmental aspects, will help to deliver the benefits of tourism development. Their approach begins with a marketing concept and ends in tourist satisfaction, as they argue in a similar way to Gunn (1988a), that it is the final user who is the judge in determining how successful the planning process has been.

A review of the area development tourism models indicates that a regional plan is considered to be part of an ongoing process which incorporates economic, social and environmental aspects and is related to local, regional and national policies. The planning approaches usually
have a logical sequence of setting objectives, data gathering, evaluation, synthesis and implementation.

Two approaches to tourism planning which are community oriented are the Community Personality Planning Process (Rosenow and Pulsipher 1979) and The Ecological Model of Tourism Development (Murphy 1983). Both present alternatives to the traditional economic emphasis of tourism planning. The former involves four steps - delineation of distinctive features, plotting critical zones, establishing use objectives and formulating specific action plans. The first step is to inventory and map outstanding existing features. Next these are examined in the light of visitor and resident activity patterns in order to identify critical zones and evaluate them according to general use objectives. These are preservation, retention, modification and enhancement. Finally delineation of the objectives is the base for formulating a specific action programme for the community to be involved. While the approach has utility at the local community level it has not been designed for application at a regional scale.

A conceptual and more detailed community approach to tourism planning is outlined by Murphy (1983). He stresses the need to involve communities in tourism planning and places this goal alongside economic and environmental considerations. His approach is to view the community as an ecosystem of which tourism is a part. An ecosystem is an area of nature that includes living organisms and non-living substances interacting to produce an exchange of materials between the living and non-living parts (Odum 1969). The ecological community approach to tourism planning includes economic, social and ecological components with the social or community component being especially
important at the local level. As the community moves towards a steady state it must balance the needs and requirements of its natural attractions, the environment (or plants), local resident views on tourism development (animals), the industry's investment and return from developing the tourist resources (predator) and finally visitor reaction to the effects of the three preceding components (prey). Though not all would agree and the model does not fit the usual ecological systems approach, Murphy (1983: 186) states that the analogy "to equate the tourist industry with predators and the visitor as its prey is well founded within the ecological community concept".

From this review of the literature the following summary and conclusions are made on regional tourism planning models:

1. Traditional tourism planning has in the past focused solely on the pursuit of economic benefits to an area;

2. Achievement of the above goal has usually been through the preparation and implementation of a 'one-off' area development plan;

3. Many plans have not been implemented because they do not integrate tourism with other regional developments and are not able to adapt to changing circumstances;

4. The goals of recent tourism planning approaches include: tourist satisfaction, rewards for owners, community integration and conservation of resources; and

5. Some models have attempted to incorporate 'ecological' or 'community' aspects. However, there are few approaches to tourism development which begin from the standpoint of the protection of environmental attributes.
3.5 EVALUATION OF TOURISM RESOURCES

Having described a number of tourism planning approaches and models it is now important to explore the various criteria used to evaluate tourism's resources as it is these factors which assist in the identification and delimitation of those areas most suitable for one or more forms of tourist development (Smith 1987, Pearce 1989). The elements of tourist resources or supply are attractions, transport, accommodation, supporting facilities and infrastructure (Gunn 1988a). Successful tourist development depends on maintaining an adequate mix both within and among these sectors.

Tourism planning approaches differ in their coverage of environmental resources which are recorded and evaluated. Pearce (1989) has grouped tourist resources into seven broad categories based on the various locational factors which influence tourist development and how these may be assessed. The factors include climate, physical conditions, attractions, accessibility, existing facilities, land tenure and use, as well as other considerations such as carrying capacity. The most commonly used categories are attractions, accessibility (transportation) and existing facilities or infrastructure. The natural and cultural attributes of a region are often included in the categories 'physical conditions' or 'attractions'.

Leiper (1990b) suggests that a tourist attraction is a systematic arrangement of three elements. A person with touristic needs, a nucleus (any feature or characteristic of a place they might visit) and at least one marker (information about the nucleus). Attractions are both natural and cultural resources which provide physical place settings for meeting tourists' experiences (Gunn 1980, 1988a). Analysis of attractions is usually made by surveys of visitors (Ferrario 1979, Boekstein et al. 1991) or experts (Ritchie
and Zins 1978). Other methods of determining the attractiveness of a region have been made by Georgulas (1970), Var et al. (1977) and Meinung (1989) with an overall summary by Lew (1987). Activities are recreational resources which provide opportunities for either active or passive experiences (O’Leary and Dottavio 1980). Existing facilities are the supporting infrastructure for tourism and include accommodation, shops, banks, health and security services, sewerage, power and water supplies. They have been investigated and identified according to their existing capacities or potential capacities (Fesenmaier and Roehl 1986).

Access includes both physical and market access. Physical access depends on the existing infrastructure, that is, the location of roads, railways, ports and airports. Market access is the proximity of the destination zone to its markets whether measured in terms of travel time, distance or cost. Climate is the relationship of the destination climate to the market climate. Many resorts or activities depend heavily on climatic criteria (Crowe 1975, Mings 1978, Gaffney 1983). Land tenure and use refer to the availability of land for either its purchase or acquisition of rights to it. This is a necessary prerequisite for any tourist development.

Mill and Morrison (1985) suggest that the inventory of tourism resources required for the analysis of a region should follow that prepared by the Economic Planning Group of Canada (1983). This method includes a number of components including natural, cultural and historical features. Natural features include landscapes, scenery, unique features and flora and fauna, some of which, for example the visual quality of the landscape, are difficult to measure (Dearden 1988). Cultural and historical features include buildings, sites, themes and communities. In addition are added components on the general socioeconomics of the area, infrastructure,
services, land use and human resources. A subcomponent of this latter
group is the residents 'attitude toward tourism'.

Gunn (1988a) combines a number of tourist resources into a category he
names physical factors. This includes climate, attractions, transportation
and existing facilities. To these he adds physical factors which are
subdivided into natural and cultural aspects. Natural features include
water and waterlife, vegetative cover and wildlife, and topography, soils
and geology. Cultural features are history, archaeology, legend and lore as
well as aesthetics. Gunn (1988a: 228) also suggests that an examination of
the socio-environmental climate of the region is very important and states
that "study of the local attitudes towards tourists could be revealing".

In conclusion there are a variety of factors which should be taken into
account when evaluating the tourism resources of an area. However,
complementing the data on tourism resources (supply) should be data on
markets (demand). This can take the form of a 'market analysis' giving
insight into tourists' demand for travel, attractions and activities (Gunn
1988a) or a 'profile of demand' which is much more detailed (Mill and
Morrison 1985). It not only includes the market analysis factors but also:
modes of travel to and within the destination area, geographical origins of
tourists, tourist demographics, trip purposes, market segments, length of
stay and tourist expenditure in the area.

3.6 TOURISM PLANNING PRINCIPLES

Underlying the various tourism planning approaches and models
reviewed in this chapter are a number of tourism planning principles.
These can be summarized as having three dimensions - essential
perspectives, spatial considerations and temporal elements (Figure 6). The
dimensions can be organised following a model proposed by Krueger and
Mitchell (1977) in relation to resource analysis. The essential perspectives
are comprehensive in scope and comprise environmental, social,
economic, technological, political, legal, and institutional elements.
Analysis of resource problems may be pursued through one or more of
these perspectives. Spatial considerations refer to responsive dimensions
from local to international in scale, and temporal elements include past,
present and future aspects which are progressive in time. The addition of
these components creates a matrix through which resource sectors, topics,
problems or issues may be analysed.

These dimensions and their elements may be related to a number of
tourism planning principles arrived at by Gunn (1988a) at the close of his
treatise on 'Tourism Planning'. He concludes that there are eighteen
which he offers "not as hard and fast rules of tourism planning" but rather
as "general principles that have evolved during the study for (his) book"
Gunn (1988a: 269). Ten of the principles are of direct application for
environment - tourism planning. They are:

**Essential Perspectives**

1. Policy sets goals and the administrative framework;

2. Integrative planning is needed for tourism;

3. Balanced social, environmental, and economic goals are essential;

4. Tourism planning requires understanding of the natural
   and cultural resources;

5. Slow-paced, indigenous tourism is best.
Figure 6 The Conceptual Components of Tourism Planning

Legend

TOURISM PLANNING
- Approaches
- Dimensions
- Principles

RESPONSIVE
in scale

SPATIAL

ESSENTIAL PERSPECTIVES
- Institutional
- Legal
- Political
- Economic
- Social
- Environmental

PROGRESSIVE
in time

10 Continuous and sporadic in nature
9 Destination stay / touring components
8 Clustering favoured
7 Geographic heterogeneity
6 A regional approach

COMPREHENSIVE
in scope

PRINCIPLES
1 Policy sets goals
2 Integrative nature
3 Balanced goals
4 Natural + cultural components
5 Slow paced + Indigenous

Notes: 1 The dimensions are organised following the resource analysis model of Krueger and Mitchell (1977)
2 The principles are derived from Gunn (1988a).
Spatial Considerations

6. Urban-rural tourism demands a regional approach;

7. Geographic heterogeneity is a tourism planning postulate;

8. Clustering is superior to dispersal; and

9. Touring circuits and long-stay destinations require different planning.

Temporal Elements

10. Continuous and sporadic planning needs to be balanced.

(Gunn 1988a: 269-278)

Drawing together the thrust of the dimensional model, Gunn's (1988a) environment - tourism planning principles, and the summary and conclusions made earlier on regional tourism planning approaches it is clear that some aspects of environment - tourism planning are well established in the literature while others need further investigation. For example, whereas some of the general perspectives could benefit from further research many of the spatial and temporal elements have been well argued and substantiated. Dimensions of tourism planning which have a substantive base in the literature include its policy driven nature, integrative orientation, the need for ongoing assessment and a regional approach.

3.6.1 Essential Perspectives

The first perspective is that policy sets goals and the administrative framework. Gunn (1988a: 270) asserts that "policy is needed to declare goals". Thus underlying any regional planning framework needs to be an examination of national, regional and local policies in regard to
environmental protection and development and hence the places within these for conservation and tourism development. Eagles (1984) argues that in relation to environmental protection there are two basic arguments for preservation. He states that the first is essentially utilitarian and such areas contain processes and products that are useful to people now and in the future. This environmental capital is a resource bank that will continue to be of use, often in unforeseen ways for the indefinite future. Eagles asserts that the second is a more altruistic and moralistic one. Nature deserves to survive because it is, that is, each species has a right to exist.

The second perspective is that integrative planning is needed for tourism both in the wider setting of regional development as well as within its own environmental, social and economic elements. The former view is that it should not be carried out in isolation of other regional development considerations. While not the focus of this research it is noted that for any tourism development plan to succeed it must not only have a strong environmental base, and encourage public participation, but also be integrated with overall regional policies and goals. This was one of the main failings of early area development tourism plans and was one of the prime reasons why they were seldom implemented (Baud-Bovy 1982).

The first main conclusion drawn from the study of Patmos was that planning for tourism must always proceed within the framework of an overall plan for the development of an area's total resources (Spanoudis 1982). Tourism was viewed not as the sole source of economic activity but in conjunction with the development of other sectors of economic activity assisting them as much as possible so as to eventually achieve a balanced economy.
What was really important was that the tourism sector was not seen in isolation but as part of a whole developmental effort, that it was viewed not only as a series of new construction projects but as a means of organizing many different elements in the life of the place from health facilities to boat schedules, that it was used as a resource and an opportunity to provide the islanders (residents) with many services they might otherwise lack.

(Spanoudis 1982: 318)

Thus for tourism planning, the general goals should pertain to the role tourism is expected to play in relation to overall policies. Ideally it should be one element of comprehensive planning for an area, that is, part of the overall regional or urban land use development plan (Mclntosh and Goeldner 1990) and be integrated into its overall development policy, planning and program (Inskeep 1988). Basic to current thinking on tourism planning is the concept that tourism must be integrated into the total development planning of an area with the cross-sectoral linkages carefully analyzed and understood (Inskeep 1987).

The third planning perspective for tourism development is that it is essential to achieve a balance of economic, environmental and social goals (Inskeep 1987, Gajraj 1988). The aims of conserving the environmental amenities of a region and of advancing regional development through tourism need to be carefully weighed (Dasmann et al. 1973). Thus a major consideration affecting all aspects of tourism planning is the extent to which either conservation or development is given precedence. Even in countries where the freedom to develop has been enjoyed as a right of land ownership some degree of regulation has to be introduced if rapidly diminishing natural and cultural resources are to be conserved for the ultimate benefit of humankind. Thus planning for the environment and tourism must ensure that a balance between preservation and
development is struck. Gunn (1988a) also highlights the role of the social goals of tourism planning and suggests such planning should encompass personal and social values.

The fourth essential perspective of tourism planning is that it requires understanding of the natural and cultural resources. This is the underlying thesis of this dissertation and environmental planning approaches and methods of evaluation are explored in the next chapter. The fifth essential tourism planning perspective is that slow-paced, indigenous planning is best. This link to a region's community groups and the need for their input in the planning process is further investigated in Chapter 5.

3.6.2 Spatial Considerations

A tourism planning principle that has been well advanced by planners is that regional planning provides the best opportunity for organizing and implementing both environmental protection and tourism development strategies. This view is also supported by a recent planning suggestion for landscapes to be planned in a far more flexible manner allowing for dynamic development without damage to stable systems. This type of planning is most viable when prepared and implemented at a regional level (Sijmons 1990).

The seventh tourism planning principle is that geographic heterogeneity is a tourism planning postulate. The essence of Gunn's (1988a) approach to tourism planning is that the potential for tourism in different areas is based on the inherent differences which exist in the distribution of natural and cultural resources. This principle also underlies the tourism planning
framework advanced in this dissertation except a distinction is made between environmental attributes and environmental resources. The final two spatial considerations are explored further in Chapter 5.

3.6.3 Temporal Elements

The major temporal tourism planning principle is that it should incorporate continuous and sporadic elements. Planning is a continuous process which takes place at all times but it should incorporate a specific regional strategic plan for tourism development. Such a plan should be grounded in regional policies, consider overall relationships, set specific objectives, incorporate public participation and identify destinations with the greatest potential for tourism development (Gunn 1988a). At a national or regional level it is suggested that there should be a balance of planning processes involving both specific regional strategic plans as part of an ongoing continuous planning process. In the past a reason why many tourism-development plans were not implemented was because of their inability to adapt to changing conditions. It has been suggested therefore that:

Wherever possible, tourism plans should explicitly view alternative actions as hypotheses to be tested through evaluation. This would effectively shift the emphasis from one-shot master plans to continuing planning and research.

(Getz 1986: 31)

No plan is infallible and continuous monitoring is desirable as tourism development proceeds of both regional and local environmental and socioeconomic impacts. Inskeep (1987) asserts that this process will reveal whether the impacts of the development are as predicated and acceptable, and detect problems for investigation and resolution.
In the following two chapters three aspects of environment - tourism planning are surveyed and discussed in relation to their inclusion in existing tourism planning methods. The three include environmental, social and spatial aspects. In the following chapter elements of environmental planning are explored from within existing environmental protection and conservation approaches. In Chapter 5 the investigation of social values is carried out through the survey of established methods of seeking resident and tourist opinions on tourism topics. Finally aspects of spatial differentiation are shown to have utility for both environmental and tourism planning approaches and therefore should be incorporated in any environment - tourism planning model.
Chapter 4 Environmental Planning

Environmental planning represents an attempt to integrate ecological concerns into societal decision making.  

Eagles 1984: 43

4.1 INTRODUCTION

In the previous chapter various approaches to tourism planning were examined. The review concluded that there are a number of principles which are common to the emerging tourism planning approaches. Prominent amongst them is the need to incorporate environmental and social values. This chapter surveys a number of environmental planning approaches to determine their underlying principles as well as the similarities and differences that exist between tourism and environmental planning. The findings will then be used to help shape a tourism planning framework underpinned by environmental planning principles.

4.2 LAND USE PLANNING

The most commonly adopted approach to the planning of natural resources is Land Use Planning. This involves identifying resources, expressing an appraisal about their use and implementing development or use strategies. The major aim of land use planning is to assist in making responsible decisions about the use of land. Traditional planning of the environment or surroundings usually consists of determining supply and estimating demand (O'Riordan and Turner 1983). Supply may be subdivided into actual or potential components. The actual supply side of the environment is generally evaluated through land use planning methods (Clark 1969, Mather 1986). Stamp (1960) suggests that this approach consists of a survey - where the present condition is recorded;
analysis - in which the reasons for patterns are sought and existing trends identified; and planning - in which the future is designed.

Westman (1985) suggests that at the policy level, land use planning goals are normally designed to specify and maintain particular land uses consistent with public goals and values. He adds that land use planning may also limit uses which are incompatible with the ecological processes of the land. Land and land use incorporate economic, social and environmental components. At one level then land use planning is concerned with reconciling these often conflicting objectives while at another level it may seek to adjudicate between the objectives of interest groups (eg. conservationists and recreationists) and thus establish compromise goals of management of government-owned land, or to balance broad policies among the main land-use sectors. Land use planning then is concerned with reconciling the goals and objectives of individuals and groups in a society and also usually includes government at one level or another. Ultimately land use planning depends on how political power is distributed and exercised (Mather 1986).

Estimation of demand for natural resources has usually focussed on either exploration of the impact of policy decisions (Grima 1972, Rees 1974) or on futuristic forecasting. This latter approach includes the Delphi Technique - a succession of iterative brainstorming rounds by a group of experts (Helmer and Rescher 1960) and The Scenario in which the writer describes a logical sequence of events which evolve from specified assumptions (Jantsch 1967).

Environmental effects vary with the type and intensities of land use as well as with management practices. Generally intensity of use increases
effects but more importantly management practice is the key factor helping to ameliorate the intensity of land use and magnitude of environmental effect. The environmental effects of land use tend to be cumulative and mutually reinforcing. Two of the key features of land use planning are the use of resource characteristics as indicators of land suitability (for one tightly defined use) and capability (a range of uses), and the recognition of homogeneous land units in relation to these characteristics. The attributes of landform, soil and vegetation have been used as indicators of a larger suite of land characteristics in different land evaluation systems in use around the world (Stewart 1968, McRae and Burnham 1981).

Some of the major forms of land use are agriculture, forests, and urban uses (Mather 1986). Inventory methods have been developed for identifying and appraising nature preserves (Jeffers 1973, Nelson et al. 1988) while others have been applied to recreation (Goodall and Whittow 1973, Johnstone and Tivy 1980). A comprehensive land use planning approach recently trialled in Greece is based not only on land capability and ecological sensitivity but also on the preferred socio-economic conditions in the region (Christodoulou and Nakos 1990). Thus not only are environmental and ecological factors being included in the planning process alongside economic considerations but increasingly social elements too.

Land use planning incorporates environmental planning. The former views the biosphere as resources which are to be used wisely whereas the latter type of planning focusses specifically on either environmental preservation or conservation. Both types of planning approaches are now surveyed by review of a number of exemplars.
4.3 PLANNING FOR THE ENVIRONMENT

Planning for the environment has increased in prominence over recent decades as the environmental movement has gained momentum. More than a decade ago Park (1980) suggested that decision makers responsible for environmental planning were becoming increasingly aware that the stability of the biosphere in general, and the survival and stability of individual ecosystems in particular, were considerations when environmental management policies and practices were being evaluated and implemented. Manning (1986) asserts that maintenance of ecosystem stability and diversity is carried out by the identification and preservation of areas with unique or representative ecosystems.

Environmental problems are metaproblems, that is, they may be described by a large number of variables, many of which are difficult to operationalize unambiguously (Cartwright 1973). In the past they have been approached from various disciplinary perspectives, mainly ecology, economics, engineering, land use and regional planning, and political science. However, Briassoulis (1989) has suggested that future environmental planning may need to consider alternative approaches such as comprehensive/rational, incremental, adaptive, contingency, advocacy and participatory/consensual.

4.3.1 Planning Goals

The goals of environmental planning focus on either preservation or conservation. Preservation is the protection of all living and non-living resources to ensure their long-term survival. It has a more restrictive
connotation than conservation and embraces more intrinsic values. The specific goals of environmental preservation include:

1. Maintenance of the natural diversity of a biogeographical province or other biogeographical unit;

2. Conservation of special features, such as rare, vulnerable and unique species, unique ecosystems, ecosystems unusually rich in species, and concentrations of species with restricted distributions; and

3. Protecting populations of species known or likely to be of value as genetic resources.

(Prescott-Allen and Prescott-Allen 1982: 2)

The second aspect of environmental planning is its use for nature conservation which is employed to reduce adverse environmental impacts. Central to it are the elements of biological and nature conservation, however, an interpretation by O'Connor et al. (1990) describes conservation as also being a human process involving an attitude to resources. They add that conservation of natural resources is about the way and rate natural resources are used. Conservation is therefore defined as the management of the human use of the biosphere to yield the greatest sustainable benefits to present generations while maintaining the potential to meet the needs and aspirations of future generations. This is the overriding goal of the WCS proposed by the IUCN, UNEP and WWF in 1980 (IUCN 1980) and revised in 1991 (IUCN 1991). The three specific objectives of the WCS are listed in Chapter 2, p21.

The environmental ethics embraced in environmental planning encompass the broad themes of protection and stewardship. Therefore environmental planning incorporates the concepts of:
1. Environmental preservation - protection of parts of the natural environment for their own sake, that is, looking after the environment for intrinsic purposes. This includes the protection of species and setting aside of environmentally significant or sensitive areas; and

2. Resource conservation - protection of the usefulness of the environment, that is, looking after the environment for humankind. This includes land use planning and environmental impact assessment.

4.4 ENVIRONMENTAL PLANNING APPROACHES

Environmental planning approaches have been designed for both environmental preservation and resource conservation. Examples of the former include a number of models devised to determine species or sites for environmental protection. They include the planning of environmentally significant areas (Eagles 1984, Nelson et al. 1988) as well as ecological planning approaches (Steiner 1988, Van Riet and Cooks 1990a). Others include ecological evaluations to complement evaluations of land use capability and suitability (Bibby and Mackney 1969), landscape attractiveness (Crofts and Cooke 1974), and to maintain large tracts of land of relatively high ecological interest (Selman 1976). They also include specific approaches such as a cross-impact assessment process to identify and analyse threats to national park environments (Becker et al. 1986) and a strategic assessment and planning framework for the marine environment (Kelly et al. 1987). At the level of the site-scale environmental impact assessment is often used to assess the environmental impacts of a proposed development (Fuggle 1979).
In addition to the environmental planning approaches for preservation and limited use, are others which have arisen from conservation planning for outdoor recreation in natural areas. These include a wilderness planning approach (Pigram 1983), carrying capacity approaches such as the Recreation Opportunity Spectrum (Clark and Stankey 1979) and the Limits of Acceptable Change (Stankey et al. 1985), as well as Threshold Analysis (Kozlowski 1986). Examples of the different environmental preservation and conservation planning approaches are now surveyed.

4.4.1 Preservation Planning

There are a number of environmental approaches to preservation planning. Examples include environmental planning and ecological planning. Two major approaches have been made to the planning of Environmentally Significant Areas (ESAs). These have been termed the planning of areas which are described as being either environmentally sensitive (Eagles 1984) or significant (Nelson et al. 1988). Both approaches originate in Canada but have had widespread application. Eagles (1984) defines an environmentally sensitive area as a specifically bounded natural landscape that fulfils the following criteria: it contains one or more of the following features - aquifer recharge, headwaters, unusual plants, wildlife or landforms, breeding or overwintering animal habitats, vital ecological functions, rare or endangered species, or combinations of habitat and landforms which could be valuable for scientific research or conservation education. An environmentally sensitive area may or may not be significantly affected by human activities and they may or may not require intensive management in order to restore, maintain or improve certain of their values. In essence an environmentally sensitive area
contains an ecosystem whose natural characteristics and processes should be maintained, preserved and protected.

Planning an environmentally sensitive area follows six major steps. They are goal formulation, resource inventory, synthesis, recommendations, implementation as well as monitoring and review. The inventory process includes physical factors such as geology, landforms, soils, groundwater, hydrology and climate as well as biological factors including vegetation and fauna. The data are compiled, described, classified and analysed according to an arbitrary but specified set of criteria. The planning of environmentally sensitive areas has been completed in many parts of the world including Britain (Ratcliffe 1977, Haigh 1990) and Canada (Eagles 1981, 1984). In addition Jennings and Reganold (1989) have made an overview of environmentally sensitive planning approaches in British Columbia, Canada, and in Washington and Oregon in the United States.

ESAs are so named because of their unusual importance for geologic, scenic hydrologic, vegetation, wildlife, archaeological, historic or other reasons (Nelson et al. 1988). They may contain landscapes which are representative of larger surrounding areas, or unique features and processes such as large aquifers and lakes, hot springs, rare plants and their habitats, threatened wildlife species, breeding areas, wildlife migratory routes, historic settlements or dwelling places of previous peoples.

Identification of ESAs can be made by the ABC resource survey method. This involves the description, analysis and evaluation of Abiotic (geologic, geomorphic, hydrologic), Biotic (vegetation, wildlife) and Cultural (archaeological, historic, land use and institutional) aspects of candidate ESAs. The aims of the method are to firstly identify and describe
outstanding abiotic, biotic and cultural features and processes in the potential ESAs. The next step is to assess their significance as well as any constraints that they pose to land use. The final phase is to link this information with an analysis of possible boundaries and planning and management systems. The natural and cultural characteristics or the purpose of the ESAs is matched with institutional arrangements appropriate for conservation and sustainable development (Figure 7). Bastedo et al. (1984) suggest that the major thrust of the ABC approach lies in its conservation of ecological values through the identification of areas that require special protection or land use controls.

The ABC resource survey method involves four levels of analysis and mapping. They are raw data, interpretation of environmental significance and constraints, synthesis, as well as boundaries and institutional arrangements. The method has been applied in many places at a range of scales including the planning of an individual ESA, for example, the case of the Aishihik area in the Yukon, Canada (Nelson and Grigoriew 1987), as well as at a regional scale in the case of the Eastern Beaufort Sea area of Canada (Nelson and Smith 1987). A similar approach has been applied to the planning of new parks in the Wrangell - St Elias Region of Alaska (Wright 1985).

Smith, Nelson and Theberge (1986) suggest that a key part of the resource survey method is the description and analysis of structural and functional aspects of the abiotic, biotic and cultural components. Abiotic information includes structural (landform) and functional (geomorphic processes) aspects. Structural biotic information includes vegetation communities and functional aspects focus on special or unique habitats in which processes such as reproduction, feeding and/or migration occur.
Figure 7 The ABC Resource Survey Method

(Nelson et al. 1988)
The cultural methodology of the ABC approach has its roots in human ecological theory wherein humans, their characteristics and activities are viewed as part of the ecosystem. Land uses are treated as processes with changing rates, magnitudes, distributions, and effects in space and time. The description and analysis of cultural features results in two types of maps. The first is a structural map showing cultural features. The second is a functional map which combines the 'lines and dots' of the structural maps into activity nodes, corridors, and hinterlands or patterns of use to planners. This functional information indicates general spatial and temporal patterns of land use and associated cultural processes. The above aspect of the ABC method is embraced by the environment - tourism planning framework proposed in Chapter 6.

Ecological planning models differ from environmental ones by their focus on ecosystems. The growing magnitude and diversity of pressures on ecological resources and their effects on habitats, ecosystems and species, coupled with the growing awareness of the values of ecological elements, have created a demand for appropriate consideration to be given to the impacts of planned developments and environmental change in ecosystems and wildlife at the planning stage (Park 1980). Thus consideration of ecological aspects is often being included in the planning process as part of environmental factors to be weighed alongside the social and economic considerations. This has created the need to evaluate the resource base of wildlife and to assess the relative values of different ecosystems, habitats and species, so they can be ranked in order of conservation priority. Such rankings are of considerable value in planning decision making because they strengthen the chances of preserving the ecologically most valuable sites and species of an area given the usually limited potential for preservation and conservation of
ecosystems. They are also important in the planning of protected environments such as nature reserves at both the regional and national levels.

Daniels (1988) asserts that ecology, especially in the form of ecological evaluation, is playing an increasing role in helping to formulate planning decisions. Approaches to the inventory and evaluation of ecological resources are numerous. They include regional evaluations based on primary ecological zones (Tubbs and Blackwood 1971), areas of ecological value (Goldsmith 1975), conservation of nature reserves (Ratcliffe 1971) and identification of reserve networks which preserve biological diversity (Margules et al. 1988). In addition a number of ecological planning approaches exist. Their underlying principles probably lie in part in the ethics of Leopold (1949), the environmental planning analyses of Hills (1953, 1961) and Lewis (1969), as well as the ecological planning principles of McHarg (1969). Joyce et al. (1983) argue that there have been two major approaches to integrating ecological theory into resource planning. The first involves the use of environmental indices while the second emphasizes mathematical modelling. General coverages of the subject have been made by Park (1980), Selman (1981) and Vink (1983).

A model proposed by Steiner and Brooks (1981) involves seven distinct steps in the ecological planning of an area. These include the establishment of goals, ecological inventory analyses, suitability analyses, possible alternatives, implementation, administration, and evaluation of the model after application. This approach has been elaborated further by Steiner (1983) and Steiner et al. (1987). An extended eleven step landscape planning method based on ecological principles has also been advanced (Steiner 1988). Van Riet and Cooks (1990a) have recently proposed a
model for the ecological planning of natural resources. It emphasizes the role of people as part of the ecosystem and stresses that the importance of understanding this connection is a prerequisite to studying nature as well as participating in ecological planning. The model investigates the problem of realizing the values of natural resources, while ensuring their long-term survival. The model involves thirteen steps and includes analysis of the social and individual values of the natural resources based on the earlier work of Juneja (1974) and Tinley and Van Riet (1978).

The model groups the natural features into various patterns based on a number of planning units termed 'landscape facets'. These are then evaluated according to their social and individual values and then placed in a number of land use zones. The final steps involve the implementation of the zoning proposals in a specific area, as well as monitoring the effective functioning of the model in order to ascertain its success in terms of the original objectives. The model has been applied to the planning of Kruger National Park (Van Riet and Cooks 1990b) as well as to the planning and design of a new camp within the park (Van Riet and Cooks 1990c). The strengths of the model lie in its integration of ecological and social values as well as its use of zoning to maintain value and limit impacts. However, the model falls short in its generalization of social values and there appears to be no incorporation of the views of the host community or the area's users.

Another ecological approach to landscape planning based on the work of Odum (1969, 1971) and using geographic information system technology for data storage, analysis and display has been proposed by Hendrix et al. (1988). Their research is based on two studies one in Massachusetts, the second in Vermont. In the former study land uses are divided into five
groups each having similar ecological requirements. The second part of
the classification is based on the physical and environmental
characteristics of a site. A comparison of the two classification schemes is
then made to determine ecological compatibility. The Vermont study was
aimed at integrating ecological values into forest land management and
planning processes. Similar approaches have been made in the Great
Lakes Basin, USA (Valiante and Beeton 1988), and a computer based
method of wilderness evaluation has been devised in Australia (Lesslie et
al. 1988, Lesslie 1991). All of the above approaches focus on the evaluation
of natural attributes and have only limited application for identifying
resource development opportunities.

Another ecological planning framework is being devised by UNESCO in
the Man and the Biosphere (MAB) project as a follow up to the
International Biological Programme (IBP). The fundamental goal is to
investigate the human impacts on different ecosystems such as tropical
forests, savannas and grasslands, aquatic systems and mountain ranges.
The evaluation techniques consist of statistical analyses, dynamic
simulation, and scenarios. Koeppel et al. (1985) stated that the project was
not yet completed and trials were still being carried out. Despite a search
further information has not been able to be obtained by this author.

4.4.2 Conservation Planning

The review of environmental and ecological planning approaches with
environmental preservation indicates that they contain many parallels
with aspects of tourism planning. Now conservation planning approaches
will be investigated to see what features they contain of relevance to
tourism planning. There are several approaches to conservation planning
in natural areas for recreation and tourism which do not have their origins in either traditional tourism or environmental methods. One approach is to separate out land use by placing a protective buffer around a wilderness core (Pigram 1983). It has parallels in the zoning approach used on a smaller scale within parks in order to separate use and reduce environmental conflict (Walther 1986). Two other approaches lie within the general concepts of 'carrying capacity' and 'threshold analysis'. The former has its origins in recreation planning for natural areas and itself originates from rangeland management techniques. The latter has its origins in regional planning and initially stemmed from research on the economic effects of urban planning. Both approaches have been used primarily in relation to the planning of recreational use in wilderness areas and national parks.

Two approaches to recreation planning in wilderness areas which have their origins in the carrying capacity concept are the Recreation Opportunity Spectrum (ROS) and its successor the Limits of Acceptable Change (LAC). Both have been applied in wilderness and other environmentally sensitive areas and have utility as a starting point for examining environment-recreation planning frameworks. The Recreation Opportunity Spectrum (ROS) is a largely resource-based approach to providing recreational diversity (Clark and Stankey 1979). The concept of a spectrum of recreation opportunities was reflected in most of the systems developed for inventorying outdoor recreation resources over the 1960s and 1970s (Brown et al. 1978). Those systems attempted to ensure that inventories of outdoor recreation resources would identify the potential of land areas to provide diverse types of recreation opportunities. Progress was made in identifying and measuring: the relative importance of different types of satisfying outdoor recreation experiences to different
types of uses (Clark et al. 1971, Driver 1975) as well as the features of recreation settings on which different types of experiences might depend (Shafer et al. 1969, Peterson 1974). Many of these research efforts employed a behavioural definition of recreation opportunity that moved beyond the conventional activity - opportunity definition (Driver and Tocher 1970).

The ROS planning framework was developed to assist in the match of recreation demand and supply. It involves specifying recreational goals in terms of broad classes of recreational opportunity, identifying specific indicators of these opportunities that permit their operational definition and defining specific standards for each indicator that make distinctions among the opportunities possible. The result is a clear definition of recreation opportunities as both the products of management and the services desired by recreationists. These opportunities, with their explicit specification of appropriate conditions for each indicator, can be incorporated into a land use planning process and used to provide guidance for on-site recreation management. The framework is one in which acceptable levels and types of environmental and social impacts of recreation are defined. The three dimensions of an ROS reflect recreation preference related to behaviour, setting and experience. The activity could be bushwalking, in a preferred setting such as a wilderness area, in order to realize the desired experiences of nature appreciation, isolation and exercise.

The ROS is not accepted universally and is based on a number of assumptions which have yet to be validated. These include the relationships amongst recreationalists preference and revealed choices for experiences, settings and attributes as well as the management of these (Driver et al. 1987), the links between behaviour and physical setting
(Schreyer et al. 1984) and between the environment and its use (Stankey 1988). In addition it has also been argued that the application of the framework in areas set aside primarily for conservation is inappropriate and contrary to the central goal in these areas of environmental protection (Van Oosterzee 1984).

A new planning tool which has emerged from the ROS, and which also appears to have its antecedents in the natural resource - tourist opportunities link espoused by Nolan (1980), is the Tourism Opportunity Spectrum (TOS). The approach presents a framework for tourism development incorporating factors of accessibility, infrastructure, social interaction, other uses and the acceptability of regimentation or control (Butler and Waldbrook 1991). However, in a similar manner to the ROS a problem lies with attempts to control tourism development and identifying responsibility for this control. In wilderness areas the control is more likely to rest with a single management agency but many tourist destinations lie outside these areas.

In an effort to find an appropriate answer to the question of 'how much is too much?' in relation to environmental capacity, research has now shifted focus onto 'what kinds of conditions are desired?' (Stankey et al. 1984). The shift in focus from 'how much use' to 'how much change' directs attention from use level as the key management concern to the environmental and social conditions desired in wilderness and natural areas. This new orientation has led to the formation of a new planning framework called the Limits of Acceptable Change (LAC) approach (Stankey et al. 1985). It focuses on managing for desired conditions rather than on how recreation use per se should be managed. Thus it addresses the matter of what constitutes acceptable change and it establishes limits
on the extent to which human-induced change is considered acceptable in a given setting. The process involves nine steps which can be summarized in the following five points:

1. Description of the desired conditions in terms of resource, social and managerial attributes;

2. Establishment of the current conditions through a baseline inventory;

3. Comparison of existing and desired conditions;

4. Initiation of management actions to maintain or achieve desired conditions; and

5. Monitoring of the results and modification of management actions as appropriate.

Despite the call of others for its application (Prosser 1986) the framework has some limitations. First it accepts the notion that some change in nature is the norm, and that a decision to allow recreational use is a de facto decision to allow some level of impact to occur (Stankey 1989). Second, Hammitt and Cole (1987) argue that it is a decision for management as to what constitutes an acceptable level of human-induced change and Pigram (1990) argues that this decision is not determined entirely by ecological criteria.

A conservation planning model which encompasses tourism is the Ultimate Environmental Threshold (UET). It originates from Threshold Analysis which itself has its origins in analysing the economic effects of urban planning (Malisz 1963, Scottish Development Department 1973, United Nations 1977). This method spawned Development Possibility Analysis (DPA), which also takes into account social criteria (Kozlowski and Zadorozna 1982), as well as the Ultimate Environmental Threshold (UET) method with its intrinsic environmental criteria and analysis of the
relationship between activities and resources (Kozlowski 1986, 1990). A UET is defined as:

The stress limit beyond which a given ecosystem becomes incapable of returning to its original condition and balance. Where these limits are exceeded as a result of the functioning or development of particular tourist or other activities, a chain reaction is generated leading towards irreversible environmental damage of the whole ecosystem or of its essential parts.

Kozlowski (1985: 146)

The process includes three stages - preliminaries, definition of the UETs and finally synthesis and interpretation. The second stage is a resource analysis which identifies four dimensions - territorial, quantitative, qualitative and temporal. Kozlowski (1985) asserted that the resulting findings are constraints which determine where and which activities should be developed, up to what quantitative level, with what quality of output, and at what rate or over what time period so that sustainable development is promoted and safeguarded. Territorial UETs are determined by various degrees of uniqueness, resistance and transformation of the key natural resources in the study area. Uniqueness is the frequency and spatial differentiation of a given natural element within a region. Fragility is the ability of the element to resist negative effects and to self-regenerate to a relatively unchanged state. Naturalness is how far a given environmental element has been altered from its original state. After evaluation according to these indicators, the key elements can then be synthesised to produce a composite picture on which decisions on areas to be targeted or avoided for tourism development can be based.
Applications of the method have been made in Tantry National Park, Poland (Kozlowski 1984) and on the Great Barrier Reef, Australia: North West Island (Kozlowski et al. 1988), Heron Island (Rosier et al. 1986) and the Capricornia Marine Section (Kozlowski et al. 1988). Kozlowski (1986) notes that conclusions drawn from these applications are that the method is especially suitable for the site-specific level of management units. Kozlowski et al. (1988) also advance the usefulness of the approach as a base for other methods which may deal more specifically with the suitability of the resource base for certain types of development, for example, the ROS and the Australian local government land use planning framework SIRO PLAN (Cocks et al. 1983). Limitations of the UET method include its decreasing reliability with increasing area (Kozlowski 1986) and its partial approach to tourism development due to its analysis of key elements solely of the natural environment (Pigram 1990).

Underlying the wilderness and national park planning approaches of the ROS, LAC and UET methods is the concept of carrying capacity. This is now reviewed in regard to its utility for environment - tourism planning.

4.4.3 Carrying Capacity

A combined approach to environmental-resource planning and use issues is enmeshed in the carrying capacity concept (Lime and Stankey 1972, Bouchard 1973, Lindsay 1980). Carrying capacity is the level of use beyond which impacts exceed acceptable levels specified by evaluative standards (Shelby and Heberlein 1984). It focuses on one management parameter - use level. It assumes a fixed and known relationship between use level and impact parameters, and the capacity will change if other management parameters alter that relationship. Butler and Knudson
(1977) have subdivided carrying capacity into four different types within recreational settings. They are ecological, physical, facility and social capacities.

The carrying capacity approach to tourism management stems from its application in determining wilderness use (Stankey 1978). It in turn has been drawn from range and wildlife management (Dasmann 1945). It is a markedly simple approach to the issue as it equates use to environmental degradation. If this is accepted then the higher the use of an area the more damage to the natural resource will occur. By extension then it should be easy to analyse the resource base and tourist use and deduce a maximum number of people who can use a site without an unacceptable alteration in the physical environment.

The carrying capacity approach to tourism activities has been outlined by O'Reilly (1986) and advocated by Andronikou (1987). At about the same time UNEP published a series of case studies in its 'Industry and Environment Newsletter' (1986). It included carrying capacity case studies of coastal areas (Pearce and Kirk), islands (Jackson), coral reefs (Salm), parks (Lindsay, Western) and mountain tourism (Singh and Kaur). Other examples include the attempt to devise a carrying capacity framework for the Ngorongoro Crater, Tanzania (Curry 1985) and the synergistic link advocated between carrying capacity and the tourism lifestyle (Heywood 1989, Martin and Uysal 1990). Discussions on the general approach to carrying capacity are offered by Niesward and Pizor (1977) and Schneider et al. (1978).

However, carrying capacity approaches to recreation and tourism planning are not universally accepted. After completing a detailed study of the
recreational carrying capacity of an area in Birmingham, England, Burton (1974) concluded that the nature of the problem makes it highly unlikely that any set of universal capacity values, applicable to a wide variety of sites, environments and circumstances can ever be produced. A decade later researchers still agreed with this view, for example, Murphy (1985: 64) stated "that (while) the carrying capacity concept is simple, its application is complex, due to the difficulty of measuring changes and establishing causal relationships". Other researchers have identified a number of capacity problems the main one being the difficulty of putting it into practice (Stankey and Lime 1973, Godschalk and Parker 1975, Mitchell 1979, Wall 1982, Romeril 1989a, Witt and Moutinho 1989, Mitchell and Murphy 1991, Farrell and Runyan 1991).

The main problems can be grouped into three categories (Stynes 1977, 1979). First there is no clear and predictable relationship between use and impact. Virtually all ecological studies of carrying capacity report a curvilinear relationship between recreational use and impact. Typically, most environmental impact occurs under light levels of recreational use, and additional recreational use causes relatively little impact (Stankey and Manning 1986). Second, the scope of carrying capacity as used above does not take into account social aspects. Social carrying capacity is the maximum number of people who can use a site without an unacceptable decline in the quality of experience gained by tourists (Mathieson and Wall 1982). P. Pearce (1988) suggests that for natural area tourism it is important to determine the environmental attitudes of visitors because there is no simple relationship between site use level and crowding. In the urban situation crowding may play a large part in determining the success of an attraction or event. For example, Expo '88 in Brisbane relied on overcrowding and queues as its signs of achievement.
The concept of a threshold level of tourist activity beyond which overcrowding, congestion and negative environmental effects will occur has obvious attractions. However, while the theory may be easy to conceptualize, the practical reality leaves much to be desired. A carrying capacity value is exceedingly difficult to quantify, not least because no single typology of tourism, nor of environment, exists.

Romeril (1989a: 205)

In the USA carrying capacity approaches to tourism or visitor use in parks now include social components as well as environmental ones (Lindsay 1986).

A third problem with carrying capacity stems from the fact that in any given situation there are limits to the volume of visitors that management can handle. Both the private and the public sectors have constraints on budgets for capital improvements and operating staff. It is not always possible to cope with increased masses of visitors. With the great growth of recreation and tourism, this has probably been the greatest limitation. While carrying capacity studies obviously have a role to play in helping shape the tourism - environment sustainability concept, it will require a perspicacious approach to ensure that it is not used as a panacea by developers keen to reduce environmental concerns to an oversimplified numbers game. Therefore in the context of this study the carrying capacity concept will be laid to one side as it is considered to encompass too many unknowns.

4.5 EVALUATION OF ATTRIBUTES

In tourism planning there are a variety of ways of evaluating tourist resources a number of which are noted in Section 3.4.3. Similarly in environmental planning there are a range of methods for evaluating
environmental attributes. The evaluation of natural areas for conservation and other purposes has gained wide application (Goldsmith 1983). The terms ecological and conservation evaluation have been used to describe the process (Ploeg and Vligm 1978, Roome 1984) and the conflicts and issues in environmental evaluation have been explored and summarised by Cocklin (1988). These evaluations have been used to assess the importance of natural areas for the purposes of land use planning, environmental impact assessment and planning protected areas. Evaluation of environmental attributes is usually carried out in three stages. They are:

1. Selection and the possible weighting of criteria;

2. Evaluation of areas in terms of these; and

3. Derivation of a relative measure of overall environmental value.

The criteria used to identify and evaluate the significance of natural areas have been reviewed by Margules and Usher (1981), Smith and Theberge (1986) and O'Connor et al. (1990). Criteria used for evaluation vary and generally fall into three categories - ecological, cultural and planning (Table 1).

The ecological criteria consist of both abiotic (non-living) and biotic (living) features and their characteristics. Widely used criteria include rarity, diversity, naturalness, representativeness and fragility. Rarity is the absence or presence of species based on geographic (restricted area) and demographic (low numbers) criteria (Argus and White 1982). The terms endangered and threatened represent extreme cases of any types of rarity noted. Diversity describes the number of species (richness) and their
<table>
<thead>
<tr>
<th>CRITERION</th>
<th>TYPE</th>
<th>No.</th>
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<tr>
<td>Diversity</td>
<td>Abiotic, Biotic</td>
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<tr>
<td>Size</td>
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<tr>
<td>Naturalness</td>
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<td>Representativeness</td>
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</tr>
<tr>
<td>Fragility</td>
<td>Abiotic, Biotic</td>
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</tr>
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<td>Importance to Wildlife</td>
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<td>6</td>
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<tr>
<td>Threat</td>
<td>Planning and Management</td>
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<td>Cultural</td>
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<td>Recreational Value</td>
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</tr>
<tr>
<td>Level of Significance</td>
<td>Planning and Management</td>
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<td>2</td>
</tr>
<tr>
<td>Accessibility</td>
<td>Planning and Management</td>
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<td>Conservation Effectiveness</td>
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<tr>
<td>Cultural Resources</td>
<td>Cultural</td>
<td>2</td>
</tr>
<tr>
<td>Shape</td>
<td>Biotic, Plan + Mgt</td>
<td>2</td>
</tr>
</tbody>
</table>

Note: Criteria used in 22 selected evaluation systems

Relative abundance (Solomon 1979). Naturalness refers to a natural condition which implies freedom from human influence (Margules and Usher 1981) and conceptually is currently being pursued from an anthropocentric to a biocentric view (Taylor 1990).

Representativeness is the representation in protected areas of the range of ecological variation (McNeeley and Miller 1984). In the past it has been viewed as either being inclusive, that is, includes the whole range of species (Margules and Usher 1981) or as being typical, but not unique, biome or habitat types (Ray 1975). The idea of representativeness is better thought of as an approach to conservation rather than simply as a criterion (Smith and Theberge 1986). The fragility of a natural area refers to its
susceptibility to perturbation, most often human-induced (Ratcliffe 1971). Resistance is often used to describe the ability of a system to avoid displacement during a period of stress (Pimm 1984).

Evaluation of cultural features in predominantly natural areas reflects the growing recognition of cultural resource management. Cultural criteria are usually divided into archaeological and historical features as well as human use for production, scientific, educational and recreational use (Steiner 1983). Once the significance of an area has been established by ecological and cultural criteria its importance must be assessed from a planning and management standpoint. Criteria for the latter assessment can be further divided into need or threat, and feasibility criteria.

A useful tool for the evaluation of natural resources is the use of a matrix in order to evaluate the relative compatibility or conflict of differing activities or uses in an area. Examples include an interaction grid used to identify potential environmental impacts caused by a development project (Conover et al. 1985), an ecological conflict matrix for evaluating regional ecological resources (Klopatek et al. 1981) as well as interaction matrices for evaluating the compatibility of recreational activities (Goodall and Whittow 1973).

A number of approaches have been made to evaluate the scenic value of landscapes for recreational purposes (Shafer et al. 1969, Al-Amiri 1986). A recent approach is based on the assessment of an area's conservation value as well as recreation and tourism potential (Cocklin et al. 1990). The conservation value assessment includes consideration of indigenous forest, wildlife and soil conservation requirements. The assessment of recreation and tourism potential embodies both the consideration of scenic
amenity and suitability for activity based recreation. Strengths of the methodology include its approach to assigning the region’s landscape units to recreation potential and conservation summary classes as well as its emphasis on a disaggregate approach to analysis in order that the basis for rating is explicit.

The most common criteria used to evaluate natural areas include ecological, or abiotic and biotic ones such as diversity, rarity, size, naturalness, representativeness and fragility, as well as cultural criteria such as historic and archaeologic significance and human use. Inherent linkages exist between criteria such as diversity and representativeness or amongst rarity, size and fragility; whilst representativeness and naturalness may be more applicable to larger sites and rarity and fragility to smaller ones (Margules and Usher 1984).

The evaluation of natural areas involves a wide variety of approaches using many different criteria to form the basis of evaluations (Margules and Usher 1981, Smith and Theberge 1986). Once the criteria have been chosen, measured and rated then they are usually combined into a single overall measure of environmental value. There are a number of ways of achieving this but three of the most common are the simple additive weighting, expected value and disjunctive methods (Figure 8).

The simple additive weighting method ranks criteria according to weighted measurements. Hwang and Yoon (1981) indicate that multiplication and addition are used and suggest that the criteria values must be both numerical (that is, measured using an interval or ratio scale) and comparable. The values of each criteria are standardized so they are able to be compared amongst criteria. However, this standardisation
Figure 8  Multicriteria Evaluation Methods
Smith and Theberge (1987)

The requirements and assumptions of three multicriteria evaluation models

<table>
<thead>
<tr>
<th>MULTICRITERIA EVALUATION MODEL</th>
<th>REQUIREMENTS AND ASSUMPTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple Additive Weighting Method</td>
<td>1. Measurement of criteria is on an interval or ratio scale.</td>
</tr>
<tr>
<td></td>
<td>2. Measurements of different criteria are comparable.</td>
</tr>
<tr>
<td></td>
<td>3. Criteria are independent.</td>
</tr>
<tr>
<td></td>
<td>4. Weights can be defined.</td>
</tr>
<tr>
<td>Expected Value Method</td>
<td>1. Each alternative can be ranked for every criterion.</td>
</tr>
<tr>
<td></td>
<td>2. Criteria can be ranked.</td>
</tr>
<tr>
<td></td>
<td>3. Criteria are independent.</td>
</tr>
<tr>
<td></td>
<td>4. Ordinal ranks are equivalent to interval measurements.</td>
</tr>
<tr>
<td>Disjunctive Method</td>
<td>1. Measurement of criteria are on at least an ordinal scale.</td>
</tr>
<tr>
<td></td>
<td>2. Minimum standards can be set for each criterion.</td>
</tr>
</tbody>
</table>

assumes comparability between each level of the differing criteria. Thus a high ranking of a site for rarity would be equal to that of naturalness or diversity. One problem with this method is that areas with a high overall value may simply reflect a high average value and not be important for any individual criteria (Van der Ploeg and Vlijm 1978, Klopatek et al. 1981). Smith and Theberge (1987) argue that the expected value method is a crude form of the simple additive weighting method. Criteria are valued subjectively then are also ranked. For example, rarity could be ranked more highly than diversity and therefore its values would be weighted accordingly.
The disjunctive method is one in which an alternative is evaluated on its greatest value of an attribute. It sets minimum standards for each criterion and therefore an area with high ranking in one of its criterion will automatically occur in the highest ranking class. This is conceptually similar to the ranking used by the GRIM approach (quoted in Van der Ploeg and Vlijm 1978), in the ESA method (Eagles 1984) and in the resource assessment for recreation tourism (Cocklin et al. 1990). In these approaches the overall ranking is based on the highest rank each area has for any criterion.

4.6 ENVIRONMENT - TOURISM PLANNING

Although there are many environmental planning models as well as numerous tourism planning approaches, there are few environmental - tourism planning frameworks. Obviously the relationship between the two needs to be better understood. The few planning processes for environment - tourism at the regional level that have already been proposed include the ecological approach of Van Riet and Cooks (1990a) and the regional strategic tourism framework of Gunn (1988a). Underlying these frameworks for the environment and tourism is the intrinsic belief that tourism developments must not only maintain the natural and cultural resources but must also sustain them. To achieve this goal strategic regional land use planning should include such components as resource protection, agriculture, pastoral use, urban areas and mining to be established in a carefully planned and controlled manner which sets conditions on growth and maintains or enhances environmental quality. Outstanding natural features can continue to be significant tourist attractions only if they are conserved. If there is any doubt that the natural
environment cannot be protected or enhanced then tourism development should not be allowed to proceed.

Environment - tourism planning involves aspects of both environmental planning and tourism planning. Components of the former include environmental protection, resource conservation and environmental impact assessment while tourism planning provides aspects of area development and social assessment. The need for further research into environment - tourism planning has been articulated for both the general planning framework arena (Farrell and McLellan 1987) as well as the evaluation of impacts (Mathieson and Wall 1982). Other aspects which require further research include case studies on areas such as the tropics, arid lands and small islands (Inskeep 1987) as well as the link between environmental and social aspects of tourism development (Murphy 1985).

An analysis of the more than 1600 tourism plans inventoried by the WTO (1980b) study found that:

1. Approximately one-third were not implemented;
2. Few plans integrated tourism with broader socioeconomic development objectives and those whose 'social aspects' have priority over direct profitability are even more exceptional; and
3. Few examples were found of plans that made firm and specific provision for protecting the environment.

(Quoted in Pearce 1989: 276-277)

One aspect of tourism planning which is often fostered is the need for the integration of tourism in area development. However, as has been argued earlier in this dissertation there are fewer approaches which advocate the need for the integration of tourism and environmental protection. Yet a
real need exists for this to take place if the symbiotic link between the two is to be transferred from concept to reality. Inskeep (1987: 128) asserts that tourism planning of natural attractions "should be closely coordinated and integrated with park and conservation planning at the national, regional and local levels with respect to both geographic distribution and intensity of the tourism development". Achieving environmental - tourism compatibility in natural areas is best undertaken at the regional level where it is suggested that tourism planning can provide one of the best opportunities for attaining environmental goals (UNDP and WTO 1986). This has also been supported from regional land use planning (Sijmons 1990).

Many similarities can be drawn between tourism and environmental planning goals and approaches. First the goals of tourism development and environmental preservation are able to meet in the crucible of conservation and sustainable development. Second, models in both approaches include the same general planning steps namely goal setting, followed by data collection and analysis, synthesis, recommendations and implementation. A third is the heterogeneous nature of the two planning approaches. Just as it was concluded that geographic heterogeneity is a tourism planning postulate so too the concept permeates environmental planning. In the different planning approaches there is the recognition that not every place has the same tourism potential, nor the same environmental attributes. Therefore the integration of data through multi layer mapping is important in the identification of significant environmental and tourism features. Through this process a number of areas of environmental protection or tourism development opportunities and/or constraints will be determined which can lead to the identification of environmental priorities and/or possibilities.
Despite their different goals, tourism planning and environmental planning also share a common spatial framework. Within a tourism destination zone Gunn (1988a) identifies attraction clusters, the service community and linkage corridors whereas in the ABC approach to environmental planning Smith, Hetherington and Brumbaugh (1986) identify cultural activity nodes, hinterlands and corridors. A final similarity concerns the integration of social values in each of the two planning approaches. The role of people as part of the ecosystem is central to emerging ecological approaches just as the incorporation of social values forms part of recent tourism planning processes.

4.7 CONCLUSIONS

From the review of literature the following summary and conclusions are made on environmental planning.

1. Traditional environmental planning incorporates environmental protection measures in land use planning;

2. The goals of environmental planning are to: maintain ecological processes, preserve biological diversity and ensure that use of resources is sustainable;

3. Within environmental and ecological planning approaches an emerging trend is the incorporation of the values of society;

4. There exists a wide range of criteria to evaluate the significance of natural areas;

5. Environmental and ecological planning methods offer ways of evaluating environmental attributes for protection and conservation within a tourism planning framework;
6. The concept of carrying capacity has inherent difficulties with quantification. ROS/LAC approaches to environment-tourism use are better suited to discrete areas under the authority of one control such as national parks and reserves. Threshold Analysis is limited by its partial analysis of key elements solely of the natural environment;

7. An environment - tourism planning approach needs to encompass social values by seeking out and incorporating community and tourist views;

8. Tourism planning in natural areas be part of a continuous process based on an iterative, strategic planning approach;

9. Regional planning offers the best method for achieving environmental protection and tourism development strategies; and

10. There is a need for the establishment of a tourism planning framework for natural areas which is grounded in the sustainable development concept, is based on environmental protection and conservation, and incorporates community and tourist values.

Thus the future of environment - tourism planning is couched in the recognition of the link between environmental conservation and tourism development. The major conclusion drawn in this chapter is that some of the goals, principles and approaches of environmental planning and tourism planning are similar and therefore it should be possible to integrate into a unified planning framework. In the following chapter the social and spatial dimensions identified in the previous chapter on tourism planning as well as again in this chapter on environmental planning are further explored and in Chapter 6 all three strands (environmental, social and spatial) are drawn together in a new environment - tourism planning framework.
Chapter 5  Social, Spatial and Other Aspects

Sustainable development planning for tourism combines elements of physical/spatial and community planning in a manner which aims to ensure that development is equitable, minimizes resource depletion and environmental degradation and limits the negative social effects of tourism.

Hall 1991: 114

5.1  INTRODUCTION

It has already been clearly established that emerging approaches to tourism planning include not only the incorporation of environmental elements but also social aspects. Therefore the involvement of the local community is becoming an integral part of the planning and decision making process of tourism. However, in many tourism planning approaches the views of the host community are seldom sought and if they are, usually only the views of business or community leaders. Rarely are the wider views of the local citizens sought and seldom, if at all, are the views of tourists canvassed. Also, in other studies which focus on surveying the opinions of residents or tourists in regard to the effects of tourism, it is more usual for tourism's economic or social impacts to be investigated rather than the environmental ones.

The spatial aspects of both tourism planning and environmental planning have many parallels. Each may be viewed in terms of spatial systems' frameworks which include elements of structure, function and stage. A spatial system's structure refers to its static features or form. The functional elements are the processes which help to shape the structural elements in a dynamic way. The third element or stage refers to the alteration of the structure and function of the system over time. In both planning approaches another distinction can be made based on
differentiation by functions. These include areal patterns which include key nodes (points), linking corridors (lines) and hinterland (surrounding areas). Strategies to differentiate structural and functional elements include clustering and zoning.

Other aspects of tourism planning which are considered worthy of investigation by this study are related to the strategies of staging - or the phasing in of tourism developments over a period of time, the application of appropriate development controls, and fostering environmentally appropriate or 'alternative' tourism. Staging is a temporal strategy which fosters the phasing in of tourism growth over a period of time so that any adverse effects of large scale development can be avoided. The application of development controls centres on the notion of promoting a balance of conservation and development rather than one at the expense of the other. Development controls are usually derived from environmental and social considerations. Examination of alternative tourism involves investigating the demand side of tourism, that is, the desires of the tourists themselves, especially in regard to environmentally compatible tourism developments and activities. This is the reverse of the usual tourism planning approach which normally examines aspects of supply only, that is, just the destination area. All of the above aspects are now examined in the light of their role as strategies with utility for environment - tourism planning.

5.2 SOCIAL ASPECTS

Involvement of the public in planning has been more of a feature of environmental planning than tourism planning, especially through the environmental impact assessment process and urban planning. In the past
inadequate attention to qualitative socioeconomic impacts has been a
major reason why many tourism development plans are not implemented
(Baud-Bovy 1982). However, there has now been a move away from the
narrow concern with physical or promotional planning facilitating the
growth of tourism to a broader, more balanced approach recognising the
needs and views of not only tourists and developers but also the wider
community. Pearce (1989) notes that concern is now expressed that
tourism should be integrated with other forms of social and economic
development. It has also been recognised that since tourism is dependent
on tourists it is important to gauge their opinions on any planned
development.

A number of studies have been made of the attitudes of specific groups of
people to conservation and tourism. Surveys of conservation attitudes
have been made of groups such as urban Australians (Newman 1983),
Greek commercial fishermen (Pyrovetis and Daoutopoulos 1989) and
English farmers (Carr and Tait 1991). While the results of the first survey
indicated a very high concern for the environment the other two showed
that commercial groups held an adverse view of the environment and
conservation due to the perceived economic drawbacks that they
engendered.

In addition, a number of studies have been made of resident groups to
tourism. These include surveys in Rarotonga (Pryor 1980), England
(Murphy 1980), Argentina (Schlüter and Var 1988), USA (Massachusetts -
Pizam 1978; Hawaii - Liu and Var 1986; Florida - Davis et al. 1988; and
Colorado - Perdue et al. 1990) and Zambia (Husbands 1989). Many others
have been made on the economic (Pizam 1978; Belisle and Hoy 1980) and
social (Smith 1977; Cooke 1982) impacts of tourism. Some communities
have reported excellent host-guest interaction (eg. Senegal - Bilsen 1987) while others have noted adverse problems (Bhutan - Allan 1988). Such differences have led one researcher to pose the question 'tourism for whom?' (Jafari 1987) and others to advocate the necessity of conducting research into the attitudes of residents towards tourism and tourists (Marsh and Henshall 1987; May 1990). Also very little has been established in relation to residents' views of tourism's environmental advantages for, and/or adverse impacts on their communities let alone the attitudes of tourists in this regard.

A recent survey and review of resident perceptions research on the social impacts of tourism indicates that although there is a sound description and knowledge base of tourism impacts, there is a need for further research of the central concepts in order to advance the conceptual and theoretical base (Ap 1990). His summary of resident perceptions on the social impacts of tourism drew no major findings in regard to positive and negative environmental impacts. The conclusions of a similar review were that resident populations have not really been canvassed to any considerable degree concerning tourism's impact on their physical environment (Husbands and Thompson 1990). It is postulated here that as well as resident views the preferences of tourists from different cultures (or groups within cultures) should be considered in the environment - tourism planning process. Gunn (1988a) suggested that since tourism planning starts with visitor activities it should include information on activities sought by travellers.

Ap's (1990) survey and review of resident perceptions on the social impacts of tourism concluded that the overall descriptive nature of the inquiries were indicative of a field of study at an early stage of
development. He suggested that future research should attempt to link the central concepts to some explicit theory. While agreeing with Ap's conclusions it is suggested in this dissertation that our understanding of host community views on tourism's environmental impacts is minimal and is not even at a satisfactory descriptive stage. It has been further suggested that even less is known about tourist perceptions on the environmental impacts of tourism. It is therefore concluded that any environment - tourism planning framework should incorporate both resident and tourist opinions.

5.2.1 Resident Opinions

Participation by residents in environment - tourism planning is fundamental to the process (Gunn 1991a). Travis (1980: 82) states that "the host population and local services are important in themselves and are incidentally basic resources in relation to tourism". UNEP (1986) advocated that tourism should be subject to environmental planning and management taking into account the wellbeing of the local population, which too often has had to accept a large influx of tourists without having had a voice in such development. The public now demand that their concerns be incorporated into the decision making process. This has resulted in the emergence of public participation programmes and requirements that environmental impact statements be prepared. However, with the exception of a small number of very recent isolated examples, there has been little public involvement in tourism planning (Mathieson and Wall 1982). Eight years later the situation had not changed significantly as Husbands and Thompson (1990: 493) stated "resident populations have not really been canvassed to any considerable degree concerning tourism's impact on their physical environment". A study of
community opinions and preferences in three English tourist centres by Murphy (1980) revealed a willingness of residents to participate in tourism planning and their ability to develop rational and practical options.

Liu et al. (1987) carried out a major study of resident perceptions on the impact of tourism on the environment in Hawaii, North Wales and Turkey. The study illustrated the value of incorporating resident perception in evaluating the effects of tourism development for planning purposes. Residents of Hawaii and North Wales gave protection of the environment the highest priority. It was ranked higher than cultural benefits, social costs and even economic benefits. Liu et al. (1987: 18) concluded that the "protection of the environment is essential for the continued success of any tourist destination". They added that there are two phases to tourism impacts and the picture is completed only when one phase supplements the other. These phases are what perceivers believe to be the case (a situation underlying policy decision) and the scientific monitoring of actual physical changes in the total environment. Applied to planning the situation is obvious - to maintain environmental protection and tourism development there must be not only scientific evidence of cause and effect but also the public support for it.

Conclusions drawn from the study were:

1. The impact of tourism on the environment is of universal concern;

2. Different cultures view the ways environmental and negative impacts of tourism are perceived differently;

3. Residents perceive many of the benefits brought by tourism such as the preservation of historic sites;

4. It is important to incorporate resident perceptions in evaluating the effects of tourism development for planning purposes. Monitoring resident opinion is necessary in
order to assess local sentiments which should be incorporated at the outset of the planning process; and

5. It confirms the necessity of adopting a holistic approach to tourism planning, since issues on the environment are not perceived as being entirely distinct from economic and social ones.

(Liu et al. 1987: 34-35)

General public participation in planning is important for a variety of reasons. They include gaining attitudes and perceptions of residents' views on their environment, tourism development, their community aspirations and on the tourists themselves. Dasmann et al. (1973: 115) suggested that "the more local people benefit from tourism, the more they will benefit from a commitment to preserve the environmental features which attract tourism". An early tourism planning study involving public participation was carried out in Prince Edward Island, Vancouver, Canada in the mid 1970s (Abt Associates 1976). It attempted to provide a balanced assessment of tourism development compared with other sectors of the island's economy as well as the overall social and environmental impacts. A number of conclusions were drawn but no single recommendation on the most appropriate form of tourist development was made. Instead the principal concern was to provide discussion and debate leading to informed statements which in turn would lead to the most appropriate decisions.

The second reason for community consultation is because not all communities are in favour of tourism development. Therefore tourism planning should always be carried out in close collaboration with the local inhabitants who are most likely to be affected. De Kadt (1979) lamented that he knew of no country which evaluated alternative approaches to tourism for the purpose of selecting one that promised to maximise social
benefits to hosts. He recommended community controlled, forward looking planning as opposed to typical remedial planning. Within a few years this emphasis on community participation for its own gain was echoed by Murphy (1985) and Getz (1986). However, at this stage there appears to be as many views on tourism development as there are community groups. For example, although the residents of the gaming community of Deadwood, South Dakota identified tourism as having strong community value (Caneday and Zeiger 1991), a survey of Florida residents uncovered a strong anti-tourism, anti-growth segment in the state prompting the researchers to propose that the state government devote a portion of its tourism promotion efforts toward community education on the benefits of tourism (Davis et al. 1988). A survey of rural residents in Colorado found that support for further tourism developments was directly related to their perceptions of whether or not such developments were associated with positive or negative impact (Perdue et al. 1990). A survey of four Austrian alpine communities found that although the residents viewed tourism positively they were also keen to ensure that their local community and environmental values were protected (Kariel 1989). To do this they suggested the adoption of 'soft tourism' as a way of achieving a balance between preservation and development.

In England and Wales management plans have been drawn up covering 28 of the 42 Heritage Coasts. Generally these plans have been able to define the nature of the particular resource, identify priorities for management and succeed in involving a wide range of local interest groups in implementing the Heritage Coast concept in their particular area. However, it was noted by Edwards (1987) that this element of residential 'goodwill' may be lost if tourism promotion is not kept within acceptable
bounds. If it is lost, then he suggests that the Heritage Coasts will remain as areas in which recreation and tourism occur alongside habitats and communities that retain their ecological integrity and intrinsic appeal.

A third reason for community consultation is because it is the local people who have much to lose or gain from policy decisions. UNEP (1986: 2) suggested that "tourism planning should always be carried out in close collaboration with the local inhabitants who are most likely to be affected". Murphy (1983) asserted that tourism thrives on a community's resources and therefore it must take into consideration the opinions of the residents of a destination area. He added that there is a growing awareness of tourism's dependency on and responsibility to the host community. Consequently it is advocated that future planning be undertaken from the perspective of a community industry, one that is responsible to the community it is selling. This is also endorsed by Getz (1986) who suggested that a tourism development plan should include statements on what tourism is expected to contribute to more general goals including community development, enhancement of cultural identity, social welfare, the provision of leisure opportunities, as well as the provision and maintenance of living amenities.

Spanoudis (1982) indicated that one of the two major conclusions of the Patmos planning study in Greece was that local conditions and demands must be satisfied before any other considerations were met. In England Murphy's (1983) survey of residents, the business community and local government on their attitudes towards tourism found that residents' attitudes differed significantly from the others. Residents were especially concerned that any development would bring with it additional amenities for local people. The implications of such findings are that all sectors of a
community, including residents, must be consulted in the early stages of the tourism planning process for any proposals to be successful in the long run. Miller (1987: 69) said in relation to Washington's coastal zone that "tourism cannot be forced upon the citizenry by either government or industry. Rather, it must gain the endorsement of coastal communities".

The fourth aspect of gaining community views during the planning process is to gauge the perceptions of hosts (residents) to guests (tourists). Mathieson and Wall (1982) suggested that planners should consider the conflicting opinions of members of the host community and Romeril (1989a) asserted that host cultures vary in their degree of robustness or resilience to the impact of tourists. Many individuals involved in the tourist industry are likely to welcome tourists, whereas others may resent their presence and behaviour. The UNESCO Courier (1990) advocated the strengths of tourism's hospitality by hosts for guests and includes case studies of the Bedouin (Chelhod 1990) and the Sahelians (Fall 1990) as well as of host communities in Poland (Lisowski 1990), India (Mohanti 1990) and Argentina (Manzur 1990).

5.2.2 Tourist Opinions

The preferences of tourists should be considered in the environment - tourism planning process because without tourists there would be no tourism. Particular attention should be given to cultural preferences for the total environment destined for tourism use. Such considerations will assist in assigning specific values to different tourist activities and developments as well as areas or features to be protected. Dasmann et al. (1973) assert that on a regional level, it is the preferences of the more outdoor recreation-oriented tourists which are important for classifying
and evaluating resources, and which lend themselves to an ecological approach in survey work.

Conventional forms of mass tourism will probably remain prevalent into the foreseeable future, but emerging new trends are strongly affecting tourism planning. Inskeep (1988) suggested that one major trend is the increasing fragmentation of tourist markets, especially as more tourists want to participate in a variety of sports, recreational, and cultural pursuits, as they seek new destinations, stay in residential, self-catering accommodation, and engage in special interest tourism. Therefore, it is essential to seek the views of tourists in order to accurately assess their opinions. Linking the social and environmental aspects of tourism planning Inskeep (1987) suggested that it is important to distinguish between capacity based on tourist acceptability and that predicated on environmental deterioration because the two may not be the same.

Pigram (1987) surveyed the attitudes and perceptions of tourists to Coffs Harbour, NSW, Australia as part of an overall study to seek ways of enhancing tourism's economic and social benefits whilst reducing its environmental costs. The study also sought to demonstrate the need for creative planning to ensure that, in meeting the demands of the tourist sector, the needs of the local community were not neglected. Examples of New Zealand surveys of tourists in a number of different areas include visitors to a popular beach (Goldsmith 1982), Auckland's regional parks (Harris and Orams 1990), national parks (Pearce and Booth 1987) and wilderness areas (Kearsley 1990). In the last study the tourists agreed that the major management goals of natural environments should be preservation, education and recreation, but that tourist and recreational development are not. Another major finding was that wilderness is a
state of mind as much as a phenomenon of place and that many environmental contexts are acceptable as wilderness, depending on the imagery and attitudes of the visitor. A survey of South African domestic tourists found a low level of awareness of tourist attractions within their own country (Boekstein et al. 1991).

In summary, public participation in the shaping of environment - tourism planning provides a more balanced approach than traditionally oriented development ones and recognizes the needs and views of both tourists and residents. Research into community attitudes towards tourism is reasonably well developed although incorporation of such views into the planning process is far less common (Pearce 1989). However, it is essential for this to occur in order to ensure environmental conservation, minimization of unacceptable impacts, community growth and acceptance of tourism. Tourism planning must reduce any conflicts between visitors and the environment as well as between visitors and residents as each competes for the same amenities (Knopp 1980). Much of this potential conflict may be resolved if resident and tourist opinions are sought and heeded when planning is carried out. A proactive stance by tourism has greater opportunities than the present reactive position in most communities (Gunn 1987). Therefore an important part of any tourism development planning process is the seeking out of public views.

5.3 SPATIAL ASPECTS

There are a number of different approaches to achieving environmental protection and compatible tourism development within the regional context. They include strategies for both supply (destination area resources) and demand (potential and actual tourists) and incorporate
spatial and temporal approaches (Komillis 1990). Organizing the natural tourism destination area includes spatial considerations (eg. areal classification by either structure or function) as well as temporal ones (scheduling activities). In his advocacy of community based tourism development, Murphy (1985) has suggested that more emphasis is needed on the interrelated nature of tourism development, in terms of its component parts (physical, economic and social considerations), its spatial implications (accessibility, routing, and intervening opportunities), and evolutionary pattern (development stage and competitiveness). To achieve this goal there are a number of different spatial strategies which foster environmental protection and compatible tourism development, within the regional context. They include the concept of functional differentiation and the strategies of clustering and zoning.

5.4 FUNCTIONAL DIFFERENTIATION

Geographic heterogeneity is a tourism planning postulate. Gunn (1988a) asserts that tourism's resources are not equally distributed and that they vary according to spatial locations and temporal considerations. Thus not all areas or seasons are alike and the strength of tourism depends on how well the special assets of an area are planned and developed. Therefore one of the first aims of tourism planning is to define and describe the natural and cultural resources of an area to identify their tourism potential.

Both the environment and tourism have been described in terms of systems. A system is a functional whole composed of organized, interacting, interdependent parts. Most systems are characterised by their component parts of inputs, processes, outputs and feedback. The natural
environment may be recognised as a system but because of its complexity it is usually divided into sub systems such as landforms, ecology and climate. In the same way tourism may be described as a system with its component parts. A comparison of both the environmental and tourism systems indicates that there are many similarities. Each has a spatial structure or form in which functional or dynamic processes operate leading to an overall consequential stage of development.

In environment - tourism planning the spatial framework can be subdivided into environmental and tourism components each differentiated according to either structural or functional classifications. In both cases the underlying elements of the framework consist of points, lines and areas of the types identified by Getis and Boots (1978). The points may be either ecologically sensitive patches or tourist destination nodes. The lines may be nature conservation strips or touring routes, and the areas are usually the surrounding environmental or tourism (non-attraction) hinterland. The identification of these areas has considerable application for environment - tourism planning in defining nodes which are either environmentally sensitive or sites of tourist development or activity, lines in the form of either environmental corridors or touring routes, and surrounding hinterland areas which may or may not contain acceptable function/use interaction (Fagence 1990).

The underlying concept in land evaluation for nature conservation is that certain areas need to be preserved solely for the purpose of maintenance of intrinsic values (O'Connor et al. 1990). The arguments for this are ethical, ecological and economic. The translation of ethical value into spatial frameworks is usually achieved by methods of zoning (Walther 1986). Zoning can be carried out according to either spatial or functional
classifications. A number of such classifications have been devised including those for geomorphology, ecology, the environment, recreation and tourism (Figure 9). Therefore, it is important to explore these ideas further in relation to their environmental and tourism elements in order to identify aspects useful for environment - tourism planning.

5.4.1 Environmental Elements

The landscape has always been classified by geomorphologists on the basis of three characteristics - form, process and stage. In this idealized concept of landscape evolution form refers to the geographical elements of the landscape or landforms which can be broadly grouped into mountains, hills, plateaux and plains. Process is the means by which the landforms changed through deposition and erosion, and stage refers to the historical point of evolution of the landscape. The whole comprehensive system was based on a 'cycle of erosion' in which there were three main stages, described metaphorically as, youth, maturity and old age (Davis 1909). Almost a century later the essence of this concept is found in ecological and environmental approaches to landscape classification.

In an ecological perspective the landscape is currently 'classified' into three characteristics - structure, function and change (Forman and Godron 1986). Landscape structure refers to the spatial relationships among the distinctive ecosystems or elements present. More specifically it includes the distribution of energy, materials, and species in relation to the sizes, shapes, numbers, kinds and configurations of the ecosystems. Essentially, the ecological landscape structure refers to spatial patterns of landscape elements. Function refers to the interactions among the spatial elements, that is, the flows of energy, materials, and species among the component
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ecosystems. Change is the alteration in the structure and function of the ecological mosaic over time.

Forman and Godron (1986) claim that the landscape exhibits the same three fundamental characteristics as a vertebrate or an economic system. In this ecological landscape classification the three basic types of structural elements are patches, corridors and the surrounding matrix. Patches are prominent and ubiquitous structural features of landscapes. Forman and Godron (1986: 83) define them as a "nonlinear surface area differing in appearance from its surroundings". They vary widely in size, shape, type, heterogeneity, and boundary characteristics and can be further classified into five types based on their differing origins. These are - disturbance patches, remnant patches, environmental resource patches, planted patches and habitations.

Corridors are strips of landscape whose key characteristic is connectivity. They originate by the same mechanisms as patches and can occur as natural parts of the landscape (eg. rivers and associated riparian vegetation) or can be artefacts occurring along roads, railways, fencelines or powerlines. Corridors also have other functions apart from providing habitat and movement conducts. They can serve as shelterbelts which increase crop and livestock productivity and ameliorate wind and water erosion. It has been suggested that corridors, especially along roadsides, are the window through which tourists and the travelling public look at the landscape, and so they have a vital role in education and increasing public awareness of nature conservation issues (Hobbs et al. 1990, Hobbs and Saunders 1991). The most extensive and most connected landscape element is the matrix. Therefore it plays the dominant role in the functioning of the landscape, that is, the flows of energy, materials and
species. It can be differentiated from any patch type within it by having a
greater relative area. It is also the most connected portion of the landscape
and has the main role in landscape dynamics.

Bastedo et al. (1984) advanced a similar approach to landscape evaluation
in their ABC resource survey method of determining ESAs. The
environment is considered to be made up of abiotic, biotic and cultural
components each of which comprise structural and functional variables
similar to those of Forman and Godron (1986) or the form and process of
Davis (1909). Within the abiotic component of the landscape structural
variables depict landform and composition and include slope, relief,
drainage pattern, soil texture and moisture regime. Distinct patterns of
structural variables correspond to landforms and materials of differing
origin (e.g. moraine, alluvium or colluvium). Functional abiotic variables
include contemporary geomorphic processes such as erosion, avalanches,
thermokarst action (Bastedo et al. 1984). Within the biotic component,
structural variables relate to vegetation communities and wildlife habitats.
Functional variables include data on areas of concentrated plant
productivity and special or unique habitats within which important
habitat functions occur, for example, reproduction, feeding or migration.

The cultural component of the ABC approach also includes structural and
functional variables. Structural variables include features related to past
and present land use. They include land use designations such as
agriculture, forestry, mining, settlements, transport and communications,
as well as historic and archaeological sites. Functional information
includes corridors and activity nodes which indicate general spatial and
temporal patterns of land use and associated cultural processes. Functional
maps combine the 'lines and dots' of the structural maps into 'patterns of
use' for planners, managers and interested citizens. Smith, Nelson and Theberge (1986) assert that the patterns of use are derived from a synthesis of the lines and dots of the structural map into categories or zones and are classified on the functional maps as either nodes, corridors or hinterlands. Nodes are areas where land uses are concentrated, corridors are transport and communication links between nodes and may contain other activities, and hinterlands are areas where concentrated patterns of overlapping activities do not occur.

5.4.2 Tourism Elements

The functional classifications of geomorphology, landscape ecology and environmental planning also have an analogy in the tourism system. Mathieson and Wall (1982) have described these as static, dynamic and consequential elements. The static element involves the stay at a destination, the dynamic element involves travel to and from the destination, and the consequential element describes the effects on the environment, social and economic systems resulting from the preceding two elements. The consequential element, which is equivalent to the geomorphic 'stage' and ecological 'change' components, has also been described by Butler (1980) as an evolutionary cycle. His hypothetical evolution of a tourist area includes six stages - exploration, involvement, development, consolidation, stagnation and either rejuvenation or decline.

Visitors will come to an area in small numbers initially restricted by a lack of access, facilities and local knowledge. As facilities are provided and awareness grows, visitor numbers will increase. With marketing, information dissemination and further facility provision, the area's popularity will grow rapidly. Eventually, however, the rate of increase in visitor numbers will decline as levels of carrying capacity are reached. As the attractiveness of the area declines relative to other areas, because
of overuse and the impacts of visitors, the actual number of
visitors may also eventually decline.

(Butler 1980: 6)

Destinations do not have to experience all of the stages of Butler's model
and in addition other models exist, for example, the structural evolution
of tourist regions (Miossec 1977), the comparison of stages of tourism
development with stages of a country's development (Van Doorn 1979),
and a spatial - temporal model for international seaside tourism
development (Gormsen 1981). In addition there exist many tourism
typologies, for example, interactional approaches (Cohen 1972, Smith 1977)
and cognitive - normative models (Plog 1972, Cohen 1979b).

Gunn (1988b) has divided the static and dynamic (or functional)
components of the tourism system into two major subsystems - touring
circuits and longer-stay destination zones. The touring subsystem includes
the attractions, transport, services and information/promotion functions
for those who utilize a tour of several locations. Attractions are most
closely associated with the touring route and they are usually visited only
once by the same party. The activities are slightly more passive, and time
constraints become very important because of a fixed touring schedule.
The geographic distribution is a circuit rather than a point.

The longer-stay destination subsystem, however, is more tightly self-
contained geographically. All activities are utilized at the destination area
which must be designed to accept repetition. Gunn (1988b) indicates that
the route between the destination and origin of residence is merely a
spacer and its design is of little significance except to move people to
destinations. He also has differentiated the longer-stay destination
subsystem into parts similar to those of the natural functional
classification systems. The three parts are attraction clusters, travel corridors and community areas. Attraction clusters are groups of things to see and do. Travel corridors can be subdivided into the main access routes or circulation corridors, as well as routes between service centres and attraction complexes or linkage corridors, and community areas which provide services, facilities, attractions and products.

Where the touring and longer-stay subsystems overlap, the physical development must be planned to accommodate both. The same highway and community service centre may be used by tourists travelling through an area as well as by those who are depending on them for access and service for a nearby resort, holiday home, or camping ground destination. Thus the two subsystems of tourism, touring and longer-stay, need to be recognized in the tourism planning process because of the differences in resources utilized, and the difference in markets.

5.4.3 Environment-Tourism Elements

The recognition of spatial and functional classification is an important tool in developing an underlying strategic approach to environment - tourism planning. It can provide useful guidelines for the delineation of primarily environmental protection zones (national parks and reserves) or tourism destination zones. In addition it can provide useful information for the identification, establishment or promotion of environmental or tourism corridors. Some tourism studies have embraced aspects of this approach. For example, (Lewis 1964) carried out a tourism planning study in the state of Wisconsin, USA which inventoried environmental resources to identify recreational potentials. Environmental features, such as wildlife complexes, vegetation, streams and lakes, waterfalls, caves and historic
sites were found to occur in distinct patterns, termed environmental corridors. Lewis (1966) later suggested that the combined features had more recreational significance than any individual resource pattern. Within the corridors, more detailed ecological studies were carried out in order to establish recreational priorities. Recommendations for environmental preservation and management of important recreational complexes were based on the findings and the priorities assessed accordingly.

Smith, Hetherington and Brumbaugh (1986) prepared a regional tourism marketing plan for Northeastern California which centered on the unifying theme of Highway 89, California's scenic mountain route. Its purpose was to develop a tourism plan for a number of small rural communities and market it as a tourism corridor. The authors concluded that with help from local communities, public participation, the formation of a regional council and sustained effort, the overall effect produced measurable results in attracting new tourism to the area.

5.5 CLUSTERING AND ZONING

Spatial differentiation underlies the strategies of clustering and zoning. Pearce (1989: 263) has stated that "environmental considerations become important at the regional level where a range of spatial strategies may be implemented". These strategies which include zoning, concentration and dispersion will now be investigated in relation to their relevance for environment - tourism planning.
5.5.1 Clustering

A tourism development policy often recommended for environmental and other reasons is containment of tourist facilities as integrated resorts in contrast to allowing dispersion of development throughout a region.

Concentration of tourist attractions and facilities in specified areas allows for efficient provision of infrastructure, offers a variety of easily accessible activities and facilities for tourists, encourages integrated planning and application of development controls, and contains any negative impacts in certain areas.

(Inskipe 1988: 366-367)

These tourism destination zones should be located where they do not preempt areas more suitable for other types of development or environmental preservation. The tourists either remain within the cluster or take day tours to attractions outside the area. Gunn (1988a) suggests that clustering is superior to dispersal in terms of benefits to visitors and reduction of unacceptable impacts to the host community and environment. This approach is particularly relevant where large-scale tourism is being developed and substantial impacts are anticipated. Clustering generally allows for a more efficient infrastructure such as water supply and sewage disposal systems thus mitigating pollution. This provides the opportunity for better controls and a higher level of environmental quality. The environmental argument for clustering is two edged. The argument in favour is that it can leave much of the environment (between clusters or nodes) in a relatively natural state and thus by implication, enjoyable, renewable and cheap to maintain. The alternative, that of continuous strip development, is usually regarded as unsatisfactory for both environmental and practical reasons (WATC/EPA 1989a).
5.5.2 Zoning

Another strategy used to reduce the negative environmental impacts of tourism is to separate out land use zones (Walther 1986). This can be applied on a variety of scales from small (within local parks) to large (at the regional level). The first process involves specific internal classification or zoning and the second centres on land classification. The environmental protection and conservation of resources has generally been approached through the separation of functions in park classification. One of the most common approaches is that proposed by the IUCN (1975). In many regions the protection of natural environments has been achieved by the establishment of wilderness areas. These are special areas in which the influence of humans is reduced to a minimum and in which the expression of nature can be readily seen. Other areas which have an environmental protection orientation include marine and nature reserves. With increasing use lands managed for conservation and recreation include international parks (such as World Heritage Areas and Biosphere Reserves), national and marine parks, conservation parks and state forests. Areas in which the primary use is for more intensive recreation are usually designated as recreation parks. These and the more accessible national parks have often been viewed as 'honeypots' which attract tourists and recreationalists and are managed for a variety of often intensive uses.

Land use classification has achieved a measured degree of environmental protection and utilization, but within each park there are still conflicts over protection and use. To deal with this problem park managers use the strategy of land use classification and zoning which, Hoole and Downie (1978: 10) state, "classifies park areas for certain kinds and groupings of use
or non-use and, in so doing, defines spatial limits of future use allocations. It provides a broad framework for land management that attempts to balance a park's dual goals of environmental preservation and public use by setting aside some areas primarily for protection and others for recreation and visitor facilities.

Forster (1973) advocated that in the national park context zoning is one of the most important tools for planning, development and management. A five class zoning system that allocates land use priorities to different areas of a park has been developed by Parks Canada (1983). This zoning system is a resource based approach by which land and water areas of a national park are classified according to their need for protection and their capability to accommodate visitors. It provides a guide for the activities of both visitors and managers within a national park and assists in managing the tension between use and preservation.

At the preservation end of the continuum are the special preservation areas based on specific and sometimes small areas within the park which possess unique, rare, or endangered species. The second zone is classified as wilderness and represents areas with specific natural history themes and environments. These areas provide outdoor recreation opportunities for hiking and primitive camping, with the activities widely dispersed so as to be consistent with the primary preservation role. The third zone is classified as natural environment and is intended to permit those intermediate levels of outdoor recreation that are compatible with natural settings. Motorized access is allowed for the first time, but on a limited basis to the periphery of this zone. In this way visitors will have easier access to the zone, but to enter it they must use strategically located and well-maintained trails. The natural environment zone represents a
balance between preservation and visitor access goals, and as such is the crucial buffer between the parks' two differing functions.

The fourth zone is an outdoor recreation zone which is a limited area accommodating a broad range of education, outdoor recreation opportunities and related facilities. Recreation opportunities are provided in locations which can maintain the activities with minimal impairment to the environment, and interpretative services are used to explain the local ecosystem and the human place within it. The fifth and final zone is Park Services. These areas provide centralized visitor support services as well as park administration functions. Even in these highly developed, sometimes urbanized, areas the preservation of natural values and environmental qualities is attempted, with the location, design, and size of the infrastructure and buildings being made as compatible as possible with the national park setting.

The strategy of zoning to separate out land uses and reduce unacceptable impacts also has application to tourism planning, especially in natural areas. The 22nd General Assembly of the IUOTO in 1971 proposed a zoning system to foster the environmental protection of tourism resources which encompassed three zones:

1. Protected areas or nature reserves where attempts should be made to conserve the natural balance (national parks, forest reserves etc);

2. Areas reserved primarily for tourism because of their natural attraction and from which industries would be excluded (beaches, mountain resorts etc); and

3. Mixed natural areas in which the establishment of industry must be so planned as to safeguard the main tourist resources.

(IUOTO 1971: 3)
Shackleford (1985) noted that implicit in the above policy directives was the concept of classification or zoning, whereby areas with a particularly sensitive or fragile environment were not developed for tourism or at least had severe restrictions on tourism access. Dasmann et al. (1973) asserted that it was vital to preface any tourism development with a zoning and management plan to ensure the preservation and public use of valuable natural sites. Budowski (1976) endorsed their view in his landmark paper on environment - tourism symbiosis. He suggested that the decision to interfere with the physical setting of natural areas was extremely complicated and should not be taken lightly. Budowski argued that as a general rule careful zoning should be instituted and rigidly maintained around the most natural areas in order to maintain their greatest values. UNEP (1986) also advocated the strategy of zoning in order to take the pressure off vulnerable areas through the provision of alternative attractions.

Zoning for environmental protection and tourism development has been carried out successfully in many locations and environments. Examples include Patmos Island, Greece (Spanoudis 1982), Les Mielles, Jersey (Romeril 1983), the Seribu Islands, Indonesia (Salm 1985), and the Great Barrier Reef, Australia (Kelleher 1987, 1990).

5.6 OTHER ASPECTS

Other aspects of tourism planning which are considered worthy of investigation for environment - tourism planning include the temporal strategy of staging, the application of controlled development, and the alternative tourism market segment.
5.6.1 Temporal Concerns

Appropriate staging of development is one temporal strategy that has been used effectively for environment - tourism planning at the regional level. Its use provides the opportunity to phase in growth over a long period of time so that when one area starts reaching the saturation level, a new area can be opened up to absorb the increased flow of tourists. Inskeep (1987) claims that even within one area additional attractions such as parks can be developed so that user demand is more widely distributed and environmental impact lessened on existing parks. Another temporal strategy often employed is that of limiting use during peak demand periods. This has been used in Yosemite National Park in California USA, as well as many other places.

5.6.2 Development Controls

An integral element of sustainable development is the notion of 'controlled development', that is, promotion of the balance of development and conservation rather than one at the expense of the other. This was recognised by Cohen (1978) who suggested that in the long run, the present widespread policy aimed to achieve the greatest possible number of tourists will have to be superseded by a policy aimed to achieve an optimal yearly number of tourists, optimally distributed throughout the country, so as to take off pressure from the most delicate, special environments and presently over-exploited tourist regions. This was later expounded by Mathieson and Wall (1982) who also suggested that planners should be asking such questions as how many, and what type of tourists, does an area want to welcome and how can tourists contribute to the enhancement of the lifestyles of residents of destination areas?
A decade after Cohen there were still calls for tourism controls. Inskeep (1988) noted the abuse of the environment by tourist activities such as the collection of live seashells and coral, removal of scarce plant and animal species, and littering must be carefully controlled. He advocated setting limits on tourism development by establishing regional planning policies for opening up new areas and manipulating admission and pricing policies to help minimize overuse of important attraction features. Some of these approaches are being employed in the Tatra Mountains of Poland in order to protect the glacial and karst landscapes from adverse tourist impacts (Wiszka and Hindson 1991). Control of tourism has also been made for a small French Polynesian Island near Tahiti (Gunn 1991b). The island has outstanding scenery which is being ruined by insensitive development and pollution of the lagoon. Gunn (1991b) briefly describes many of the island’s other tourism - environment problems and states that such problems occur in many other places too.

In conclusion it seems clear that controlled development is important for tourism especially in natural areas. The pressure for introducing such controls comes from both within planning, with its emphasis on environmental conservation (Romeril 1989a), as well as from groups concerned with global ethics (Millman 1989).

5.6.3 Alternative Tourism

Another aspect of environment - tourism planning is to approach it from the standpoint of demand (market forces) in addition to the realm of supply (destination zone characteristics). One of the most common approaches to achieve sustainable tourism is through the process of selective marketing in order to attract environmentally conscious tourists.
who will show respect for tourism environments and be conservation-minded in their use of them. This approach is called 'alternative' or 'appropriate' tourism which embraces strategies considered preferable to mass tourism (Britton 1980).

Alternative tourism, and indeed a whole range of nature tourism options such as farmhouse tourism and kibbutz guesthouses, offers ideal vehicles for sustainable development. Romeril (1989a) suggested that they can represent a new order of tourism development to parallel the hoped for new economic order. Alternative tourism has also been referred to in whole or in part as 'defensive' tourism (Krippendorf 1982, 1987), 'green' tourism (Jones 1987), 'nature-oriented' tourism (Durst and Ingram 1988), 'conscious' or 'soft' tourism (Mäder 1988) and ecotourism (Boegger 1991).

The positive features of alternative tourism typically include:

1. Development within each locality of a special sense of place, reflected in architectural character and development style, sensitive to its unique heritage and environment;

2. Preservation, protection and enhancement of the quality of resources which are the basis of tourism;

3. Fostering development of additional visitor attractions with roots in their own locale and developed in ways which complement local attributes;

4. Development of visitor services which enhance the local heritage and environment; and

5. Endorsement of growth when and where it improves things, not where it is destructive, or exceeds the carrying capacity of the natural environment or the limits of the social environment, beyond which the quality of community life is adversely affected.

(Cox 1985: 6-7)
Cook (1988) has advanced further benefits of alternative tourism and it has been advocated as a link between environmental conservation and economic growth for a number of countries including China (Liu and Dowling 1991), French Guiana (Lewis and Wood 1991) and Malaysia (Nør 1992). However, alternative approaches to tourism are not always considered to be environmentally appropriate (Järviuluoma 1992) or culturally sensitive (Combrink 1992). Warnings have been sounded that it can be harmful, uncontrolled, unplanned and not always under local control (Butler 1990, Pigram 1990).

Ecotourism has been equated with nature tourism (Boo 1990), however, this view is disputed by Farrell and Runyan (1991: 49) who state that while 'nature tourism' is a wider comprehensive phrase for nature oriented tourism, ecotourism is a subset within it which "is more purposeful and focused on the enhancement or maintenance of natural systems through tourism". Ecotourism is ecologically and socially responsible nature-based tourism that fosters environmental appreciation and understanding. It has been defined by the Ecotourism Society as the conservation of the natural environment and the wellbeing of local people through responsible travel (Western 1992).

Problems associated with ecotourism include both the problems of environmental damage and safety (Butler and Waldbrook 1991) as well as the lack of benefits it brings for the host community both from an economic standpoint (e.g. Nepal - Folsom 1988) and in terms of social interaction or cultural benefits (Curacao - Testers 1990). Marketing strategies to attract new tourists may simply result in shifting adverse impacts from one area to another as well as introducing a whole set of new ones. Butler (1990) has also argued that the problems, implications, and
potential costs of alternative tourism have generally been ignored by its proponents and that in some situations it may have a greater overall negative environmental effect than maintaining the 'status quo'.

We should support the development of alternative tourism where it is clear that is the most appropriate form of tourism, but reaching this requires consideration of much more than counting the negative effects of mass or conventional tourism.

Butler (1990: 45)

The explosive growth of and interest in ecotourism specifically has been documented by a number of authors including Ingram and Durst (1989), Vallentine (1990), Boeger (1991), Farrell and Runyan (1991), and Western (1992). Many meetings have been held to discuss the topic including the International Academy for the Study of Tourism's 1989 meeting in Poland devoted to 'Alternative Forms of Tourism'; the American Society of Travel Agents and Smithsonian Magazines' cohosted first Environmental Summit Conference for Tourism, New York, 1990; the Inaugural International Ecotourism Symposium held in Brisbane, Australia, 1991; the Asean Heritage Tourism Conference held in Penang, Malaysia in 1992; and an Ecotourism Conference for the Pacific organised by PATA in Auckland, New Zealand in 1992. Special issues of two journals have been devoted to alternative tourism - Tourism Recreation Research (1987) and Cultural Survival Quarterly (1990). In addition an extensive bibliography has been prepared (Packard and Miller 1990), a conceptual framework advanced (Fennell and Eagles 1990), suggested developments proposed (Gunn 1990), the motivations of ecotourists described (Eagles 1991), marketing strategies advanced (Eagles et al. 1992) and impacts identified (Marion 1990).
Ecotourism has been described in a number of different settings including in remote areas (Canadian wilderness, Marsh 1986b; Nepal's mountain regions, Folsom 1988; amongst the Kung Indians of Panama, Chapin 1990; on the island of Dominica, Burnett and Uysal 1991, Weaver 1991; the rugged Tortuguero area of Costa Rica, Place 1991, Lee and Snepenger 1992; the Kalahari Desert, Hitchcock and Brandenburgh 1990; and in Brazil (Ruschmann 1992) as well as in rural farming areas of England (Morris and Romeril 1986), New Zealand (Pearce 1990) and Wales (Davies and Gilbert 1992).

5.7 A NEW PLANNING APPROACH

It has been argued in the last two chapters that the future of environment-tourism planning is couched in the recognition of the link between environmental conservation and tourism development, the incorporation of community and tourist views, and the inclusion of functional differentiation. Thus it is asserted that the planning of natural areas for tourism:

1. Begin from an environmental base and work forwards towards the identification of tourism opportunities;

2. Include the views of community groups and tourists especially in regard to the environment-tourism relationship; and

3. Conclude with a planning strategy which embraces the spatial features of environmental and tourism nodes, corridors and hinterland.

The key to achieving compatibility is to start with clearly defined environmental, tourism, and sustainable environment-tourism goals.
Once these have been established then research can commence to describe, evaluate and provide directions for achieving these goals. The first step is to evaluate the environmental attributes of a region according to conservation (especially environmental protection) and utilisation (tourism use). A second step in this planning approach is to evaluate the present tourism resources (supply). This should be supplemented by an evaluation of demand as well as analysis of the views of local residents, tourists and managers on the region’s environment, tourism, and environment - tourism relationship.

Following this phase the two studies on environment and tourism should be compared so that areas of environmental preservation and tourism development can be clearly identified. It is during this phase that zones of conflict will show up and these should be evaluated by environmental assessment to provide guidelines for the future planning of these areas. The final phase is to synthesize the data to provide strategies which foster environmental protection and conservation, the realization of tourism potential, community wellbeing and environmental - tourism integration. Such an approach is the essence of the environmentally based tourism planning framework.
Chapter 6  The Environmentally Based Tourism (EBT) Planning Framework

A holistic approach built on a symbiosis between tourism and the social and physical environment, surely provides the way forward.

Romeril 1989b: 110

6.1 INTRODUCTION

The environment and development agenda of the 1980s and 1990s is grounded in the concepts of the sustainable use of natural resources as fostered by the World Conservation Strategy (IUCN 1980) and the sustainable development strategy of the World Commission on Environment and Development (WCED 1987). This environment-development link often includes tourism as a bridge. The base of this partnership is resource sustainability and to achieve this, tourism planning must be fully integrated within the resource planning and management process. This integration will require the adoption of resource conservation values as well as the more traditional development goals within tourism planning. Central to the goals of environmental conservation and resource sustainability is the protection and maintenance of environmental quality. To achieve this primary goal requires planning which is grounded in environmental protection and enhancement yet fosters the realisation of tourism potential.

Planning frameworks exist for both environmental protection and conservation. As outlined in previous chapters, environmental planning approaches include the ESA Framework (Eagles 1984) and the ABC Resource Inventory Method (Bastedo et al. 1984). Land use planning approaches based on ecological principles include those of Steiner and
Brooks (1981) and Van Riet and Cooks (1990a). Planning of the natural environment for recreational use has included approaches through the ROS (Clark and Stankey 1979) and LAC (Stankey et al. 1985) methods. The environmental planning literature also includes a framework for assessing resources for recreation and tourism (Cocklin et al. 1990). Tourism planning for area development incorporating environmental aspects includes The Tourism Planning Model (Mill and Morrison 1985), the Regional Strategic Planning Process (Gunn 1988a) and a comprehensive tourism development planning approach (Inskeep 1988). However, few frameworks or models for tourism development have arisen from the environmental disciplines. Those that have include geographical approaches such as an analysis of environmental stress (Pearce 1985a) and an emphasis on local community participation (Murphy 1985) while an approach from regional planning is the evaluation of environmental thresholds (Kozlowski 1986).

What is required now is a new planning approach which will incorporate the essential elements of natural area tourism development planning identified at the end of Chapter 5. Those elements are for the plan to be based on environmental protection, foster community wellbeing and tourist satisfaction, and utilize functional differentiation in order to achieve environment - tourism compatibility. The planning approach should also be strategic and iterative, regionally based, incorporate land use zoning, and be environmentally educative, that is, embrace the environmental ethic.

In order to achieve the above goals an environmentally based tourism plan should be able to identify the following:
1. Areas of the natural environment which should be protected because they are:
   (a) fundamental to the maintenance of ecosystem stability and diversity, and/or
   (b) contain environmentally unique, rare or endangered features, biota or processes, and/or
   (c) representations of the region's natural environment.

2. Areas of the natural environment which should be conserved because they:
   (a) contain or represent good examples of natural features, and/or
   (b) can sustain a broad range of environmentally compatible outdoor recreation opportunities.

3. The relationship between people and the environment gained from the evaluation of views of the local community, tourists and managers in regard to their support for:
   (a) environmental protection and conservation,
   (b) tourism development and environmentally compatible tourism activities.

4. Existing and potential tourism destination areas which are or could be:
   (a) easily accessible by land, air and/or water,
   (b) able to provide services, accommodation, facilities and attractions,
   (c) reasonably close to other attractions.

5. Touring routes which:
   (a) link destination zones, and
   (b) provide limited attractions, services and facilities.

6. Areas of environment and tourism tension which should then be evaluated by:
   (a) environmental impact assessment,
   (b) integration of community and tourist views.

7. An interpretive and educational programme which is based on the environmental ethic and sets guidelines for environmentally
compatible activities and developments in the area. From this
different guidelines could be prepared for developers, managers, the
local community and tourists.

The above goals form the direction of the Environmentally Based
Tourism (EBT) Planning Framework which essentially seeks to foster
environmental protection and tourism development through a
sustainable resource and development planning framework. In essence
the major thrust of the EBT planning framework is not towards the
determination of land use sustainability or capability, carrying capacity,
threshold analysis or pattern analysis. Instead it is best summarized as
determining environmentally compatible tourism through the
identification of significant features, critical areas and compatible activities.

Significant features are either environmental attributes which are valued
according to their level of diversity, uniqueness or representativeness, or
tourism features valued for their resource value. Critical areas are those
in which environmental and tourism features are in competition and
possible conflict. Compatible activities are outdoor tourism recreational
activities which are considered to be both environmentally and socially
compatible.

The framework does encompass a few aspects of the ABC resource
inventory method (Bastedo et al. 1984) to evaluate environmental
resources as well as the tourism resource methodology (Ferrario 1979) to
evaluate tourism resources. It is similar to the regional tourism planning
frameworks of Mill and Morrison (1985) and Gunn (1988a) but differs in its
environmental basis. It incorporates local community involvement
similar to the Ecological Model of Tourism Development (Murphy 1983)
and identifies critical zones similar to the Community Personality
Planning Process (Rosenow and Pulsipher 1979). The uniqueness of the EBT planning framework lies in its environmental base, incorporation of both resident and tourist opinions, and its functional differentiation in order to achieve environment - tourism compatibility. Finally, its application to an arid coastal zone crossing the temperate/tropical boundary provides a unique case study by world standards.

6.2 OVERVIEW OF THE EBT PLANNING FRAMEWORK

The EBT Planning Framework is a strategic planning approach to environment - tourism planning in five stages. It includes: Stage (A) - a statement of objectives, (B) survey and assessment, (C) evaluation, (D) synthesis, and (E) proposals. The five stages can be expanded into ten processes (Figure 10). The first stage consists of one process (1) - the statement of objectives. It begins with a background analysis of the environment - tourism relationship in order to produce the basic direction for the succeeding stages. The direction is determined by the objectives or planning goals which have emerged from the environment - tourism relationship review. It is important to note that the objectives are imported into the framework from the survey of the study area and its environment - tourism issues and they are not arbitrarily fixed for all applications. However, as a general guide, a number of planning zones are defined which are designed to protect conservation values while fostering tourism developments and activities. The second stage consists of survey and assessment. This includes two processes (2) - the description and assessment of environmental attributes and (3) - the description and assessment of tourism resources. The third stage is one of evaluation of significant features (4), critical areas (5) and compatible activities (6) together with suggestions of appropriate strategies and controls (7).
## Figure 10 The EBT Planning Framework

<table>
<thead>
<tr>
<th>STAGES</th>
<th>PROCESSES</th>
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<tr>
<td><strong>A. OBJECTIVES</strong></td>
<td></td>
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<tr>
<td></td>
<td><strong>1. STATEMENT OF OBJECTIVES</strong></td>
</tr>
</tbody>
</table>
| | **2. ENVIRONMENTAL ATTRIBUTES**  
General survey, selection and assessment of attributes.  
Map significant attributes. |
| | **3. TOURISM RESOURCES**  
General survey of residents and tourists.  
Selection and assessment of resources.  
Map significant resources. |
| **B. SURVEY AND ASSESSMENT** | **Insufficient**  
Insignificant no further assessment |
| **C. EVALUATION** | **4. SIGNIFICANT FEATURES**  
Determined by environment - tourism map comparison then evaluated by Resource Values |
| | **5. CRITICAL AREAS**  
Evaluated by the Environment-Tourism Resource Matrix |
| | **6. COMPATIBLE ACTIVITIES**  
Evaluated by Environmental Impact and Recreational Compatibility Matrices |
| | **Indicate appropriate** |
| **D. SYNTHESIS** | **7. STRATEGIES AND CONTROLS** |
| | **8. ZONE ALLOCATION**  
Sanctuary  
Nature Conservation  
Outdoor Recreation  
Tourism Development |
| **E. PROPOSALS** | **9. ZONING PLAN** |
| | **10. PLAN IMPLEMENTATION** |
Following the evaluation the resultant information is amalgamated in the fourth stage of synthesis in which the planning zones are allocated (8). The final stage outlines the proposals and includes the preparation and presentation of the final zoning plan (9) as well as its implementation (10).

6.3 STAGE A OBJECTIVES

This first stage sets the scene by reviewing the current situation and stating objectives for the study. This stage consists of a situational analysis phase that produces the basic direction for the succeeding phases. It is carried out by literature review, discussions with government, regional and local managers as well as by informal discussions with residents and tourists. This stage incorporates brief reviews of:

1. The study area in terms of environmental, social and economic characteristics;

2. Environmental policies affecting the region, current environmental land uses and issues (supply) as well as likely future environmental proposals (demand) such as land set aside for future national and regional parks;

3. Tourism policies affecting the region and current tourism land uses and issues (supply) as well as likely tourism trends in future (demand); and

4. Regional issues regarding the environment and tourism.

Next the specific goals of the study are established. In general they are to identify:

1. Specific areas of outstanding environmental significance worthy of special protection;
2. Natural areas considered appropriate for compatible tourism activities;

3. Specific areas which may be fostered for intensive tourism development, and

4. Environmentally and socially compatible outdoor tourism recreational activities.

The goals help shape appropriate planning zones to assist in achieving the objectives. These zones are identified and described based on an approach where the land and water areas of a region are classified according to their need for protection and compatibility with tourism. The following general zones and their primary functions are proposed: sanctuary zones (areas requiring special preservation), nature conservation zones (areas sustaining a combination of protection and use but with emphasis on the former), outdoor recreation zones (natural areas that can accommodate compatible outdoor recreation activities) and tourism destination zones (small areas of concentrated attractions). All other areas in the study region are designated as areas with other uses (Table 2). This provides a guide for future environmental planning (Figure 11a); tourism planning (Figure 11b); and regional development planning.

Zoning also assists in managing the tension between preservation and use and more importantly seeks ways of fostering tourism in natural areas. The main argument against zoning is possibly rigid and inflexible prescriptions for use, however, the zones are used as general guides rather than rigid prescriptions.
Table 2 Proposed Zones

1. Sanctuary

These include areas of varying size considered to be of importance to the protection and maintenance of either ecological processes, biological diversity, unique, rare or endangered features, or the best examples of natural features. Access to these areas is strictly controlled and is usually granted only for scientific or educational purposes.

2. Nature Conservation

Areas that are maintained as natural environments and which can sustain, with a minimum of impairment, a selected range of low impact environmentally and socially compatible outdoor recreation activities. Tourism is normally restricted in these areas to non-commercialised tour groups.

3. Outdoor Recreation

A range of areas which can accommodate a broad range of education, outdoor recreation opportunities and related facilities in ways that respect the natural landscape and that are safe and convenient. Commercial tourism activities and developments are acceptable provided they are environmentally compatible and do not conflict with existing uses.

4. Tourism Development Zone

These are tourist centres which focus on natural and cultural attractions and may provide some facilities and accommodation. If they are in or near a sensitive area then the built structure and tourist activities should reflect and be compatible with the special qualities of the environment. Environmentally compatible tourist ventures are fostered in these zones.

5. Other Zones

The rest of the landscape is comprised of other land uses that are not specifically oriented towards environmental protection or tourism development. Examples could include urban areas, agriculture, forestry or mining. Within these land uses would be special components of the environment such as pastoral protection areas, production forests, or mining rehabilitation zones. Special components with relevance to tourism would include urban areas or service centres and travel routes which form part of the touring or longer-stay destination subsystems.
Figure 11 The EBT Zoning Classification

Figure 11a The EBT Zoning Classification - Environmental Attributes

Correlation between natural environmental and ecological attributes

<table>
<thead>
<tr>
<th>High</th>
<th>Degree of environmental naturalness</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>SANCTUARY</td>
<td>NATURE CONSERVATION</td>
<td>OUTDOOR RECREATION</td>
</tr>
<tr>
<td>protection</td>
<td>protection</td>
<td>multiple use</td>
</tr>
</tbody>
</table>

Attributes: Increasing quality of natural environment as measured by increasing natural landscapes, abundant natural resources, and intact flora and fauna.

Abiotic Attributes:
- Natural landscapes
- Vegetation and fauna
- Ecological significance

Biotic Attributes:
- Cultural landscapes
- Vegetation and fauna
- Human-made or altered landscapes

Increasing correlation between natural environment and ecological value.

Figure 11b The EBT Zoning Classification - Tourism Resources

Correlation between natural environments and their tourism potential

<table>
<thead>
<tr>
<th>High</th>
<th>Degree of environmental naturalness</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>SANCTUARY</td>
<td>NATURE CONSERVATION</td>
<td>OUTDOOR RECREATION</td>
</tr>
<tr>
<td>protection</td>
<td>protection</td>
<td>multiple use</td>
</tr>
</tbody>
</table>

Tourism Attractions and Activities:
- Limited areas of primitive environment under intensive tourism activities
- Natural conservation is a priority but low impact on environment and compatible activities are acceptable
- Low index of attractions, increasing difficulty of access, higher environmental impacts, increasing potential of activities

Environmental preservation zone - tourism use nil

Increasing correlation between natural environment and tourism potential.
6.4 STAGE B SURVEY AND ASSESSMENT

This stage of the framework identifies and describes significant environmental attributes and tourism resources in the region. Both are described in terms of structure and function (Figure 9). The structure of the attributes and resources are the spatial patterns of landscape, ecological and human (especially touristic) elements. Functions are the interactions amongst the spatial elements. Analysis of both structure and function will often lead to a clarification of the stage reached by the element through time.

Many approaches have been used in different parts of the world to identify, describe, classify and evaluate environmental attributes (for example, Smith and Theberge 1986) and tourism resources (for example, Pearce 1989). After examination of a wide range of options it is proposed that three general categories each are used for environmental attributes and tourism resources (Table 3). These include:

1. Environmental - abiotic, biotic and cultural; and

2. Tourism - attractions, accessibility and services.

The end product are maps of significant environmental attributes and significant tourism resources. The major purpose of each map will be to show special zones, corridors and hinterlands. For example, the environmental map will comprise a summary of landscape categories and ecological processes indicating environmentally sensitive nodes requiring special protection (central elements of sanctuary zones), environmentally sensitive strips (environmental corridors) and the surrounding matrix which forms part of the hinterland. The tourist map will comprise
## Table 3  The Assessment of Attributes and Resources

<table>
<thead>
<tr>
<th>Attributes and Resources</th>
<th>Criteria</th>
<th>Significance Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ENVIRONMENTAL ATTRIBUTES</strong></td>
<td></td>
<td><strong>CLASS DESCRIPTION</strong></td>
</tr>
<tr>
<td>Abiotic</td>
<td>Rarity</td>
<td>1. Moderate Environmental or Tourism Significance</td>
</tr>
<tr>
<td>Geology</td>
<td></td>
<td>Sites in this class have at least one area or feature with a Category 1 rating. The site is usually of significance within the study area, but not outside of it.</td>
</tr>
<tr>
<td>Landforms</td>
<td></td>
<td>2. Moderately-High Environmental or Tourism Significance</td>
</tr>
<tr>
<td>Soils</td>
<td>Representativeness</td>
<td>Sites in this class have a Category 2 rating for at least one criterion. The site is usually of significance at the regional (provincial or state) level. Category 1 ratings may exist for the other criteria.</td>
</tr>
<tr>
<td>Water</td>
<td></td>
<td>3. High Environmental or Tourism Significance</td>
</tr>
<tr>
<td>Climate</td>
<td>Naturalness</td>
<td>Sites in this class have a Category 3 rating for at least one criterion. The site is usually of significance at the national level. Category 1 or 2 ratings may exist for the other criteria.</td>
</tr>
</tbody>
</table>
|                          | Diversity/Rarity | 4. Outstanding Environmental or Tourism Significance |}

| **TOURISM RESOURCES**   | | |
| Attractions             | Attractions | |
| Natural                 |             | |
| Cultural                |             | |
|                         |             | |
| Accessibility           | Access      | |
| Transport               |             | |
| Communications          |             | |
|                         |             | |
| Services                | Accommodation | |
| Accommodation           |             | |
| Retail Services         |             | |
| Information             |             | |

**Note:** Sites with low or no significance levels are not rated on the Significance Class Scale but are sometimes described as of Potential Significance.
existing and potential tourist attraction clusters (tourist destination zones),
touring and longer-stay destination routes (tourist corridors) and service
centres (towns and community areas).

6.4.1 Assessment of Environmental Attributes

In Stage A the region's natural resources are briefly described. In the first
part of Stage B, (Process 2), the description is more detailed and aims at
identifying 'valued' environmental attributes. This is carried out first by
general environmental description and the identification of natural
regions. Next it is followed by the selection and assessment of
environmental attributes establishing their distribution, then mapping the
significant environmental attributes.

The first part of the assessment of environmental attributes is to describe
the region's environment in terms of its component parts. This is carried
out by systematic description of the abiotic features - geology,
geomorphology, soils, climate and hydrology; biotic attributes - vegetation
and wildlife; and cultural components - historic and archaeological.
Within each of the data categories, the distribution of features is illustrated
by grouping them into various patterns which are described and
represented in two ways, first by description and second by visual
illustration of their distribution by map.

Data are derived from interpretation of topographic maps, review of
appropriate literature and on-site observations. Where available, further
information could be gained by interpretation of black and white aerial
photographs or through the use of remote - sensing techniques. These
may include the digital analysis of LANDSAT data or manual
interpretation of high elevation colour infrared photography to map vegetal communities and delimit habitat types. Throughout the classification particular attention is paid to identifying special or sensitive ecological processes as well as representative examples of the abiotic features and biotic species. Similarly unique or distinctive landscape features and unique, rare or endangered species are identified.

Following the general regional description of the environment it is interpreted into a more meaningful form by identifying areas of environmental 'significance'. These are derived from a combination of ecological theory, for example, diversity as well as relative occurrence, for example, uniqueness. It will include the following environmental attributes - landforms, vegetation and fauna. Each of the attributes are grouped into three overall environmental significance classes. They include moderate, moderately-high and high environmental significance. The word significant is used in all categories because the areas being considered have already been assessed as being environmentally 'significant'.

The most common criteria used to assess natural areas include ecological, or abiotic and biotic ones such as diversity, rarity, size, naturalness, representativeness and fragility, as well as cultural criteria such as historic and archaeological significance and human use. Inherent linkages exist between criteria such as diversity and representativeness or amongst rarity, size and fragility; whilst representativeness and naturalness may be more applicable to larger sites and rarity and fragility to smaller ones (Margules and Usher 1984).
The assessment of natural areas involves a wide variety of approaches using many different criteria to form the basis of assessments (Margules and Usher 1981, Smith and Theberge 1986). Once the criteria have been chosen and the attributes rated, then they are usually combined into a single overall measure of environmental value. There are a number of ways of achieving this but three of the most common are the simple additive weighting, expected value and disjunctive methods (Figure 8).

In the EBT methodology differentiation of significant environmental features is made by a non-compensatory, disjunctive approach to multicriteria evaluation. The non-compensatory approach is used because compensatory models require all criteria to be in comparable units and have equivalent value. Non-compensatory models are used when the levels of different criteria cannot be compared and must be assessed criterion by criterion. The conjunctive method ranks alternatives on whether an alternative meets acceptable minimum standards for all criteria. Disjunctive methods rank alternatives on their meeting a minimum standard for at least one criterion, regardless of its value for other criteria. Thus it is based on minimum standards or thresholds.

The approach developed in the EBT Planning Framework is based on a four point scale which reflects the overall significance value of an area of the landscape or environmental site. Each environmental site is either an environmental area or feature which has been clearly established or identified from the scientific literature on the region under study. The existence of abiotic, biotic and cultural attributes within the site is the basis for the evaluation. Each attribute is assessed separately and rated on a four point scale. Category 1 sites generally have moderate significance, Category 2 sites have moderately-high significance and Category 3 sites have a high
significance. In certain cases another grouping (Category 4) is invoked for sites of outstanding significance. A zero rating is assigned if an area or feature has no environmental significance in terms of the respective attribute.

By combining the ratings of the abiotic, biotic and cultural attributes, each environmental site can then be assigned an overall environmental significance rating. The summary rating is intended to provide an overall guide to identifying levels of environmental significance which can then be compared with an assessment of tourism significance within a particular area. The relationships among environmental - attributes, criteria and significance classes, are illustrated in Table 3.

The final part of the environmental assessment occurs with the grouping of environmentally significant areas into nodes, corridors and hinterlands and their illustration by map. Nodes occur where there are concentrations of units which are environmentally significant. Corridors occur where there are strips of environmentally significant units. The hinterlands are comprised of the remaining areas of discrete environmentally significant units.

6.4.2 Assessment of Tourism Resources

In Stage A the region's tourist resources were inventoried and described. In this stage (B - Process 3) the description is more detailed and aims at identifying 'valued' tourism resources. This is carried out by surveys of resident and tourist opinions, the classification of tourism categories, as well as the selection, evaluation and mapping of tourism resources into clusters, corridors and service areas.
The first part of the tourism assessment is to describe the region's tourism in terms of its component parts. This is carried out by systematic description of the tourists, attractions, activities, facilities, accessibility and land tenure. The climate and natural environment are not reviewed in this section because they will have already been described in the environmental evaluation. Data are derived by researching tourism statistics, literature review, guide book analysis as well as by resident and tourist surveys. Within each of the data categories, the distribution of tourism resources is illustrated by grouping them into various patterns. It is important that all variables of each category be described and represented in two ways, first by description and second by visual illustration of their distribution by map.

As part of the tourism classification and underpinning a large part of the environment - tourism evaluation both residents and tourists of the study region are surveyed in order to gather their opinions on the environment, tourism, and the environment - tourism relationship. The overall aims of the surveys are to investigate both resident and tourist recreational and touristic attitudes, experiences and related environmental impacts, as well as their attitudes towards tourism development and environmental conservation in the region.

Following the general regional tourism description, the findings are interpreted into a more meaningful form by the assessment of tourism significance carried out by the evaluation of tourism resources. The most common resources are attractions, existing facilities, accessibility, land tenure, climate and physical conditions. Sometimes other factors are considered such as the availability of regional development incentives or carrying capacity considerations. Inherent linkages often exist between
resources such as climate and attractions or accessibility and attractions (Pearce 1989), or among existing facilities, accessibility and attractions.

The methods usually used for evaluating tourist attractions include either opinion surveys of tourists (eg. Piperoglou 1967) or experts (Ritchie and Zins 1978). A comprehensive survey of tourist resources in Southern Africa combines features of both of these approaches (Ferrario 1979). Visitors' opinions were surveyed and the number of features mentioned in guidebooks of the area was used as a surrogate for expert evaluation. This approach is adapted in the EBT methodology with the addition of residents included as well. These are included because from a practical point of view while the ultimate test of the appeal of a tourist attraction must be the preferences and interests shown by the tourists themselves, the residents too also visit and use the attractions often at different times, and for different reasons, from the visitors.

Therefore, attractions are evaluated by tourist opinions, resident opinions and mentions in guidebooks. Both general and specific attractions are taken into consideration for example, general characteristics such as pleasant climate, beaches and fishing are surveyed as well as specific and localized attractions related to well defined places. An overall index of attraction for each tourist feature is then generated and ranked relative to all the other attractions in the area. Each attraction is then divided into moderate (Category 1), moderately-high (Category 2) and high (Category 3) attraction significance categories based on its place within the final ranked list. Category 1 attractions will have lower overall values than Category 2 attractions which in turn will have lower values than Category 3 attractions. One of the limitations of the index is that the data are being obtained from three different sources, each with its own attendant
measurement problems. Potential errors are then compounded by an 'apples and oranges' type of aggregation procedure. However, the approach is accepted in the tourism planning literature (eg. Pearce 1989) and is really no different from that used for environmental assessment.

The second resource chosen to reflect tourism significance is accessibility. This is usually divided into physical and market access but is taken here as the former type. Accessibility is determined by inventory of regional, state and national ports, airports and roads. They are mapped and ranked according to their level of importance. A regional road will have a score = 1, a designated state highway = 2, and a national highway = 3. Where an area is served by two or more access points (eg. a town with a regional highway, state airport and regional port) then the area assumes the highest score, in the same manner as the environmental assessment.

The third resource used to assess tourism resources is accommodation. Existing tourist accommodation facilities are surveyed and inventoried. Types of accommodation included are hotel, motor inn, motel, guest house, hostel, caravan park and designated camping spots. Available beds or bed spaces are used as indicators and these are summed then ranked according to number. When this has been completed the overall scores are summarized into three categories from moderate to high accommodation significance.

Once the resources for tourism significance have been assessed the next step is to integrate them in the same way as the integration of the environmental attributes. Category 1 sites have moderate significance, Category 2 sites are moderately-high, and Category 3 sites have high significance (Table 3). In certain cases another grouping (Category 4) is
invoked for sites of outstanding tourism significance. Areas outside of those represented by the resource ratings are presumed to have low or no significance at this time. The summary rating is then mapped in a similar manner to the overall map of environmental significance.

6.5 STAGE C EVALUATION

In this stage an evaluation is made of significant features, critical areas and compatible activities. Significant features are environmental attributes and tourism resources which have been analyzed as being significant. Critical areas are areas which comprise both significant environmental and tourism features. Compatible activities are outdoor tourism recreation activities which are considered to be both environmentally and socially compatible.

Having established areas or features which have environmental significance and those which have tourism significance, the next step is to identify where they are relative to each other. To establish this the tourism map is laid over the top of the environmental map (Process 4). The resultant map will now indicate the spatial relationship of the two and show areas which are solely environmentally significant, others which are solely of tourism significance, as well as a third group which comprises critical areas where the two coincide. All of these three groupings now undergo evaluation before being allocated to either a zoning class or being referred to further evaluation in terms of compatible activities.
6.5.1 Significant Features

Features of environmental or tourism significance which do not impinge on the other are now subject to further analysis. This is carried out by incorporating the views of tourists and residents. Their opinions on preferred sites for environmental protection or tourism development are determined, rated and applied giving significant areas an added 'resource value' (Process 4). These values are different from those of the initial environmental and tourism evaluations. In the earlier assessment of the environment the value of environmental attributes is made on the basis of intrinsic qualities, that is, consideration of the environment for its own sake. During the second assessment the environment is now valued as a resource from an extrinsic standpoint and is assigned value for either protection or use. According to Van Riet and Cooks (1990a) this assessment is based on a group of individual values linked to a specific land use and need not be related to society as a whole.

Once the resource values have been calculated and the areas ranked according to social desirability for either protection or development then the next step it to incorporate these values with those of significance. For example, a feature rated moderately-high in terms of environmental significance may contain within it an area of high resource value for environmental protection. This now provides a more informed situation in which to allocate the area to a zoning class, probably within the nature conservation or sanctuary zones. Where other situations exist, for example, a tourism area of high significance but of high environmental protection resource value, then these areas are 'set aside' for further analysis of their compatible activities before being assigned to a planning zone.
6.5.2 Critical Areas

These areas are defined as those having both environmental and tourism significance. They are identified by areas of overlap from the significance maps. Critical areas are also analyzed in terms of their resource values. In addition they are evaluated by an environment - tourism matrix (Process 5). Evaluation of critical areas is made by plotting their relative values of environmental and tourism significance on an environment - tourism resource conflict matrix (Figure 12). This approach is based on an ecological - energy resource conflict matrix devised for the segregation of resource tracts according to their ecological ratings and energy and mineral resource ratings (Klopatek et al. 1981). Areas which have both environmental and tourism significance are plotted within the matrix grids so that their relative rating can be easily identified.

In cells where the environmental significance of an area is greater than the tourism significance, then the environmental significance assumes greater overall significance and the area is assigned to a zone with greater overall conservation value. For example, an area with a high level of environmental significance, but only a moderate tourism significance should be better suited for overall environmental protection or conservation. If, however, a cell represents an area of greater tourism significance than environmental significance, the tourism significance assumes greater overall significance and the area is assigned to a zone where tourism values predominate. A second area with a high tourism significance but only a moderate environmental significance should be better suited for intensive outdoor recreation or as a tourism destination zone. Where the values of environment and tourism significance are at the same level, for example, both high, then as a general rule the
As a general rule the environment takes precedence over tourism in terms of relative significance for cells of the grid which are of equal environmental and tourism significance. This is a general guide only and any situation where there is an obvious inconsistency should be further examined on its own merits.

1. O/S = Outstanding
environmental significance is greater than the tourism significance and takes precedence over it in the decision making process. This is based on the underlying principle of the EBT planning approach that the environment forms the basis of tourism in natural areas and therefore must be protected and conserved.

Overlying the matrix are four divisions which represent the zones of the EBT method, that is, sanctuary, nature conservation, outdoor recreation and the tourism development zone (Figure 12). The relative positions of the zones are established from two sources. The first is by review of the zoning classification descriptions for environmental attributes (Figure 11a) and tourism resources (Figure 11b), identified during the statement of objectives (Stage A). The second is by analysis of the regions' resident and tourist responses to the survey in regard to the relativity of the notions of environmental protection and tourism development. Where one is ranked more importantly than the other, this should be included in the decision making process to allocate the various zones in terms of environment and tourism significance. Once the zoning boundaries are allocated to the matrix and justified in terms of their placement, then the critical areas can be allocated to the various zones.

6.5.3 Compatible Activities

The next process is the evaluation of the outdoor tourism and recreational activities in terms of their environmental and social interactions (Process 6). The activities are identified then assessed by two environment-tourism interaction matrices which evaluate recreational activities in terms of their environmental impacts and social compatibilities.
The attraction of most natural areas is usually attributed to the climate, scenery and opportunities for activity-based recreation. Tourism related activities often cause unacceptable environmental impacts (Mathieson and Wall 1982). However, such adverse impacts can be mitigated if controlled and zoning is a major way of achieving this. The control of tourism related activities in natural areas starts with their identification. In the EBT approach tourism activities are identified by tour guidebook designation, literature search, and field survey. The activities are then inventoried and categorized according to whether they are based on land, water, land and water, or in the air.

The next task is to evaluate each activity in terms of its environmental and social compatibility. An environmentally compatible tourism activity is one whose impacts on the biophysical environment are either minor, negligible, nil or positive (after the definitions of Conover et al. 1985). An activity which has a moderate impact on the environment is partially compatible, and one which has a major impact is incompatible. The rating of activities into the compatibility categories is made by an assessment based on related environmental impact studies of tourism activities in natural areas (eg. Buckley and Pannell 1990).

A socially compatible tourism outdoor recreational activity is one which is generally accepted as being able to coexist both spatially and temporally with another tourism activity. Thus socially compatible activities can use the same area of land or water, at the same time (Patmore 1983). Partially compatible activities can use the same area of land or water, but not at the same time. Incompatible activities cannot use the same area of land or water. The rating of activities into compatibility categories is made by an assessment based on related recreation studies in natural areas (eg. Laut
and Yapp 1978). The inventory and assessments of environmental and tourism compatibility are then combined to form a compatible activities matrix (Figure 13). This presents a visual summary of the areas major tourism recreation activities and their compatibility in terms of the environment and other users.

Compatibility ratings on the matrix are then modified by tourist and resident opinions on environmentally harmful and environmentally compatible activity preferences. Lists of both types of activities are made and ranked. Following this they are rated into levels of moderate, moderately-high, and high environmental compatibility values. A procedure is then followed to relate 'activity values' to 'activity compatibility levels' in exactly the same way that 'resource values' were related to 'significance levels' in the evaluation of significant and critical areas. The final part of the evaluation of compatible tourist activities is to place them into appropriate zones. The process for completing this is achieved through a review of an activity's environmental and social compatibilities related to the classification of tourism resources (Figure 13) and the definition of the zones (Table 2).

The final part of the third stage (Process 7) involves the suggestion of appropriate strategies and controls for the proposed developments and activities. Strategies and controls to protect the environment, conserve tourism resources and influence tourist demand will also be proposed. In addition to the overall zoning strategy other options proposed may include both direct management options such as mandatory permits, charges, and regulations, as well as indirect management approaches including interpretation and education programmes. In addition an overall strategy of concentration or dispersal of tourist activity is suggested.
### Figure 13 The Compatible Activities Matrix

<table>
<thead>
<tr>
<th>BIOSPHERE COMPONENT</th>
<th>ACTIVITIES</th>
<th>ENVIRONMENTAL IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Cultural Site Damage</td>
</tr>
<tr>
<td>Land</td>
<td>Camping</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bush Walking</td>
<td></td>
</tr>
<tr>
<td>Land and Water</td>
<td>Fishing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Swimming</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water Skiing</td>
<td></td>
</tr>
<tr>
<td>Land &amp;/or Water</td>
<td>Photography</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sightseeing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wildlife Viewing</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>Diving</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sailing</td>
<td></td>
</tr>
<tr>
<td>Air</td>
<td>Flightseeing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hang/Gliding</td>
<td></td>
</tr>
</tbody>
</table>

### BIOSPHERE COMPONENT

<table>
<thead>
<tr>
<th>ACTIVITIES</th>
<th>RECREATION COMPATIBILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Destination Based</td>
</tr>
<tr>
<td>☆ Compatible</td>
<td></td>
</tr>
<tr>
<td>○ Compatible Under Management</td>
<td></td>
</tr>
<tr>
<td>■ Incompatible</td>
<td></td>
</tr>
<tr>
<td>x Not Applicable</td>
<td>(Unlikely to compete for the same areas/resources)</td>
</tr>
</tbody>
</table>

- Camping
- Fishing
- Swimming
- Water Skiing
- Photography
- Wildlife Viewing
- Diving
- Sailing
- Bush Walking
- Sightseeing
- Flightseeing
- Hang/Gliding

**Note:** Similar recreational activity matrices have been compiled for the Forestry Commission, England (Goodall and Whittow 1973) and the CSIRO, Australia (Laut and Yapp 1978).
The concentration option favours the location of all or most facilities in certain designated localities whereas the dispersion policy encourages the distribution of smaller scale developments throughout the region in order to reduce the environmental pressures on any particular locality.

6.6 STAGE D SYNTHESIS

After the completion of the previous three stages the next stage is a careful and studied synthesis that brings together all the many fragments of information collected and analyzed during the research. Therefore it is now possible to match the significant features, critical areas and compatible activities with the various zones defined in the goal formulation phase as well as with the functional nodes, hinterland and corridors identified during the environmental and tourism assessment. A map is now produced which indicates the allocation of the region's environmental units to each of the various zoning classes.

6.7 STAGE E PROPOSALS

The plan is presented for consideration as part of the overall regional planning framework having concerned itself solely with the environment - tourism aspects. After consultation with the region's resource managers it may be necessary to amend or adapt some of the proposals in order to attain effective management. Suggestions for its implementation are then made and pursued until finally an acceptable zoning plan has been established.
Chapter 7  The Gascoyne Region

One of the most fascinating places on earth straddles the 26th parallel on the
coast of Western Australia.

Thomson 1991: 10

This chapter introduces the case study area - the Gascoyne Region (the
Region) of Western Australia. It provides the background regional
information and introduces the specific planning goals which the EBT
planning framework will seek to answer for the Gascoyne case study. This
is followed by a description of the Region's abiotic, biotic and cultural
environmental attributes which lays down the foundation for the
environmental assessment in the following chapter.

7.1  INTRODUCTION

The Gascoyne Region is situated on the WA coast approximately 1000 km
north of Perth. It is an area of low relief, open drainage and some ranges.
The climate is arid and tropical with low rainfall (220 mm pa), warm
temperatures (average 26-27°C) and a high number of days of sunshine
(320 pa). The coastline is marked by two large marine embayments
(Exmouth Gulf and Shark Bay) as well as a fringing coral reef (Ningaloo).
The land is covered almost entirely by natural semiarid shrubs with few or
no trees. Despite this the Region has a number of outstanding, and in
some cases unique, geological and biological phenomena.

The Region's natural environment is protected by a number of national
and marine parks and nature reserves which are managed by the WA
State Government's Department of Conservation and Land Management
(CALM). Existing nature reserves include Toolonga and Cooloomia
Nature Reserves as well as a number of the offshore islands. Hamelin Bay is the region's sole marine nature reserve. The established parks include Cape Range National Park and Ningaloo Marine Park in the Shire of Exmouth, Mt Augustus National Park in the Upper Gascoyne, and Francois Peron National Park and Shark Bay Marine Park in Shark Bay. In addition, a number of other national parks have been proposed and in December 1991 Shark Bay was entered on the World Heritage List as WA's first such entry. However, there is increasing concern for the region's environment especially due to the pressures placed on it by tourism.

The Region covers an area of 149 000 km² and is sparsely populated (13 000 people, Australian Bureau of Statistics 1992). It is divided into four local government areas. These are the Shires of - Carnarvon, Exmouth, Shark Bay and Upper Gascoyne (Figure 14). The principal town is Carnarvon with a population of approximately 7000, about 30% of whom are Aboriginal. Other main towns are Exmouth (2600), Denham (500) and Gascoyne Junction. The Region's economy is based on pastoralism, horticulture, fishing, mining, tourism and defence. The Department of Regional Development and the North West (DRDNW) has stated that tourism is the fastest growing industry in the Gascoyne Region (Department of Regional Development and the North West 1988a). The demand is monitored by the State Government's tourism department, the WA Tourism Commission (WATC). The need for increased attractions, facilities and developments has been highlighted in the Region's Tourism Development Plan (WA Tourism Commission 1986). This is further emphasized by the widespread expansion of existing facilities and current proposals for resorts and marinas (WA Tourism Commission 1988). Both CALM and the WATC have produced tourist brochures and books such as 'North-West Bound' (CALM 1990) and 'Western Australia's Unique
Figure 14  The Gascoyne Region
North’ (WA Tourism Commission 1990).

Tourism in the Gascoyne Region is increasing rapidly. In 1990 there were 210,600 tourists (up 6.8% on 1989) who generated $41.7 million in revenue (WA Tourism Commission 1991). They came from within WA (70%), the rest of Australia (22%) and overseas (8%). The main reasons for visiting the Gascoyne are its pleasant climate, fishing and natural attractions (WA Tourism Commission 1991). The peak tourist season is June to September which is the cooler winter period. The Region attracts residents from the southern parts of WA who travel north to escape the relative cold. Private vehicles are the most popular mode of transport (71%) and caravan parks and camping are the most frequently used accommodation (52%). The average length of stay in the Region is fifteen nights. The major attraction is the sensitive coastal region encompassing Shark Bay, Ningaloo Reef and Exmouth Gulf.

7.2 LAND MANAGEMENT

Most of the land in the region is owned by the Australian Government and leased to pastoralists (Figure 15). The Region’s terrestrial and marine parks and reserves are vested in the National Parks and Nature Conservation Authority (NPNCA) and managed by CALM. Approaches to the environmental protection and conservation of the Region stem from the years 1975-1980 when the Environmental Protection Authority (EPA) prepared a series of reports for the Government identifying areas of future conservation importance (Conservation Through Reserves Committee [CTRC] 1974; Environmental Protection Authority 1976). The main area of the Gascoyne Region is covered in the area known as System 9. Mt Augustus is the only area in the region outside of this system and is
contained in System 8. The areas of conservation significance identified by the systems in the Gascoyne Region were North West Cape, Lake MacLeod, Nerren Nerren East, Kennedy Range, Mt Augustus, the Ningaloo Reef Tract, Shark Bay and the offshore islands (Conservation Through Reserves Committee 1974). Since that time many of these areas have been either established or are in the process of being established as national or marine parks or reserves.

A decade after the CTRC and EPA reports were published the WATC prepared a Tourism Development Plan for the Gascoyne Region in which they concluded that the relationship between tourism and the environment was vital for the success of both the State's tourism industry as well as its conservation goals (WA Tourism Commission 1986). The Commission also suggested that:

The management and promotion of the Gascoyne Region as a package based on the concept of a zoned multi purpose park in which different levels of protection are provided and different activities both commercial and recreational, are permitted in various areas, would be viewed positively by the tourism industry.

(WA Tourism Commission 1986: 95)

They recommended a number of environmental zones (mainly the CTRC and EPA designated areas) as well as the future development of a number of tourist centres and sites.

Two years later the Shark Bay Region Plan was produced by the State Planning Commission (SPC) and CALM (SPC and CALM 1988). The plan's aims were to provide for community and economic development within the overall planning goal of providing for the conservation of natural resources. The report concluded that tourism held the greatest potential
for economic development in the bay and suggested that the WATC in conjunction with other bodies should prepare a Tourism Development and Management Plan which reflects conservation priorities. However, the EPA in response to the plan’s draft, indicated that the regional plan did not go far enough in achieving a conservation objective. It stated that "Shark Bay is an environment of State, National and International significance and conservation should be the major priority" (Environmental Protection Authority 1987: 23).

Between 1988-1991 Shark Bay was the focus of intense political lobbying as national environmental and conservation groups urged the Federal Government to seek World Heritage Listing for the Bay. The local people did not support this and instead urged the State Government to foster the implementation of the Region Plan. In April 1988 a vote taken by the local residents at a meeting on the World Heritage proposal was 399:1 against (Chubb 1988). Since that time the Federal Government vigorously sought the nomination mainly to court the large green vote of the eastern states, and in December 1991 Shark Bay was finally included on the World Heritage List (West Australian 1991).

Development strategies have been proposed for both Carnarvon (Department of Planning and Urban Development 1988) and Exmouth (Department of Regional Development and the North West 1988b) and these both include tourism as primary components. Management plans have been prepared for both Cape Range National Park (CALM 1987) and Ningaloo Marine Park (CALM 1989). In response to mounting environment - tourism conflicts, additional strategies have been suggested for the planning and management of Point Quobba (Department of Land Administration 1990), Coral Bay (Department of Planning and Urban
Development 1991) and the Ningaloo Area (Department of Planning and Urban Development 1992). Within the next 2-5 years other reviews are planned for the Region's environment (by CALM) and tourism (WATC).

In 1988 this research project was set up by Murdoch University's Environmental Science division and the State Government Departments for conservation and tourism to generate and test the EBT planning framework. Its purpose was to investigate the environment - tourism relationship in the Gascoyne Region, particularly in relation to CALM administered areas. Specific goals were to describe the Region's environment and determine those attributes which are highly valued, survey the characteristics and resources of tourism, and develop a plan for the Region which promotes tourism development whilst maintaining environmental quality, that is, fosters environment - tourism integration. Chapters 7-10 summarize the findings and the results of the application.

The regional environmental description focuses on three major attributes each having a number of categories. They are:

1. Abiotic  - geology, landforms, soils, climate and water,

2. Biotic    - vegetation and fauna, and


A detailed description of the Gascoyne environment has been made as part of this research (Dowling 1992) and what follows is merely a brief summary of the findings.
The spatial representation of data by mapping is a key part of the land planning process and also is fundamental to the EBT planning framework. Pearce (1989) has indicated that simple cartographic methods, for example, those used by Piperoglou (1967), are adequate for tourism planning. This method was adopted in this study with resource and evaluative maps being drawn freehand at a scale of 1:2 million. The evaluative maps drawn from the derived data were then entered on multiple data layers of a Micro Computer based Geographic Information System (u-GIS) using the GS-Map survey-mapping CAD drafting tools developed by GS Corporation and is similar to the one applied to the state of Oklahoma, USA by Gunn and Larsen (1988). These maps were also plotted at a scale of 1:2 million. The reasons why the raw data were not entered directly into the computer for later analysis included the Region's relative lack of environmental data, as well as the limitation of the time available for the study.

7.3 ABIOTIC ATTRIBUTES

The abiotic attributes of the Gascoyne Region comprise its geological, pedological, climatical and hydrological environmental elements which are without life.

7.3.1 Geology

The primary units of continental crust or geological building blocks of Australia are called cratons. They generally consist of igneous and metamorphic rocks that have evolved through a cratonisation cycle of sedimentation, deformation, metamorphism and volcanism gradually stabilizing over millions of years (Atlas of Australian Resources 1988: 10). As they stabilized, weathering and erosion have led to the formation of
secondary units of the continental crust called craton covers. The major cratons and craton covers for Australia, Western Australia and the Gascoyne Region are listed in Table 4.

Western Australia forms the oldest part of the continent whose origins lie in the dawn of geological history (McArthur and Bettenay 1979). The major cratons in WA are the North Australian Craton, the Nullarbor, Pilbara and Yilgarn Blocks, Capricorn Orogen and the Central Australian Mobile Belts. As the sequence of Craton formation is generally one of eastward evolution, WA comprises the oldest rocks on the continent, having formed in the first geological period - the Precambrian Eon.

General summaries of the Gascoyne Region's geology have been made by McWhae et al. (1958), Thomas and Smith (1974, 1976), Playford et al. (1975), and Johnstone et al. (1976). More detailed studies have been recently written on the Carnarvon Basin (Hocking et al. 1987), the Gascoyne Province (Libby et al. 1986, Williams 1986) and Shark Bay (Playford 1990). Underlying the Gascoyne Region are two major geological structural units or building blocks. They are the Central Australian Mobile Belts and the Capricorn Orogen. These support the major surface structural elements of the Carnarvon Basin, Gascoyne Complex and the Bangemall Basin (Figure 16). A third major craton, the Yilgarn Block, underlies the southern border of the region and is exposed on the surface as the Narryer Complex.

The Carnarvon Basin contains several points of geological interest. These include the Tamala Limestone which is mainly developed in Edel Land and its type section at Womerangee Hill. The unit is one of considerable importance in Southwestern Australia but has yet to be studied in any detail in Shark Bay where the formation reaches its maximum
## Table 4 Major Structural Units

Adapted from ‘Atlas of Australian Resources: Geology and Minerals’ (1988)

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<tr>
<th>TIME</th>
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### Reference

1. Craton = a major structural unit of the earth’s crust.
2. Craton cover = a secondary unit of the earth’s crust.
3. Basin = a large depression formed on the surface of craton covers.
4. Mobile belt = a relatively unstable area.
5. Orogen = a geosyncline which has undergone transformation and eventual cratonic stabilization.
6. Complex or block = a stable area of cratonic rock bounded by a fault.
7. Province = an area where the origin of a craton has been obscured by metamorphism and deformation.

* Unit occurring in the Gascoyne Region.
< Unit touches the Region’s edge.
⁺ Unit occurring elsewhere in Western Australia.
Figure 16  Geology
development (Playford 1990). Evaporite deposits in gypsum filled hollows are distributed widely in the Region and are known locally as 'birridas'. These birridas reflect areas which were originally interdune depressions. Their peripheral moats were formed from seepage of fresh groundwater from the surrounding sandplain systems which dissolved the gypsum.

Around the shores of Hamelin Pool are two geological features of international interest. They are the Hamelin Pool stromatolites and the Hamelin Coquina beach ridges formed of the small bivalve shells of *Fragum erugatum* (Playford 1990). Hamelin Pool, and its neighbour Lharidon Bight, are landlocked hypersaline marine basins less than 10 m deep with extensive fringing tidal flats and beach ridges. Hamelin Pool is partially separated from Shark Bay by a shallow barrier bank, the Faure Sill. The basin is one of the few areas in the world where marine waters are hypersaline with salinities of 55-70 ppt, almost twice the salinity of normal sea water (Hagan 1973).

The size, depth and other geomorphic features of the basin combine with salinity to make this an environment unique in modern seas with the development of a number of unique geological and biological features (Conservation Through Reserves Committee 1974). Algal mats dominate the tidal flats and shallow subtidal areas and stromatolites extend around Hamelin Pool in the tidal-shallow subtidal zone (Logan 1961). These are outstanding geological formations of worldwide scientific interest as they represent a process common to the Precambrian Eon (Playford and Cockbain 1976). Regarded as 'living fossils' the stromatolites survive in a hypersaline environment and grow by mats of blue-green algae trapping sedimentary particles (McNamara 1988).
Several key factors control the distribution and morphology of the stromatolites the most notable being prevailing wind direction, wave translation direction and the presence of the hard substrate (Playford 1980). The pool is also renowned for the presence of vast deposits of organic shells (coquinas) which have formed dunes at Shell Beach (Pilgrim 1979). Other interesting features include ooid shoals and lithified sediments of recent age, all rare or scientifically important. The key element in the formation and maintenance of hypersaline conditions in Hamelin Pool has been the growth and shoaling of Faure Sill. This geomorphic structure is a barrier bank constructed in the past 5000 years through the accumulation of skeletons of marine organisms living in seagrass meadows that flourish on the bank surfaces.

Another interesting geological feature is the Wooramel seagrass bank which forms a marginal platform along the eastern shore of Shark Bay. The bank is 130 km long, averages 8 km in width and covers an area of approximately 1000 km². The structure of the bank is a wedge-shaped body of sediment composed mainly of biogenic carbonate debris that is mixed with terrigenous detrital grains. Its formation and preservation is attributed to the modifying influence of seagrasses on processes of sedimentation, despite strong tidal currents and prevailing winds. The Wooramel seagrass bank is unique in its combination of geomorphology, physical oceanography and marine biology and its size, continuity, growth rate and variety of features have made it the standard global reference for carbonate banks, seagrasses and other organic baffles (Davies 1970).

East of the Carnarvon Basin lies the Gascoyne Complex of the Capricorn Orogen. It is a middle Proterozoic trough-like craton which is a major orogenic zone involving geosynclinal sedimentation, basement reworking
and granitoid emplacement (Fletcher et al. 1983). It occupies an area of about 40 000 km² in the midreaches of the Gascoyne River basin and consists of early Proterozoic granitic intrusions (eg. the Minnie Creek, Landnor and Mt. Marquis batholiths) and high-grade metamorphic gneiss domes (eg. Yinnietharra and Dalgety). These outcrop in the mid to eastern part of the region in the Yinnietharra Hills area at Mounts Observation, Dalgety and James (Williams 1986).

Lying to the east of the Capricorn Orogen is the Proterozoic post-orogenic Bangemall Basin which forms a cratonic cover sequence over remnants of the North East Orogen. These shallow marine sediments have been subjected to low-grade metamorphism, folding and intrusion by numerous dolerite sills and consist of sandstone, shale and dolomite (Libby et al. 1986). One of the intrusions is the Mt. Augustus monocline (1105 m) comprising of sandstone and conglomerate strata.

7.3.2 Landforms

Australia is divided into three distinct physiographic features - the Western Plateau, Interior Lowlands and Eastern Uplands (Atlas of Australian Resources 1988). Each of these major features has previously been further divided into a number of provinces and sections (Jennings and Mabbutt 1977). Western Australia lies totally within the Western Plateau. This physiographic division coincides with the main geological Archaean and Proterozoic structural elements. The major physiographic regions of WA have been described by Pilgram (1979) which in turn are based on the geomorphic divisions of Jutson (1950). Additional information can be gained from a summary of the State's landform-soil associations (McArthur and Bettenay 1979) which is derived from an
amalgamation of geological studies (Geological Survey of Western Australia 1975, Johnstone et al. 1976) and information in the Description of Australian Soils (Northcote et al. 1975). The Western Plateau division may be further subdivided into nine physiographic provinces within WA, three of which are to be found in the Gascoyne Region (Table 5). These are the Carnarvon Basin, the Gascoyne Province and the Bangemall Basin (Figure 17).

The Carnarvon Basin is an elongate depression composed of Phanerozoic rocks which trends roughly parallel to the Gascoyne Region coast. Low areas of the basin have been flooded by the sea in Quaternary times to form a shallow marine gulf (Exmouth Gulf), a large playa lake (Lake MacLeod), and a shallow marine embayment (Shark Bay). The basin is mostly an area of subdued relief covered by sand and gravel. Offshore lies the Ningaloo Reef, a fringing coral reef which extends 160 km southwards from Northwest Cape along the coast to the vicinity of Cape Farquhar.

In the north the area is dominated by Exmouth Gulf, a shallow marine gulf lying between Cape Range in the west and a broad system of tidal-supratidal flats on the eastern mainland shore. The gulf is approximately 80 km long, 40 km wide and covers an area of about 3000 km². It slopes gently from south to north, is deepest at about 20 m and contains numerous islands. On the peninsula separating the reef from the gulf lies Cape Range. It is an anticline about 100 km long and 20 km wide reaching a maximum height of 315 m above sea level composed of tertiary limestones which have typical karst topographic features including numerous caves (White 1989). It also features spectacular deep estuarine canyons on its eastern flank. Along its western side are flanking emergent, tectonically warped, erosional sea level terraces (Van De Graaff et al. 1976).
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<th>ZONE(^2) (Gascoyne)</th>
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<td>Bangemall Basin</td>
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Source

1. Major divisions and provinces are from Jennings and Mabbutt (1977).
2. Zones, districts and sections for the Carnarvon Basin are after Hocking et al. (1987) and Payne et al. (1987). For the Gascoyne Province and the Bangemall Basin they are after Wilcox and McKinnon (1972).
3. The Cooloomia Section forms part of the Yaringa Sandplain of Jennings and Mabbutt (1977).
Figure 17 Landforms
At the outlets of the larger creeks are alluvial fans while coastal dunes mark the western edge of the plain. Yardie Creek is an unusual feature enclosed by vertical limestone walls and containing the only permanent freshwater pool in the Gascoyne Region. At its lowest reach is a tidal mangrove estuary.

South of Cape Range is Lake MacLeod, a large saline playa which formed through the barring of a marine embayment by the Cuvier and Gnaraloo-Warroora Anticlines (Denman and Van De Graaff 1977). The lake occupies an area of approximately 2900 km² with most of its surface lying as much as 3 m below present sea level. It is generally dry except when the Gascoyne, Minilya or Lyndon Rivers flood.

The southern part of the Carnarvon Basin is the area of Shark Bay. It is a shallow marine embayment of approximately 13 000 km². Its average depth is 9 m but about a quarter of the area is occupied by shoals lying in depths of about 1 m. The bay is partly cut off from the Indian Ocean by aeolianite barrier ridges and the embayment is broken into a series of gulfs, inlets and basins by north-south trending ridges and sea-grass banks (Logan and Cebulski 1970). There is virtually no input of material into the waters of Shark Bay and consequently nearly all of the material forming the sediments in the bay is a direct result of biological, chemical and physical processes operating within the bay over geological time (Logan 1961). The land area of peninsulas and islands is formed of indurated limestone dunes overlying anticlinal structures similar to those in the Lake MacLeod section (Logan et al. 1970). Shark Bay includes the north trending Peron and Nanga peninsulas which divide its southern waters into a series of broad, semi-enclosed gulfs. From west to east these are Freycinet Reach, Freycinet Estuary (Harbour), Lharidon Bight and Hamelin
Pool which contain a number of outstanding geological formations of worldwide scientific interest (Playford and Cockbain 1976).

Inland the landforms of the Carnarvon Basin include the Kennedy Range which consists of a sand covered duricrusted plateau and is the mesaform erosion residual of arenaceous rocks topped by red seif dunes trending east-west. It rises to over 300 m asl and forms the most elevated area of relief for some distance. Its western and southern parts are extremely dissected to produce an intensely dendritic drainage pattern. The eastern edge is flanked by a prominent escarpment or cliff about 100 m high and 80 km long on the west side of the lower course of the Lyons River (Beard 1975). Most of the Permian rocks are fossiliferous and the Wandagee Formation of the Byro Group has a particularly rich assemblage. Semi-precious stones are deposited here and have attracted considerable attention from both amateur and commercial collectors. The most attractive scenery of the Carnarvon hinterland is provided by this range (Australian Heritage Commission 1989). A second feature is Fossil Hill, a small, isolated conical erosion remnant lying 38 kms east of Gascoyne Junction. It comprises a circular area 100 m in radius from the top of the hill and consists of a loose pile of very fossiliferous Permian limestone. The numerous marine fossils are an excellent teaching resource (Australian Heritage Commission 1989).

The Gascoyne Province occupies the central area of the Gascoyne Region. The geomorphic divisions of the Gascoyne Province have been described by Condon (1962) and Wilcox and McKinnon (1972) - the latter forming the basis of further reports by Williams et al. (1980) and Beaumont (1989). The province's landforms take their shape from the underlying structural units of the Capricorn Orogen's Gascoyne Complex (Williams 1986). The
area is one of Mid Proterozoic volcanic and metamorphic parallel ranges (eg. The Barlee Range) and dissected plateaux with intervening broad flat sedimentary lowland sandplains. The Gascoyne River and its tributary the Lyons rise among the ranges.

The Bangemall Basin covers the northeastern corner of the Gascoyne Region and comprises the post orogenic cover rocks of the Bangemall Group. The Basin is represented in the Gascoyne Region along the northern side of the Gascoyne River where it forms its watershed. The rocky divide on the north consists of massive Bangemall (Mid Precambrian - Proterozoic) series ranges where severe dissection of the softer sediments of slates, shales and mudstones has produced a rugged terrain. Here sharp cliffs and truncated bottle-necked canyons are common. Isolated massive remnants such as Mt. Augustus, Mt. Genoa and Mt. Isabella occur in the Bangemall Basin and are now associated with the major drainage plains and not with the watersheds. These are massive sandstone or layered monoliths arising abruptly to up to 800 m above the drainage plains. Mt. Augustus (1105 m) is the largest single monolith in Australia and is of impressive scenic grandeur (Australian Heritage Commission 1989).

7.3.3 Soils

The soils of Australia exhibit a wide variation in the preciseness of their zonal distribution and a number of unusual morphological features either not evident, or rarely seen, in the soils of other continents (Northcote 1960, Stephens 1977). WA soils reflect the long period of geological stability in which the landscapes have been subjected to extreme and deep weathering. Laterisation is extensive and dominates the soil pattern and
many soils are deficient in the major and minor mineral nutrients which are generally leached (Conservation and Environment Council 1983).

The soils in the Gascoyne Region have many features that are common to semi-arid soils elsewhere in Australia. They were first described by Teakle (1938) in a general account of soil regions throughout the state but have been superseded by the CSIRO's Atlas of Australian Soils at a scale of 1:2 million. The Gascoyne Region is included in Sheet 6, the Meekatharra - Hamersley Range area (Bettenay et al. 1967). The soil characteristics are thus well-known, and although the mapping units are somewhat generalized, considerable detail is given in the explanatory notes. More comprehensive information is given in the later vegetation surveys of WA (Beard 1975, 1976a+b) and the rangeland condition surveys of the Gascoyne Catchment (Wilcox and McKinnon 1972) and the Carnarvon Basin (Payne et al. 1987).

Soils of the Gascoyne Region reflect the underlying structural and landforms units (Figure 18). The major or zonal soil in the Gascoyne Region is the shallow earthy loam overlying an alkaline red-brown hardpan. The latter usually lies between 20-100 cm deep but is sometimes exposed at the surface. These soils predominate in the plains with red sands in the dunefields. The red colour of the soils is due to colouration by iron oxides (Cook and Warren 1973). The coastal strip comprises sandy calcareous soils which are lighter in colour due to littoral shell fragments and oxide leaching.

The sandplains are covered with leached sandy soils near the coast and yellow sands with an earthy fabric further inland both overlying laterite (Beard 1990: 98). Brown calcareous earths tend to differ in colour due to
the high concentrations of carbonates and lower concentrations of iron oxides. Organic matter is low and greatly concentrated within the top few millimetres (Payne et al. 1987). Around the lower reaches of the Gascoyne River lie rich alluvial soils which are either loamy fine sands or silty loams. They are well drained, alkaline and reasonably fertile.

In the inland desert region there is frequently very little soil in the ordinary sense and there are extensive areas without soil cover (Beard 1975). The mountains, hills and rock ridges are formed of very hard material which weathers slowly, particularly in such an arid environment. There is also little plant cover and the rains received from thunderstorms and cyclones are frequently torrential, so any soil tends to be carried away as soon as it is formed. Therefore, soils in this vast area are described as skeletal. However, the soils which are present are chiefly shallow earthy loams overlying red-brown hardpans on the plains with shallow stony soils on the ranges (Beard 1990).

7.3.4 Climate

The Gascoyne Region lies astride the Tropic of Capricorn and hence it embraces aspects of both tropical and temperate climatic features. The northern part is arid and tropical while the southern section tends towards a temperate Mediterranean climate. The western coastal strip is modified by the influence of the Indian Ocean while inland the climate is continental and extreme. Four divisions have been formalized by Beard (1975, 1976a+b, 1990) following the method of classification by Bagnouls and Gaussen (1957). They include the Northern Semi-Desert, the Mediterranean, the Dry-Warm Mediterranean, and the Inland Desert (Figure 19).
Figure 19  Climate
The climate of the Northern Semi-Desert is characterised by hot summers (November to March) and low rainfall (Department of Regional Development and the North West 1988a). The vast majority of the rainfall occurs as a result of cyclonic activity from January to March and in consequence the amount can vary substantially (Coleman 1971). Climate conditions in the coastal Gascoyne are dominated by tropical cyclones especially in this area. In a forty-two year period from 1925-1966 exactly one hundred cyclones were recorded in the region and in the area immediately to its north (Lourensz 1981). All occurred during the summer months and most between January and March. Maximum temperatures are highest in February (36.7°C) and are the highest recorded along the Gascoyne coastal strip. The lowest mean maxima occurs in July and is higher than elsewhere for the Gascoyne Region.

The climate of the Mediterranean Semi-Desert area is different from the northern coastal climate in that it has a reasonably equitable climate throughout the year. The area has approximately 320 days of sunshine a year and its monthly mean maxima is highest in February (33°C) and lowest in July (22°C) with a mean annual average of 27°C. Precipitation is lower than in the north and is approximately 200-250 mm pa. In 46 years of record (1945-1991) at Carnarvon the average annual rainfall was 225 mm. Rain also falls during winter, as opposed to the northern summer falls, with the highest mean monthly rainfall maxima occurring in June and July.

The third climatic division occurs in Shark Bay. It has a dry, warm, mediterranean climate characterised by hot dry summers (20-35°C), mild winters (10-20°C) and long dry periods (7-8 months pa). The area is also influenced by the belt of southeast winds for most of the year. During
summer southerlies commonly blow for several days at over 25 km/hr. There are infrequent summer cyclones which generate stronger winds of 70-110 km/hr with variable gusts in excess of 180 km/hr. The fourth major division of climate is the Inland Desert. It is arid and temperatures are extreme compared to the coastal strip. The mean monthly maximum and minimum temperatures for Gascoyne Junction are given in Figure 18 (Beard 1990). The hottest months are January and February with temperatures often recorded in excess of 50°C (Payne et al. 1987). At Gascoyne Junction the average annual rainfall is 207 mm pa.

7.3.5 Water

Australia is the world’s driest continent. Forty percent of its 2.5 million km² is arid and receives less than 250 mm of rainfall annually. Western Australia also has relatively little water (Jarvis 1986). The average annual rainfall in WA is 310 mm compared with Australia’s 420 mm and the average annual runoff of 46.7 km³ from this western third of the continent is only 11% of the country’s total. WA has less rain and less streamflow than the other Australian states with the exception of South Australia and in comparative terms, is therefore one of the dry regions of the world (Conservation and Environment Council 1983). The availability and distribution of surface and underground water in WA are described according to four drainage divisions. These are the Timor Sea in the north, the Western Plateau in the east, the Southwest division in the south and the Indian Ocean in the west.

The Gascoyne Region as defined by this study is wholly contained in the Indian Ocean drainage division which covers 21% of WA’s land but contains only 7% of its population. The Region includes parts of the
Ashburton, Lyndon, Minilya, Gascoyne, Wooramel and Murchison river basins (Figure 20). Only the Lyndon, Minilya, Gascoyne and Wooramel Rivers lie in the Gascoyne Region. These basins have streamflows which are very irregular and short lived and are described as ephemeral. Because of this and the high rates of evaporation the region has very little surface water. The principal river is the Gascoyne. It is the second largest river in WA with a catchment area of 79 000 km². However, it has an estimated average annual discharge of 875 million m³ which places it only ninth out of WA's seventeen rivers, in terms of river flow volume, and its flow is both irregular and of variable water quality (Hodgkin et al. 1979). The Gascoyne River flows on average 1.5 times per year. However, once every five or six years it fails to flow at all - the longest period without run-off being 2.6 years. In addition it has been estimated that the basin contains a further 238 million m³ of groundwater. Most of this occurs in the rocks or unconsolidated sediments of the coastal Carnarvon Basin.

The history of development in the Region reflects an adaptive approach with the main centres of water use concentrated in areas of more abundant supply. At the same time land clearing for pastoralism has accelerated the salinity of the water and mining has caused pollution (WA Water Resources Council 1984). The Conservation and Environment Council (1983) indicate that the predominant water quality problem in WA is salinity, a non-point source pollution problem, caused by land clearing. The salinity of shallow groundwater generally exceeds 6000 mg/l and may have a temperature of up to 50°C (SPC/CALM 1988). Groundwater is desalinated for use at Denham and Exmouth. Carnarvon is the centre of a small but important irrigation area which produces a considerable amount of WA's vegetable production and commercially grown bananas. With
Figure 20  River Basins
heavy groundwater withdrawal, there has been a slow but progressive
deterioration in quantity and quality (Hodgkin et al. 1979).

7.4 BIOTIC ATTRIBUTES

The biotic attributes of the Gascoyne Region include the vegetation and
fauna.

7.4.1 Vegetation

Australia has been divided into three principal botanic regions - the
Tropical, Eremaean and Temperate zones (Atlas of Australian Resources
1990). The nature of the plant cover in each zone reflects the major
environmental factors, and in particular the aridity and fertility that are
characteristic of much of the country. The overall pattern of distribution
of the vegetation is related to gradients of effective precipitation and
notably to the general decline towards the interior of the continent
(Carnahan 1977). The vegetation of WA can also be subdivided into three
regions - the Northern, Eremaean and Southwest Botanical Provinces
which equate approximately to the Australian botanic regions. The
Northern Province consists of semi-desert savanna and shrubland
vegetation due to its tropical climate. Grasslands predominate except for
on the sandplains where an acacia shrubland occurs. The Eremaean
Province consists of desert and is the largest botanic province in WA. The
Southwest Province comprises the relatively well-watered southwestern
portion and it has a variety of vegetation including shrublands, woodlands
and forests.
The Gascoyne Region is covered by two of WA's three major vegetation provinces the Eremaean and the Southwest and comprises low woodland, shrubland, steppe and mozaic units (Figure 21). The boundary between the Eremaean and the Southwest bisects the southern part of the region. The Eremaean province is by far the larger and covers more than 90% of the Gascoyne Region. It is dominated mainly by perennial shrubs of the spinifex (*Triodia*), wattle (*Acacia*) and poverty bush (*Eremophila*) varieties. The smaller area of the Southwest province is dominated by a mix of *Acacia* scrub containing scattered Eucalyptus trees. Major structural formation types have been described and mapped at 1:1 million by Wilcox and McKinnon (1972), Beard (1975, 1976a+b, 1990) and Payne *et al.* (1987).

The Eremaean Province is comprised of desert. In the sandy deserts spinifex steppe consisting of hummock grass, eucalyptus trees and scattered shrubs prevails. Areas of low woodland and scrub continue south to the Nullarbor - a treeless plain. The two divisions of the province found in the Gascoyne Region are the Carnarvon and Ashburton Botanical Districts. The Carnarvon Botanical District is the largest vegetation district of the Gascoyne Region. Covering virtually all of the western half it coincides broadly with the geological Carnarvon Basin. In the north it consists mainly of a tree and shrub steppe with spinifex (*Triodia*) dominant whereas in the south it consists mainly of *Acacia* scrub and low woodland. The inland section between Exmouth Gulf and Lake MacLeod is an Acacia dominated area of low woodland and scrub. Along the crest of the ranges there is a thin cover of *Triodia* with sparse *Acacia bivenosa*. The Carnarvon Botanical District contains forty known endemics and another nineteen near endemics. This number is conservative as floral surveys are not well-known and require further study and revision (Keighery 1990).
Figure 21  Vegetation
The Eremaean Ashburton Botanical District occurring in the Region consists almost entirely of mulga (*Acacia aneura*) often with snakewood (*A. xiphophylla*) and other *Acacia* sp. such as scrub on the hills and low woodland on the plains (Maslin and Pedley 1982). Typical of the sparsely vegetated country further inland is Mt. Augustus. It has a thin cover of mulga (*Acacia ramulosa*) and bowgada (*A. linophylla*) on the sides while the summit is topped by spinifex. This last plant is prevalent throughout Australia's arid and semi-arid areas and is an endemic grass (Jacobs 1984).

The second major botanic area in the Gascoyne Region is the Southwest Province which receives higher rainfall, almost all of which is confined to winter. The vegetation of this area comprises distinct areas of tree heath, *Acacia-Casuarina* thickets, and scrub heath (Burbidge and George 1978). The first vegetation section, the Tamala System, is located at the northern limit of the Southwestern Province where it reaches the southern shores of Shark Bay. On a red sandplain is an area of tree heath consisting of small trees up to 6 m in height, large and small shrubs, as well as grasses and herbs. Some of the species are local endemic ones of outstanding interest notably *A. denanths acaanthophyllus*, *Eucalyptus beardiana*, *E. roycei* and *Melaleuca* (Conservation Through Reserves Committee 1974). The community has been described as being remarkable and unique (Beard 1990: 114; SPC/CALM 1988: 13).

In the waters of Shark Bay the dominant organism is seagrass, which grows prolifically in the shallow, protected waters where light intensities are high. Seagrass covers about 4000 km² including most of the southern waters other than the hypersaline Hamelin Pool and Lharidon Bight. Seagrass is most abundant in the eastern waters where the Wooramale seagrass bank has an average width of 8 km, a depth of approximately 10 m
and covers an area of over 1000 km². The seagrass bank is the largest structure of its type in the world and is a vital part of the Shark Bay ecosystem (Dale 1988). There are fifteen species of seagrass in the bay of which *Amphibolis antarctica* is the most common (Walker *et al.* 1988). It occurs at the northern limit of its range and contrasts with the tropical species *Halodule uninervis* and *Syringodium isoetifolium* (Walker and Prince 1987). A large bed of the former species lying off the Wooramel River delta near Gladstone on the eastern shore of the Bay, provides a crucial summer food supply and refuge for a large dugong herd. Another species (*Cymodocea augustata*), endemic to the northern section of the WA coastline, is common in Shark Bay. WA's southernmost extensive mangroves, a stand of white mangrove (*Avicennia marina*), occurs at Guichenault Point on Peron Peninsula.

### 7.4.2 Fauna

The biota of the Gascoyne Region has not been recorded either uniformly or comprehensively. Superficial data is recorded in the report of the Conservation Through Reserves Committee (1974) and additional data is contained in the records of the Australian Heritage Commission (1991). Shark Bay fauna is better known than other areas in the Region with detailed records as part of biological surveys of its islands (Ride *et al.* 1962; Burbidge and George 1978) and nature reserves (Burbidge *et al.* 1980; Hopper 1980). General accounts of Shark Bay's fauna are outlined in reports on conservation issues (Nevill and Lawrence 1985) and in the regional plan (SPC/CALM 1988). Faunal studies have been made of Shark Bay's birds (Davies and Chapman 1975), fishes (Lenanton 1977; Allen and Swainston 1988), reptiles (Storr and Harold 1990) and mammals (Baynes 1990). Biological reports of other areas in the Gascoyne Region are few but
some information is available in reports on Ningaloo Marine Park (May et al. 1983), the Australian arid zone (Cogger and Cameron 1984), the Carnarvon Basin (Payne et al. 1987) and the Gascoyne Environment (Dowling 1992). A brief description of the Region's fauna follows and a more detailed account occurs in Appendix 4.

There are a number of terrestrial and marine fauna in the Gascoyne Region. They include Red Kangaroos and Euros. Smaller, marsupials and bats, including rare and endangered species, are found often in the less accessible parts of the mainland or on offshore islands. A wide diversity of birds, both resident and migratory also inhabit the region. Large flocks of corellas and galahs are the most easily visible and audible and others include emus, parrots and numerous smaller birds. There are also many species of snakes and lizards including large and impressive goannas. Amphibians include the mudskipper in mangrove swamps and frogs which spend most of their lives burrowed in the earth. Dingos and feral animals such as goats, foxes, cats and rabbits are widespread and have had a significant effect on the vegetation and fauna of the Region.

The marine fauna of the Region is diverse and plentiful. The single, most profound effect on this fauna is the Leeuwin Current. Usually, western shorelines have a cold, northward flowing current, yet along the Gascoyne coast a warm, southerly ocean current flows carrying tropical seed for fish and coral from the Indian-Indonesian Archipelago. The Gascoyne coast is renowned as being a most diverse and species rich area. There are many beautiful fish species in the Region and in the Ningaloo Marine Park more than 200 species of coral fauna can be found. Also occurring in the coastal waters are a number of turtles, dugong, whales and whale sharks. Mangroves along the coast provide valuable breeding grounds for birds.
7.5 CULTURAL ATTRIBUTES

The heritage of the Gascoyne Region comprises a long history of Aboriginal occupation superimposed by the much later arrival of the Europeans since the eighteenth century. Therefore the heritage is briefly summarised under Aboriginal and European values.

7.5.1 Aboriginal Heritage

The traditional Aboriginal societies of WA can be grouped into fourteen cultural entities (Jarvis 1986). Of these three occur within the Gascoyne Region. They are the northern, southeastern and southwestern groups (Berndt 1979). The northern group is the largest and covers half of the Region. It comprises Djalendji, Maia and Djiwali societies and can be subdivided into ten tribal groups denoted by an emphasis on matrilineal descent and similar use of kin terms. The two southern groups are based on patrilineal local 'totemic' territorial clans which emphasize descent, territory and connections with natural species. The southeastern group comprises of clans grouped into larger divisions such as the Dedei, Inggada, Malgana and Wadjari. The southwestern group is composed of the Nganda tribe of Shark Bay and the Nandu tribe of Carnarvon.

All known Aboriginal archaeological sites in WA are recorded and registered with the Department of Aboriginal Sites (DAS), WA Museum. The sites are protected legally by the Aboriginal Heritage Act, 1972-1980. Thousands of sites are registered but many others remain undiscovered (Jarvis 1986). Of the known sites a large number has resulted from excavations made during the construction of a natural gas pipeline from Dampier to the north of the Gascoyne Region, and Perth.
Aborigines have occupied the Gascoyne for at least 26 000 years (Flood 1990). Distinct tribal groups have different languages, social organisation and mythology. Each group has a defined territory based around permanent water on the Region's rivers (Department of Regional Development and the North West 1988a).

There are approximately 1000 registered Aboriginal sites in the Gascoyne Region. Of these about half (55%) have been identified by physical archaeological features. A further (25%) have been identified from ethnographic information obtained from Aboriginal people, and the rest (20%) from a combination of both sources. Most sites comprise artefacts or are middens. Others include ceremonial or burial sites, quarries, paintings or engravings. 92% of the sites are classified as having an open status which allows them to be viewed by anyone. A small number (5%) are classified as being of significance to the Aboriginal people, 2% are of unknown status, and approximately 1% of all sites have restricted access as these are of utmost Aboriginal significance. Some sites of significance include Boom Boom Springs, Turawarra Pool, Edney's Spring Art Sites, Bunburi Cave and the Bernier and Dorré Islands. These are described in greater detail in the following chapter.

7.5.2 European Heritage

The European heritage has been recorded in a number of books. These include general North West histories (Battye 1915; Webb and Webb 1983) and a summary of the maritime history (Henderson and Henderson 1988). Short histories of Carnarvon (Findlay 1984) and Shark Bay (Carmody 1970; Lefroy 1978) have also been prepared.
The shipping route from Holland to the Dutch East Indies in the seventeenth and eighteenth centuries inevitably led to the West Coast of Australia being discovered by Dutch mariners. One sea captain landed on Dirk Hartog Island, which now bears his name, on 25 October 1616. This is the first recorded landing by a European in Western Australia. During his stay he had a pewter plate from the ship's galley inscribed with particulars of his visit and attached it to a pole set up at the northern end of the island, which is now known as Cape Inscription (Valli 1983). A number of other Dutch mariners visited the Region and today their names or those of their boats are preserved as place names. They include Willem de Vlamingh in 1697 (now 'Vlaming' Head) and the 'Zuytdorp' in 1712 (Zuytdorp Cliffs). French interest in the continent during the Napoleonic era brought further visitors to the region and many geographic features of the Shark Bay Region bear their names, for example, Hamelin Pool, Freycinet Reach and Harbour, Bernier and Dorré Islands, and Peron Peninsula. Cape Murat is named after Napoleon's brother-in-law.

Following Cook's proclamation of Australia as a British colony in 1788 other parts of the country were visited and British bases established (Beatty and De Lacy Lowe 1980). In 1818 Phillip Park King, the first major Australian born maritime explorer, began his long and thorough investigation of the west coast including the Gascoyne Region. King named the 'Bay of Rest' and shore parties there recorded both the desert vegetation and indications of Aboriginal inhabitants. King also named the large inlet Exmouth Gulf after the English Viscount of that name. In 1839 Lieutenant George Grey visited both Shark Bay and Carnarvon and reported favourably on them for settlement. Seven years later the British proclaimed the Colony of Western Australia at Perth in 1829. Approximately thirty years later in 1857 Shark Bay was visited by Captain
Denham in the ship HMS Herald. To record his visit he inscribed his name, that of his ship and the date, into a limestone cliff-face at Eagle Bluff. Today part of it still remains and the main town of the area bears his name.

The earlier discoveries by Grey led to further exploration of the Region. In 1858 F.T. Gregory surveyed the inland central Gascoyne. From the summit of Mt. Augustus, which he named after one of his brothers, he sketched the surrounding area and recommended that it should be taken up by pastoralists. The first arrived in the 1860s about the same time as pearl traders. By the early 1870s small settlements were scattered along the shoreline and pearling attracted many Aborigines and Asians especially Malays and Chinese to the Region (Wilson 1980). In the late 1800s many pastoralists were in the Carnarvon area and a small settlement was started at the mouth of the Gascoyne River as the number of pastoralists and settlers grew throughout both the Region and the state. After seventy years of trading the Depression of the early 1930s caused the pearling industry to close. Subsequently fishing became the mainstay of the district and a cannery and processing works were established in 1912. In World War II the Region was attacked by Japanese aircraft and the HMAS Sydney was sunk off the coast of Carnarvon with the loss of 645 Australian lives (Winter 1984, WA Newspapers 1991).

The Gascoyne Region has undergone tremendous change in the last century. Pastoralism has been further increased to cover the entire Region, Carnarvon has become WA's centre for tropical agriculture, Shark Bay has become a major commercial fishing area, and the Region has become a prominent commercial salt mining centre. Carnarvon is now a major Aboriginal urban centre and Shark Bay still has many descendants
of the original Chinese, Filipinos, Malays and Kupangers employed in the pearling industry last century. An American presence is strong too with a joint Australia-United States of America (USA) Naval Communications Station operating from Exmouth since 1966, another joint facility - the Learmonth Solar Observatory just south of Exmouth, and a USA NASA tracking station which operated at Carnarvon from 1964-1987.
Chapter 8 Environmental Assessment

The natural history of the Gascoyne Region has produced a landscape and marine environment with many unique features.

Department of Regional Development and the North West 1988a: 12

8.1 INTRODUCTION

In the previous chapter the Gascoyne Region was introduced as a case study for application of the EBT Planning Framework. The goals were stated and the background issues were discussed. In addition the natural and cultural environment were described in order to lay the base for a survey and assessment of the environmental attributes so that an overall environmental evaluation could be made. The discussion which follows focuses on the selection of the chosen attributes, their evaluation and an overall summary of the region's valued environmental components.

Six environmental criteria are used to describe and evaluate the significance of proposed environmentally compatible tourism zones in the EBT planning framework (Table 3). In the Gascoyne case study it is important to note that the application of the criteria did not involve any direct acquisition of new environmental data. Instead the method has involved screening, interpreting and ordering existing information. Criteria chosen for the Gascoyne Region evaluation differed slightly from those proposed in the EBT framework because some data were not available. The criteria considered appropriate and practical for the evaluation of environmental significance in the Gascoyne Region are environmental representativeness, naturalness, distinctive abiotic features, rare and endangered species, historic significance, and archaeological significance.
8.2 ENVIRONMENTAL REPRESENTATIVENESS

The representation in protected areas of the range of ecological variation is a primary goal of conservation. Areas selected to be representative usually include typical or common species but they can also include rare species since their objective is to represent the range of biota. This approach views the selection of reserves as a means to represent the full range of natural features in a system of reserves. Whereas the definition and discussion in Section 4.5 has application for 'ecological' representativeness, the EBT methodology utilizes 'environmental' representativeness. This distinction is important because the latter term is more encompassing than species and their habitats and includes the broader aspects of the general landscape features.

Applying the EBT methodology the Region's landscape is accorded either 'moderate', 'moderately-high' or 'high' environmental significance. The rationale for this is the same as for conservation in general, that is, to ensure that a diversity of species, habitats and natural features is preserved. Areas which do not form part of any category are assumed to have minor significance in terms of environmental representativeness and therefore have limited status. However, it is accepted that in a broad environmental context all areas interrelate and no one area can be truly said to be of minor significance. In the EBT approach this point is recognised and accepted as a limiting factor which may well be improved upon with increased knowledge of both the environment under study as well as of environment - tourism planning frameworks in general.

In order to rate the Gascoyne Region in terms of environmental representativeness a methodology has been developed that relies on extant
studies of parks and reserves. Regional parks and reserves are accorded moderate significance, those proposed by the CTRC and the EPA are of moderately-high significance, and those listed on the Australian Register of the National Estate are regarded as having high significance. The CTRC and the EPA lists have evolved from a 1962 study by the WA sub-committee of the Australian Academy of Science which pointed out the rapid rate at which the State's natural areas were then being cleared for agriculture. They suggested the need for action to ensure the establishment of a set of reserves representative of "all major communities of natural wildlife and scenery types" in Western Australia (Australian Academy of Science 1962: 1).

Responding to this a decade later, the EPA appointed the CTRC to develop proposals for such a set of reserves. The CTRC divided the State into twelve environmental systems and reported to the EPA on eleven of them. The Environmental Protection Authority (1975: ii) proposed reserves which "placed WA in conformity with environmental protection and conservation standards throughout the world, taking into account reserve size and adequate representation of various ecological variations in the natural environment".

Areas of high significance are those which have also been listed on the Australian Heritage Commission's (AHC) register of the 'National Estate'. To protect environmentally significant areas at a national level the AHC advises the Commonwealth Government on the protection of Australia's National Estate. This includes those places, being components of the natural or cultural environment of Australia that have aesthetic, historic, scientific or social significance or other special value for the present community as well as for future generations (Australian Heritage
Commission 1991). One of its major tasks is the compilation and maintenance of a Register of the National Estate which is the national list of the Country's natural, historic and cultural heritage which it is believed should be conserved. There are eight criteria for inclusion of places in the Register of which three are natural. In WA there are 997 registered sites of which 205 are designated as being of natural heritage value, 25 being in the Gascoyne Region (Australian Heritage Commission 1989). In the EBT methodology these areas are classified as having high significance as they have already been selected as being environmentally representative by their inclusion on the CTRC list and in addition are considered to be of national significance by their listing on the National Estate Register. The summary map of environmental representativeness of the Gascoyne Region is shown in Figure 22.

8.3 NATURALNESS

Few detailed studies have been made of the outback environment of WA. However, as large parts of the state are in pastoral lands the Pastoral Board of Western Australia has undertaken regional surveys of some of them. These surveys are part of a continuing programme of pastoral land classification, mapping and resource evaluation and cover the West Kimberley (Payne et al. 1979), part of the Nullarbor Plain (Mitchell et al. 1979) and the Ashburton River Catchment (Payne et al. 1982). The whole of the Gascoyne Region study area has also been surveyed in two parts. They are The Gascoyne Catchment - the Region's eastern inland section (Wilcox and McKinnon 1972) and The Carnarvon Basin - the western coastal segment (Payne et al. 1987). The purpose of the surveys was to provide a comprehensive description and mapping of the pastoral resources of the area together with an evaluation of pastoral potential and
Figure 22  Environmental Representativeness
the condition of the soils and vegetation throughout. In addition to these aims the final reports consisted of complementary land system maps and summary accounts of landforms, soils and vegetation which also provide researchers with a reference on the features and geography of the area (Payne et al. 1987). In the earlier survey by Wilcox and McKinnon (1972) the various land system units were classified according to range condition, erosion and rangeland potential. Range condition was determined from vegetation and soil data, erosion from evidence of wind and water erosion, and rangeland potential by the criteria of accessibility, durability and availability.

In this study the classification of range condition is used as an indicator of naturalness. The term naturalness implies the recognition of some natural condition with minimal human-caused alteration (Eagles 1984). Naturalness is linked to representativeness as environmentally significant baseline areas must contain elements of both criteria. Similarly, it is also related to fragility in that the conservation of many fragile ecosystems and disturbance-sensitive species requires a great degree of naturalness or freedom from human disturbance (Smith and Theberge 1986). While the range condition assessments are not measures of naturalness, the former is used as an indicator of the latter by virtue of its assessment of the natural landforms, soils and vegetation of the region. P. Curry (pers. com. 1991), one of the authors of the Carnarvon Basin Report, suggests that while the range condition assessments do not provide a quantitative description of presettlement vegetation they do provide a useful measure of naturalness at the present time.

Additional reasons for incorporating rangeland condition as an indicator of naturalness are three-fold. First, the condition classes reflect the present
vegetation and soil conditions in the area. Second, even though one of the two pastoral surveys in the Region is twenty years old, together they represent the only comprehensive surveys of landforms, vegetation and soils throughout the region. The older survey covers the remote inland section of the Region where few people live and very few tourists visit whereas the relatively more populated, popular and sensitive western coastal section was surveyed far more recently, only six years ago. Finally, while the condition classes may have limited application outside the study region, within it they at least provide a basis for comparability.

In the Gascoyne Catchment survey range condition was classified according to five condition classes (Wilcox and McKinnon 1972). These range from class 1 = pristine or original condition, 2 = good condition, 3 = vegetation degradation obvious with little or no erosion, 4 = vegetation degraded and obvious erosion, and 5 = vegetation degraded with major erosion. In this study only the first three classes are used as the task is to determine areas of environmental significance. Land system units or 'areas' covered by equal to or greater than 50% range condition in each class are assigned an environmental significance rating. For example, areas covered by >50% range condition class 3 are rated as being of moderate environmental significance, class 2 = moderately-high and class 1 = high (Table 6).

In the Carnarvon Basin survey rangeland conditions are also evaluated according to the criteria of pasture condition as well as wind and water erosion. The overall assessments are rated according to three levels termed 'good', 'fair' and 'poor'. Each land system unit or area is then rated according to the percentage of each condition level which it contains. The terms for the overall criteria levels do not adequately reflect the
### Table 6 Environmental Significance Ratings for Naturalness

**Based on Landscape Condition Classes**

<table>
<thead>
<tr>
<th>Rating</th>
<th>Environmental Significance</th>
<th>EBT Planning Framework</th>
<th>Gascoyne Catchment 1</th>
<th>Carnarvon Basin 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Moderate</td>
<td>Areas where vegetation degradation is obvious with either minor or moderate erosion.</td>
<td>Areas covered by ( \geq 50% ) range condition class 3 - vegetation degradation obvious with minor erosion.</td>
<td>Areas covered by ( \leq 60% ) 'good' range condition but ( \geq 80% ) 'good' and 'fair' range condition classes combined.</td>
</tr>
<tr>
<td>2</td>
<td>Moderately - High</td>
<td>Areas of original vegetation condition with the loss of some species and minor erosion.</td>
<td>Areas covered by ( \geq 50% ) range condition class 2 - vegetation in good condition with loss of some rare species.</td>
<td>Areas covered by ( \geq 60% ) 'good' range condition class.</td>
</tr>
<tr>
<td>3</td>
<td>High</td>
<td>Areas of original vegetation with little or no erosion.</td>
<td>Areas covered by ( \geq 50% ) range condition class 1 - pristine or original condition.</td>
<td>Areas covered by ( \geq 80% ) 'good' range condition class.</td>
</tr>
</tbody>
</table>

**Notes:**
1. After Wilcox and McKinnon (1972)
3. The following condition classes are not included in the EBT classes. The Gascoyne Catchment Condition Classes 4 and 5 and the Carnarvon Basin 'poor' condition class.

individual criteria ratings. For example an area with no erosion and excellent vegetation cover is given the overall range condition term good.

Therefore in order to more fully reflect the individual indicators and also to try and further refine the criteria to indicate areas of significant condition and hence naturalness, the levels have been reclassified into three classes. The first level of moderate environmental significance
occurs when an area is covered by equal to or greater than 60% 'good' range condition as well as equal to or greater than 80% 'fair' and 'good' range conditions combined (Table 6). An area of moderately-high environmental significance is comprised of ratings equal to or greater than 60% 'good' range conditions. The highest level, or area of high environmental significance, occurs where an area is rated as having a 'good' range condition of equal to or greater than 80%. In the reinterpreted classification no account is taken of the 'poor' range condition level as it represents conditions not considered to be significant. The Gascoyne summary map of naturalness is shown in Figure 23.

8.4 DISTINCTIVE ABIOTIC FEATURES

Eagles (1984: 51) defines distinctive abiotic features as "significant geological features that illustrate specific land evolution or landforms". Examples could include reef tracts, karst features or coastal embayments. They have a localised distribution or are only fully developed at a limited number of sites in the region and beyond. The identification of distinctive abiotic features is particularly important to ensure the maintenance of abiotic diversity. The significance of each feature is determined by assessment of three characteristics - development, abundance and/or extent. Development is the degree to which the occurrence is the best developed example of the feature or possesses all of the potential characteristics of the feature. Abundance is the number of examples of the feature and its extent the area covered by it. Each of these characteristics may be used to evaluate the significance of particular abiotic features.

Assessing the rarity of each occurrence of every abiotic feature is not possible because an area the size of the Gascoyne possesses a large number
Figure 23  Naturalness
of abiotic features some of which would occur a number of times. Therefore, an alternative approach is adopted following in part the methodology utilized in the identification of ESAs in the Northwest Territories, Canada (Smith, Nelson and Theberge 1986). The method includes reviewing the available geological and other scientific literature for the Region and assessing which abiotic features are distinctive. The methodology is qualitative but being based on existing earth science literature can be critiqued and verified (Smith, Nelson and Theberge 1986: 64).

Abiotic features in the Gascoyne Region which are noted as being distinctive, that is, special or different from others in the area, by existing earth science and environmental literature are classified as having moderate significance. Abiotic features which are noted in either the CTRC or EPA proposals for Conservation Reserves within the State are accorded moderately-high significance. Abiotic features which are considered to be distinctive at the national level and are listed on the AHC National Estate Register are accorded high significance. In addition three areas of gemstones are described as having potential environmental significance because of their local importance. The Gascoyne summary map of distinctive abiotic features is shown in Figure 24.

8.5 RARE AND ENDANGERED SPECIES

The need for conservation is well documented in the World Conservation Strategy (IUCN 1980). This value is increasingly presented in terms of the value of biodiversity, both in economic terms (McNeely 1988, Norton 1988, Randall 1988), as well as in the wider dimensions of human welfare (Fitter 1986, World Commission on Environment and Development 1987, Reid
Figure 24  Distinctive Abiotic Features
and Miller 1989). Of all the reasons supporting conservation the biodiversity one is the strongest because it is impossible to recreate a species. Endangered species warrant special conservation attention because their extinction is more likely than for other species. To determine the degree of threat to any particular plant or animal species the IUCN Species Survival Commission classifies them in the following way.

1. An unendangered species is widespread and abundant, adapted to a variety of habitats and known to be at a level of abundance comparable with or greater than it had in historic times;

2. A vulnerable species faces no known threat, but should such a threat develop, it would probably be classified as endangered;

3. A threatened species is likely to decline in abundance, if present trends continue; or, having once been classified as endangered, is now known to be increasing but has not yet reached its former level of abundance;

4. An endangered species is in danger of becoming extinct if present trends continue and no action is taken in time to be effective; and

5. A species of indeterminate status is not perceived to be vulnerable, threatened or endangered, but equally is not known positively not to belong to one of these three categories.

(IUCN 1988)

On a global scale the WCU publishes lists of rare and endangered species for both plants and animals (IUCN 1988). In addition it has also published Red Data Books for specific faunal species, or the fauna and flora within certain countries.
The fourth criterion in the EBT environmental evaluation is rarity of species or populations. Rare means unusual or uncommon and rarity is based on either geographic (restricted area) or demographic (low numbers) parameters (Argus and White 1982). Species are any taxonomic group which are capable of interbreeding. A population is a group of individuals of the same species inhabiting a given area. Smith and Theberge (1986) suggest that a species or population may be designated as rare in a number of ways. These include widespread rare species which occur over a wide area but are scarce wherever they do occur; endemic species with restricted geographical ranges; disjunct populations that are geographically separated from the main range of the species; peripheral populations that are at the edge of their species' geographical range; and declining species that were once abundant and/or widespread but are now depleted. The terms endangered and threatened represent extreme cases of any types of rarity noted.

Unique, rare or endangered plant and animal species are determined by a review of the literature, consultation with experts and listing on regional, national or international rare or endangered species lists. Three categories are used to describe the conservation status of each species. They are:

1. Moderate Significance - endangered (rare or unique) species in the Gascoyne Region but occurring elsewhere in the state;

2. Moderately-High Significance - endangered species in the Gascoyne Region and not occurring elsewhere in the state; and

3. High Significance - endangered species in the Gascoyne Region and not occurring elsewhere in the country.
8.5.1 Rare Flora

In Australia the rarity of plant species is most often assessed using the rare or threatened plant lists of the Australian National Parks and Wildlife Service (ANPWS) of which the most recent is by Briggs and Leigh (1988). Their classification includes species which are vulnerable, endangered, rare or presumed extinct. In WA the rarity of plant species is assessed using a Schedule of Declared Rare (Endangered) Flora which is reviewed annually by CALM. The Australian classification is not used but instead an all embracing term of endangered is utilized to include plants that may be numerically rare or endangered, or locally abundant but in need of special protection. Comparison of the Australian and WA lists indicates that some of the WA plants on the Australian list do not appear on the state list. This is due to CALM’s stringent requirements for adequate field surveys to reliably assess conservation status. To overcome this CALM maintains a Reserve List of Endangered Flora which classifies endangered species in five priority categories (Hopper et al. 1990). They are species with few poorly known populations: 1 = on threatened lands, 2 = on conservation lands, 3 = some on conservation lands; as well as 4 = species presumed extinct and 5 = those in special need of monitoring.

To evaluate the significance of rare plant species in the Gascoyne the WA definition of endangered species is adopted. The three levels of environmental significance classification recognised are:

1. Moderate Significance - endangered species in the Gascoyne Region but occurring elsewhere in WA. Members of this class are derived from the WA Reserve List of Endangered Flora;
2. Moderately-High Significance - endangered species in the Gascoyne Region and not occurring elsewhere in WA. Members of this class are derived from the WA Reserve List of Endangered Flora, and

3. High Significance - endangered species in the Gascoyne Region and not occurring elsewhere in Australia. Members of this class are derived from the WA Schedule of Endangered Flora and/or the Australian list.

The Gascoyne Region has 36 (4.1%) of the WA's 883 taxa currently on the Reserve List of Endangered Flora. Of these fifteen are found in other regions of the state and are therefore accorded regional significance (Table 7). The remaining 21 are not found elsewhere in the state and are accorded provincial significance. Of the 36 Gascoyne regional and provincial endangered flora, 32 taxa (89%) are poorly known and are under possible threat, one (3%) is presumed extinct and two (8%) are in need of special monitoring.

Flora classified as being of national significance in the Gascoyne Region are derived from the WA Schedule of Endangered Flora and/or the Australian list. There are 260 taxa which have been declared as Endangered Flora in WA. These have been listed in the Schedule of Endangered Flora in the WA Government Gazette of July 1991. All but one of the taxa are flowering plants, the majority being woody perennials (Hopper et al. 1990). Of the 260 only 4 (1.5%) are located in the Gascoyne Region (Table 7). Two are located in the Shire of Shark Bay and a further two in the Shire of Upper Gascoyne. No taxa on the Endangered List occur in the Shires of Exmouth or Carnarvon. The four endangered taxa comprise two shrubs, a tree and a herb. The shrubs are found in the
<table>
<thead>
<tr>
<th>SPECIES</th>
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<th>DISTRIBUTION</th>
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<tbody>
<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>REGIONAL</strong>³</td>
<td></td>
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</tr>
</tbody>
</table>

| Acacia didyma               | 2       | Dirk Hartog Is⁴ Tamala Stn⁵ | G         |
| Acacia plautella            | 3       | Wannoo                | G         |
| Anthocercis intricata       | 3       | Denham                | G         |
| Anthothroche walcotti       | 3       | Shark Bay            | G         |
| Bergia auriculata           | 1       | Doorawarrah Station   | G         |
| Calocephalus aervoides      | 1       | Dorre Island          | G         |
| Dicrasytis linearifolia     | 3       | Bet. Geraldton + Carnarvon | G       |
| Dipteranthemum crosslandii  | 3       | Dalgety Downs Station | C, P      |
| Eremophila caespitosa       | 1       | Waldburg              | C         |
| Eremophila coacta           | 1       | Pingandy              | --        |
| Eremophila youngii lepidota | 5       | Southern Cape Range   | C, P      |
| Lepidium puberulum          | 2       | Dorre Island          | G, P      |
| Livistona alfredii          | 5       | Cape Range            | P         |
| Maireana murrayana          | 3       | Dairy Creek Station   | G         |
| Zygophyllum aff. retivalve  | 3       | Coral Bay             | P         |

References

1. Reserve List Classification
   1 = species with few poorly known populations on threatened lands;
   2 = species with few poorly known populations on conservation lands;
   3 = species with several poorly known populations on secure conservation lands;
   4 = species presumed extinct;
   5 = species in need of special monitoring.
   R = species which are rare or endangered and occur on the WA Schedule of Endangered Flora.


3. Regional = Species listed on the WA Reserve Flora List and occurring in the Gascoyne Region though not confined to it.

4. Is = Island.

5. Stn = Station.

Table continued on following page
Table 7  Endangered Flora continued

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</tr>
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<td>Acacia drepanophylla</td>
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<td>Coburn + Yaringa Stns</td>
</tr>
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<td>Acacia ryaniana</td>
<td>2</td>
<td>Cape Cuvier + Coral Bay</td>
</tr>
<tr>
<td>Acacia sclerosperma</td>
<td>3</td>
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<tr>
<td>Acacia startii</td>
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<td>Brachychiton obtusilobus</td>
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<tr>
<td>Chthonocephalus tomentellus</td>
<td>2</td>
<td>Shark Bay, Denham</td>
</tr>
<tr>
<td>Corchorus crassifolius</td>
<td>2</td>
<td>Mt Augustus</td>
</tr>
<tr>
<td>Daviesia sp. (ASG 10288)</td>
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</tr>
<tr>
<td>Eremophila arguta</td>
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</tr>
<tr>
<td>Eremophila occidens</td>
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<tr>
<td>Eremophila physocalyx</td>
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<td>Meadow + Talisker Stns</td>
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<td>Gnephosis tenussima</td>
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<tr>
<td>Lythrum sp. Tawrana</td>
<td>1</td>
<td>Towrana</td>
</tr>
<tr>
<td>Olearia occidentissima</td>
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</tr>
<tr>
<td>Pilotus alexandri</td>
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<td>Dirk Hartog Island, Quobba</td>
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<tr>
<td>Pityrodia glabra</td>
<td>2</td>
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<td>Sclerolaena stylosa</td>
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<td>Spyridium divaricatum</td>
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<td>Verticordia serotina</td>
<td>2</td>
<td>Cape Range National Park</td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>Drakonorchis barbarella</td>
<td>R</td>
<td>Southern Shark Bay</td>
</tr>
<tr>
<td>Eucalyptis beardiana</td>
<td>R</td>
<td>Southern Shark Bay</td>
</tr>
<tr>
<td>Pityrodia augustensis</td>
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<td>Mt Augustus</td>
</tr>
<tr>
<td>Thryptomene wittweri</td>
<td>R</td>
<td>Mt Augustus</td>
</tr>
</tbody>
</table>

References

4  Provincial = Species listed on the WA Reserve Flora List and occurring in the Gascoyne Region though not confined to it.

5  National = Species listed on the WA Schedule of Endangered Flora.
Ashburton Botanical District of the Eremaean Province and the other two lie in the Southwest Province's Irwin Botanical District.

The two Eremaean Province shrubs occur in the area around Mt. Augustus. The Mountain Thryptomene (*Thryptomene wittweri*) is known from just two populations one of which occurs near Mt. Augustus, the other lying outside the study area near the Hamersley Range to the north of the Gascoyne Region. The second shrub is the Mt. Augustus Foxglove (*Pityrodia augustensis*), a hairy shrub which grows up to 2 m and is known only from the rocky hillsides of the Mt. Augustus area. The endangered plants of the Southwest Province are a tree and a herb. The tree is Beard's Mallee (*Eucalyptus beardiana*) which is smooth-barked, has slightly glossy leaves and grows up to 5 m high. Only six populations occur on CALM lands. The fourth endangered taxa is a small dragon orchid (*Dranonorchis barbarella*) an inconspicuous tuberous herb which grows to 20 cm.

8.5.2 Rare Fauna

Australia has the worst rate of recent plant and animal species extinction of any continent or country of its size, and a large number of surviving native species are also threatened with extinction (Kirkpatrick 1991). The country's threatened animal species have been documented five times in the last decade (eg. The Total Environment Centre 1983; Flannery and Dodd 1988; Kennedy 1990). The Australian classification of a species' conservation status is that defined by Kennedy (1990) which itself is derived from the categories of endangerment employed by the Species Survival Commission (SSC) of the IUCN in Switzerland. The terms used are potentially vulnerable, vulnerable and endangered Kennedy (1990).
Potentially vulnerable species are those not currently considered to be vulnerable or endangered but are in need of careful research and monitoring to ensure they do not end up in the higher threat categories. Vulnerable species are believed likely to become endangered in the near future if threats currently facing them continue. Endangered species are those in danger of extinction whose survival is unlikely if the threats they face continue to operate. In WA the rarity of fauna species is assessed using a Schedule of Declared Rare (Endangered) Fauna which is reviewed annually by the CALM.

A number of rare fauna have been identified in the Gascoyne Region. These have been cited in local studies (Ride et al. 1962; Davies and Chapman 1975), regional studies (Baynes 1990; Berry et al. 1990) and national studies (Kennedy 1990). Rare or endangered fauna in the Region are automatically classified as being potentially vulnerable, vulnerable or endangered if they are listed under any of these categories on the national list of Kennedy (1990). Species which are described in regional or state publications as being rare or in need of special protection but are not included on either the state or national lists, are classified as being potentially vulnerable. In addition fauna listed on the WA Wildlife Conservation (Rare Fauna) Notice 1990 (Western Australian Parliament 1990) also gain automatic inclusion. Those which are listed in Schedule 2 as being otherwise in need of special protection, are included in the vulnerable threat category. Those which are listed in Schedule 1 (the higher of the two schedules) as being likely to become extinct or are rare, are included in the endangered category.

Terms used to describe the conservation status of each class in this study are:
1. Moderate Significance - endangered species in the Gascoyne Region but occurring elsewhere in WA. Members of this class are derived from either literature review or the Australian List of Potentially Vulnerable Species;

2. Moderately-High Significance - endangered species in the Gascoyne Region and not occurring elsewhere in WA. Members of this class are derived from either the Australian List of Vulnerable Species or the WA List of Endangered Fauna (Schedule 2); and

3. High Significance - endangered species in the Gascoyne Region and not occurring elsewhere in Australia. Members of this class are derived from either the Australian List of Endangered Species or the WA List of Endangered Fauna (Schedule 1).

For ease of description the fauna are further subdivided into terrestrial and marine groups within each category (Table 8). A summary of the rare and endangered fauna in the Region is given in Appendix 4. Finally an overall summary map of the Region's rare and endangered species is given in Figure 25.

8.6 ABORIGINAL SITES

Aboriginal sites are used in the Gascoyne Region as a surrogate for the EBT Planning Framework cultural environmental attribute criterion of archaeological sites. Aboriginal areas which are of significance for the indigenous people of the Region are included based on their entry on State and/or National Registers of significant Aboriginal sites. Such sites can be separated into two broad divisions - ethnographic sites for which first-hand Aboriginal comment is or has been available, and archaeological sites which usually contain physical evidence of their occupation.
<table>
<thead>
<tr>
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<th>SCIENTIFIC NAME</th>
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<tbody>
<tr>
<td>1 POTENTIALLY VULNERABLE</td>
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</tbody>
</table>

**Terrestrial**

**Mammals**

- Ash-grey mouse
- Desert mouse
- Sandy inland mouse
- Western chestnut mouse

**Birds**

- Australian Bustard
- Bush Thick Knee
- Southern Emu-wren
- Variegated Fairywren
- Wedge-tailed shearwater

**Reptiles/Amphibians**

- Legless lizard
- Legless lizard
- Legless lizard
- Legless lizard
- Scincid lizard
- Scincid lizard
- Dragon lizard
- Skink
- Skink

**Invertebrates**

- Land snail
- Schizomid

**References**

1. From the WA Schedule of Rare Fauna (WA Parliament 1990) and Australia’s Endangered Species (Kennedy 1990).
2. Potentially Vulnerable = species in need of special protection.

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<thead>
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<tr>
<td>Marine</td>
<td></td>
</tr>
<tr>
<td>Mammals</td>
<td></td>
</tr>
<tr>
<td>Pigmy Sperm Whale</td>
<td>Kogia breviceps</td>
</tr>
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<td>Reptiles/Amphibians</td>
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<td>Flatback Turtle</td>
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<tr>
<td>Green Turtle</td>
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<tr>
<td>Hawksbill Turtle</td>
<td>Eretmochelys imbricata</td>
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<tr>
<td>Loggerhead Turtle</td>
<td>Caretta caretta</td>
</tr>
<tr>
<td>Shark Bay Sea snake</td>
<td>Aipysurus pooleorum</td>
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<tr>
<td>Molluscs</td>
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</tr>
<tr>
<td>Baler Shell</td>
<td>Melo amphorus</td>
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<tr>
<td>Giant Conch</td>
<td>Syrinx aruanus</td>
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<td>Volute</td>
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<td><strong>2 VULNERABLE</strong></td>
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<td>Little Tern</td>
<td>Sterna albitrons sinesis</td>
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<td>Minke Whale</td>
<td>Balaenoptera acutorostrata</td>
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1. Potentially Vulnerable = species in need of special protection.
2. Vulnerable = species believed to become endangered in the near future if threats currently facing them continue.

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Table 8  Rare and Endangered Fauna continued

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<td>Blind Gudgeon</td>
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</table>

1. Endangered = species in danger of extinction
Figure 25  Rare and Endangered Species
The Department of Aboriginal Sites of the WA Museum maintains a register listing all known sites in the state. The status of each site is classified as being either open, significant or restricted. Open sites may be visited by arrangement with the Department of Aboriginal Sites, significant sites are only available for inspection for scientific or heritage reasons, and restricted sites have the most stringent conditions placed on them for visitation, if allowed at all, due to the highest significance placed on them by the Aboriginal people. At the national level the AHC also maintains a list of Aboriginal heritage sites.

To evaluate the significance of Aboriginal Sites the following three levels of classification are recognised. They are:

1. Moderate Significance - Aboriginal Sites identified in the Gascoyne Region which are listed as being of open access on the WA Register of Aboriginal Sites;

2. Moderately-High Significance - Aboriginal Sites identified in the Gascoyne Region which are listed as being of significance to Aboriginal People on the WA Register of Aboriginal Sites; and

3. High Significance - Aboriginal Sites in the Gascoyne Region which are either listed as being of restricted access on the WA Register of Aboriginal Sites or are listed on the AHC's Register of the National Estate.

A map of significant Aboriginal sites in the Gascoyne Region is shown in Figure 26.
Figure 26  Aboriginal Sites
8.7 HISTORIC SITES

In the absence of a generally accepted and more detailed set of criteria, the following method is used to assess historic sites in the Gascoyne Region after Hans-Bastedo (1983). An area may be considered to be of historic importance if it is found, through literature research, field observations, or interviews with knowledgeable persons, to contain features or artifacts associated with an event, feature, or theme generally recognised as noteworthy. Where guidelines are lacking these cannot be ranked in terms of their importance for protection, and as Cocklin et al. (1990: 300) argue, "there is also some question as to the real opportunities for effectively quantifying such values".

Sites which meet the criteria listed above and which are recorded in the Region's historic, heritage and environmental literature are accorded moderate environmental significance (Figure 27). Sites which meet the above criteria but in addition are recorded in the WA Register of Historic Sites are classified as being of moderately-high significance. Finally historic sites which are listed on the AHC's Register of the National Estate, which lists not only places of natural heritage value but also sites of historic heritage value, are considered to be of high heritage value and therefore of high environmental significance.

8.8 VALUED ENVIRONMENTAL COMPONENTS

Overlay of the maps of the six environmental criteria indicates a number of areas of moderate, moderately-high, and high significance (Figure 28). The majority of the Region consists of a central zone which is of moderate environmental significance towards the west and 'potential' significance
Figure 28  Overall Environmental Significance
in the east. This latter zone is classified as having potential significance because although it is presently classified as having no status, this has been made largely on the lack of data for the area. At some stage in the future an ecological or resource survey may well provide information that alters the findings of the present assessment. Areas of moderately-high significance are mainly scattered in the central and southern parts of the Region. These areas include large portions of the Gascoyne River, a strip from Carnarvon to Gladstone and the Nerren Nerren area of the inland Shark Bay.

Areas of high significance in the inland are two northwest-southeast trending strips. The first runs from Exmouth Gulf through to the Kennedy Ranges and the other is roughly parallel to it and further inland from the Barlee Range to an area south of Mt Augustus. Virtually the entire coastal strip is of high environmental significance and includes the Cape Range - Ningaloo Reef area in the north, the central area of Lake MacLeod and a portion of the coastline to its west, as well as Shark Bay and Edel Land in the south. In addition there are four areas which contain two or more environmental components rated category 3 which are of international significance. These are promoted to the fourth class of outstanding environmental significance. They include Hamelin Pool, Shell Beach and the Wooramel Seagrass Bank, all of which are in Shark Bay, and Mt Augustus in the inland.
Chapter 9  Tourism Survey and Assessment

Tourism is the fastest growing industry in the Gascoyne Region.

Department of Regional Development and the North West 1988: 12

9.1  INTRODUCTION

In the previous two Chapters the environmental components of the Gascoyne Region were described and assessed. In this chapter the Region's tourist resources are described and assessed. As part of the assessment the Region's residents and tourists were surveyed and their views incorporated in the overall discussion and findings.

Tourism in the Gascoyne Region has developed mainly as a result of people taking advantage of recreational opportunities afforded by the marine environment. Until recent years the relative isolation of both the Region generally as well as the main attractions within it have necessitated visitors to be independent and somewhat adventurous. The use of caravans, tents and 4WD vehicles have formed the basis for the early development of tourism in the Region. Also important is the Region being an interim destination for WA residents touring the northern part of the State or out-of-state residents touring around Australia.

The main portions of the Region's tourism infrastructure have been developed to service the needs of the caravan and camping market. Another large element is free camping where people enjoy the informal opportunities for camping. Built infrastructure such as hotels and motels have developed mainly in Carnarvon, Exmouth and Denham as a result of the needs of commercial travellers and military personnel. Others have
developed at tourist attractions such as Coral Bay, Monkey Mia and Mt Augustus.

9.2 TOURISM DEMAND

In May 1986 a survey of visitors to the Gascoyne Region was carried out as part of the Tourism Development Plan (WA Tourism Commission 1986). Two hundred telephone interviews were completed of visitors who had been in the Region within the previous twelve months. The results indicated that 84.5% were intrastate visitors and the rest were interstate visitors. No international visitors were included in the sample. Groups with two adults only accounted for 55% of the visitors and a low incidence of children in the groups reflected a large percentage of older couples travelling to the Region. The principal reason for travel to the Gascoyne was for holidays (83.6%), followed by business (11.6%) and visiting friends/relatives (4.3%). The Region was the main destination for 57.9% of the visitors, a further 24.6% were travelling through the Region and 17.5% visited as part of a WA or Australian tour.

The majority of visitors were family groups, 94% of whom travelled to the Region by car. Seasonality is an important element in visitation to the Region with the major time being May through to September. The peak month is August and the average duration of stay is eleven days. The most frequently used forms of accommodation used were caravan parks (56%), camping (11%) and hotel/motel (11%). The major attractions visited were North West Cape (29%), Monkey Mia (17%), Carnarvon (15%), Exmouth (12%) and the Blowholes (11%). The reasons for visiting the Region include its pleasant climate (29%), fishing (14%) and as a new
destination (10%). The most popular activities were fishing (61%), swimming (42%), sightseeing (38%) and walking (19%).

The major problems identified within the Gascoyne Region generally relate to the built environment. They include poor road surfaces (16%), low quality accommodation (16%), the length of travel (12%) and lack of fresh water (10%). Other markets not sampled in the survey but identified in the overall study include - free camping, coach tours, special events, visiting friends and relatives, and sporting tours. In addition a large number of potential markets were identified which can be broadly categorised into two segments - adventure travellers and resort stayers.

9.3 TOURISM RESOURCES

The tourist resources of the Region have been described generally as part of an overall regional development review in the Gascoyne Regional Profile (Department of Regional Development and the North West 1988a) and in much greater detail in The Gascoyne Region Tourism Development Plan (WA Tourism Commission 1986). Therefore, they are only briefly reviewed here in relation to climate, attractions, activities, access, infrastructure, information and land tenure.

9.3.1 Climate

The climate of the Gascoyne Region is considered to be one of its major tourist attractions. The climate is moderately tropical and a major feature is the very high number of sunshine days each year. The Region is promoted as 'the sun's winter home' with the cooler months of winter considered the prime months for tourists. The primary climatic drawbacks
for visitors are the very hot summers with temperatures often exceeding
40°C for long periods, and the cyclonic activity which occurs during the
period from January to March.

It is difficult to measure how climate affects human activity and therefore
any index of climate comfort tends to be of a generalised nature. However,
climatic ratings for various outdoor activities have been compiled on a
broad scale for the Commonwealth of Independent States (the former
USSR; Vedenin and Miroshnichenko 1970), Canada (Crowe 1975) and
Australia (Gaffney 1983). In the last study the ratings are based on a
combination of a climate component (cloudiness and rain) and a 'comfort'
component (temperature), each weighted to generalised subjective
estimates of people's perception of suitable weather for a particular
activity. Maps have been drawn for the climatic ratings of both 'passive'
and 'vigorous' outdoor activities (Atlas of Australian Resources 1986).
The ideal weather for passive activities is given as sunny and hot while for
vigorous activities it is fine and cool. The ratings are in three categories:
0-59 poor, 60-69 marginally suitable, 70-100 good.

Ratings for the Gascoyne Region indicate that it has ideal weather for the
more passive activities of swimming, beach-going or sunbathing for three
quarters of the year, during spring, summer and autumn. In winter the
major part of the Region is rated as 'marginally suitable' for passive
activities with the exception of Shark Bay in the south which is rated as
being poor. For more vigorous activities where the ideal weather required
is fine and hot the Gascoyne Region is rated as good during winter. Thus
the Region has ideal weather for passive recreational activities over the
full year.
9.3.2 Attractions

The natural attractions of the Region may be divided into the coastal environment and the outback. The coastal attractions may be further subdivided into three sectors - North West Cape in the north, Carnarvon Coast in the centre and Shark Bay in the south. The main attractions of the northern section are Cape Range, Yardie Creek, Exmouth Gulf, Ningaloo Reef and Coral Bay. These have all been described in more detail in Chapter 7. The central coastal section comprises spectacular coastal scenery of rugged marine cliffs, reefs and offshore islands. Features of this coastline include Red Bluff, Cape Cuvier, Quobba Station, The Blowholes and Gnaraloo Bay. Carnarvon itself is located at the mouth of the Gascoyne River and has a number of scenic attractions. The natural attractions of Shark Bay mainly relate to the marine environment and the recreational opportunities it provides. The bay is protected from the effects of the southerly winds and ocean swell and makes it attractive for recreational fishing and boating. The major attractions in the Bay are the Monkey Mia dolphins which are considered to be of international significance (Raffaele 1989a+b, Fox 1991). Also of significance are the stromatolites, Shell Beach, Freshwater Camp, Big and Little Lagoons and Dirk Hartog Island.

The rugged inland is a vast dry area which is becoming increasingly popular with visitors (Department of Regional Development and the North West 1988a: 19). Of prime importance is Mt Augustus which is claimed as the world's largest monocline. It is twice the size of Ayers Rock and considerably older. The area surrounding Mt Augustus contains a variety of attractions with billabongs (pools) such as Edithana and Cattle Pool, the Lyons River and Centipede Range. The Kennedy Range has
many attractions including escarpments containing abundant wildlife together with creeks and springs. Fossils, gemstones and Aboriginal paintings are other features of the inland.

The few major built attractions in the Region are at or near each of the main townsites. In Exmouth they include the Harold E. Holt Naval Communications Base, Vlaming Head Lighthouse and Cloates Lighthouse. The built attractions of Carnarvon are One Mile Jetty, Lighthouse Museum, The Tropical Agricultural Research Station and 'The Big Dish' - a former satellite communications facility. In Denham a number of buildings are built of blocks of shells from Shell Beach and Freshwater Camp at Nanga Bay contains the Pioneer Homestead Museum. In the inland are a number of historic pastoral homesteads as well as the Bangamal Inn, which was once the terminal of Sir Charles Kingsford-Smith's mail run.

9.3.3 Activities

Recreational activities in the Region are almost entirely related to the marine environment and include fishing, swimming, diving, boating and windsurfing. Fishing is by far the most popular activity and the Region presents some of the best fishing available in Australia (WA Tourism Commission 1986: 15). A wide variety of types of fishing activity include big game, shore-based game, sports, bottom, surf and snapper fishing. There are limited opportunities for the shore-based angler and most fishing is carried out from boats. Snorkelling, diving and boating opportunities exist all along the Gascoyne coast and the Ningaloo Reef in particular provides a full range of opportunities for all three as well as for seashell collecting. Windsurfing is becoming increasingly popular as
opportunities exist along the coast for windsurfers of all abilities. Cape Range and the inland are excellent areas for bushwalking and fossicking for gemstones, gold and fossils. In addition the numerous caves of Cape Range are sought after by speleologists for their opportunities to explore new caverns.

9.3.4 Access

Access into the Region is by either land, sea or air. Roads play a vital part in the economic and social life of the Region and almost all goods, produce and visitors travel into and out of the area by road. Transport between towns is almost exclusively by road. The major transport route is the North West Coastal Highway which links the Region with Perth in the south and Darwin in the north. Other roads link the townships of Exmouth, Gascoyne Junction and Denham. Intertown coach passenger services are conducted by two companies and intraregion coach services are available by charter.

Air services in the Region are centered around the airports at Carnarvon and Learmonth (near Exmouth) and the airstrip at Denham. There is a regular passenger service with daily flights between Perth, Carnarvon and Learmonth. A number of light aircraft landing strips occur throughout the Region and charter services are available. There are no recognised public passenger or cargo ports in the Region although Shark Bay, Carnarvon Harbour and Exmouth Gulf are all used by visiting yachts.
9.3.5 Infrastructure

The Region has a range of tourist infrastructure items including accommodation establishments, camping and boating facilities, as well as food and beverage outlets. Carnarvon is the main accommodation centre accounting for 55% of hotel/motel rooms and 43% of caravan bays. Other major centres are Exmouth, Coral Bay and Denham. There are over 50 accommodation establishments in the Region of varying standards. In the past the overall standard was considered to be fairly low, there was a lack of suitable motel accommodation outside of Carnarvon for coach companies and there were no true resorts (WA Tourism Commission 1986). However, over recent years there has been a marked increase in both the standard and number of accommodation establishments with more either currently being built or proposed. There are 19 caravan parks which are generally of high standard. The only formal camping facilities outside of caravan parks are on several pastoral stations and in Cape Range National Park. There is also a considerable amount of free or informal camping on pastoral properties particularly along the coast. This pressure has led in some cases to a degree of formalisation of tourist infrastructure at Red Bluff and Quobba Station.

With fishing being the most popular tourist activity, boating facilities are a major factor in attracting tourists to the Region. The only facility for larger non-trailerable boats is at Carnarvon in Fishing Boat Harbour. Small jetties exist in Denham and Exmouth and there are a variety of launching ramps scattered throughout the Region. The strongest pressure on these facilities is at Coral Bay where poorly controlled boating traffic is a problem. Food and beverage outlets may be categorised into two basic types: restaurants and hotels, as well as takeways and cafes. The standard
of these facilities has been described as 'average' and there is a need for more facilities of a higher standard (WA Tourism Commission 1986: 19).

9.3.6 Information Services

There are four visitor information centres in the Gascoyne Region consisting of the tourist bureaux located in Carnarvon and Exmouth and two tourist information centres in Denham. Additionally the US Navy at the Harold E. Holt Communications Station operates a travel centre for navy personnel. Signage in the Region relating to major and secondary highways provides information on service facilities and distance between stops. However, signage in the interior is not adequate and often tourists become lost and have to rely on directions from pastoralists.

9.3.7 Land Use and Tenure

The predominant land use in the Region is the pastoral farming of sheep for wool (Figure 15). In 1990 there were 75 leases covering 12 million hectares or 84% of the Region. Around Carnarvon is a thriving banana plantation industry which covers 1000 hectares (Johnston 1989). Mining lease boundaries change frequently but in 1991 there were approximately 400 mining tenements in force covering 1.7 million hectares. The rest of the Region includes national and marine parks and reserves.

9.4 TOURISM SURVEYS

Surveys of Gascoyne residents and tourists were carried out to solicit their opinions on the environment - tourism relationship. The overall aims of the surveys were to investigate both resident and tourist recreational and
touristic activities, experiences and related environmental impacts. In addition their attitudes towards tourism development and environmental conservation in the Region were canvassed. The questionnaires were designed and tested in the Shires of Shark Bay and Exmouth in October 1989 during the peak tourist season. The pilot study was conducted in order to finalize the survey instrument. The questions asked included some with a five point Likert-type scale to determine the respondents attitudes towards statements made about the environment and tourism. Some included a combination of open and closed questions as well as a number of statements with an ordinal scale in order to determine both classification and rank ordering following the suggested methods of Kendall and Kendall (1988). Samples of the finalized questionnaires for residents (Appendix 5) and tourists (Appendix 6) are attached.

Four surveys were made during a sixteen month period from January 1990 to April 1991. They were carried out in February, July and October 1990 and April 1991 so that a representative sample could be made of tourists to the region throughout the year (Table 9). Residents were sampled randomly from areas representative of Gascoyne demographics. This included sampling residents of both the towns and surrounding areas. In the three major towns of Carnarvon, Exmouth and Denham respondents were selected using the technique of surveying one in every two houses using a random starting point. Permission was not granted to sample the residents of the company mining town of Useless Loop and was not sought for the US personnel stationed at the Communications Base at Exmouth as a large number live in the town. Carnarvon's horticultural population and the pastoral residents in each of the three Shires were also sampled using a random sampling technique of surveying one in every two properties. Less than 3% of all residents approached declined to be
<table>
<thead>
<tr>
<th>SHARK BAY</th>
<th>DATE</th>
<th>RESIDENTS</th>
<th>TOURISTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot</td>
<td>October 1989</td>
<td>26</td>
<td>56</td>
</tr>
<tr>
<td>1.</td>
<td>January 1990</td>
<td>34</td>
<td>60</td>
</tr>
<tr>
<td>2.</td>
<td>July 1990</td>
<td>33</td>
<td>57</td>
</tr>
<tr>
<td>3.</td>
<td>October 1990</td>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td>4.</td>
<td>April 1991</td>
<td>17</td>
<td>51</td>
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<tr>
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<th>TOURISTS</th>
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<td>1.</td>
<td>January 1990</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>2.</td>
<td>July 1990</td>
<td>54</td>
<td>57</td>
</tr>
<tr>
<td>3.</td>
<td>October 1990</td>
<td>72</td>
<td>58</td>
</tr>
<tr>
<td>4.</td>
<td>April 1991</td>
<td>80</td>
<td>55</td>
</tr>
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<td>TOTAL (1-4)</td>
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<td>256</td>
<td>230</td>
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<table>
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<th>DATE</th>
<th>RESIDENTS</th>
<th>TOURISTS</th>
</tr>
</thead>
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<td>30</td>
</tr>
<tr>
<td>1.</td>
<td>January 1990</td>
<td>42</td>
<td>35</td>
</tr>
<tr>
<td>2.</td>
<td>July 1990</td>
<td>53</td>
<td>40</td>
</tr>
<tr>
<td>3.</td>
<td>October 1990</td>
<td>59</td>
<td>79</td>
</tr>
<tr>
<td>4.</td>
<td>April 1991</td>
<td>58</td>
<td>82</td>
</tr>
<tr>
<td>TOTAL (1-4)</td>
<td></td>
<td>212</td>
<td>236</td>
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</table>

<table>
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<tr>
<th>GRAND TOTAL</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>577</td>
<td>684</td>
</tr>
</tbody>
</table>
interviewed citing 'ill health' or 'a recent bereavement' as reasons. These 
people were not approached again and therefore did not become part of the 
sample.

Tourists were sampled at predetermined tourist spots identified in the 
Region. These included Monkey Mia in Shark Bay, the Fascine in 
Carnarvon, and Cape Range National Park in Exmouth. Tourists at 
Monkey Mia, the Fascine and in the national park were selected from 
those seated in a chosen area. When each survey was completed the next 
tourist approached for interview was always someone in the nearest seated 
group. On a few occasions the person selected for survey was a resident 
but in every case they were with a tourist who agreed to be surveyed. On 
three occasions tourists selected for interview had already been surveyed 
previously at another location in the Region and so these people were not 
resurveyed. Less than 5% of all tourists approached declined to be 
surveyed, usually due to their 'lack of time' or limited understanding of 
English. In all cases they commended the survey and were disappointed at 
ot being able to take part.

At this point it is emphasized that, like the environmental description, the 
findings of the tourism surveys are only summarized here as more 
detailed results and findings are contained in a large number of papers 
(Frontpiece) and reports (Appendix 1) as well as in a detailed summary 
(Dowling 1992). Therefore what follows represents an abbreviated 
summary of the overall survey findings.

A total of 577 residents were sampled in the 1990-91 surveys in three of the 
Region's four shires (Figure 29). The survey distribution by shire of 
residence is skewed towards Exmouth. However, responses gained from
the other two shires indicate that the overall results are not significantly different and therefore would probably not affect the outcome. Hence it is felt that the findings are valid in indicating general trends. The sample included 321 males and 256 females with a wide range of education levels and occupations. Respondents ranged in age from 14-73 years and had lived in the area for an average of 12.6 years. Their reasons for living there include job opportunities or employment (51%), a desirable place to live (24%), the pleasant climate (15%), being born in the Region (8%) or a desirable place to retire (2%).

The tourist surveys were carried out at Monkey Mia Beach in the Shire of Shark Bay, in Carnarvon Township, and at Cape Range National Park in the Shire of Exmouth. Tourists to the inland and relatively more remote
Shire of Upper Gascoyne were not surveyed. A total of 684 tourists (374 male, 310 female) were sampled (Figure 30). Tourists sampled in the survey were predominantly interstate visitors (70%), the others being either from other parts of Australia or from overseas (Figure 31). Their travel was as a family or group of friends (684 respondents, total visitors 2675) with an average of 3.9 people per group. Half of the tourists were first time visitors (50%). Those who had visited the area before were generally frequent visitors having been more than five times (41%), between 2-4 times (38%) or once only (21%).

Travel to the area was mainly by either private vehicle (48%) or 4WD vehicle (28%). Other modes of transport included commercial bus, campervan, rental vehicle and motorcycle. Few of the respondents to this survey had travelled to the Region by air which normally brings in 13% of the Region's tourists. This is because of the effects of the Australian Pilots' Strike which occurred during the early part of the survey. An emphasis on outdoor camping and tourism is indicated by the respondents having brought along items such as a caravan (38%), tent (29%), boat (16%), trailer or bicycle.

The major market identified in the survey were family groups seeking budget accommodation and outdoor recreation opportunities. A second market are adventure tourists seeking recreational fishing, shooting or 4WD touring either along the coast or in the outback. Another market is retired people, usually husband and wife couples from Perth, who wish to 'winter over' in caravan parks and who spend some time fishing or exploring the outback by 4WD and caravan. A fourth market is the 'Round Australia' traveller who passes through the Region either by 4WD and caravan or by coach tour. A fifth market identified is the resort stayer
Figure 30  Gascoyne Tourists Surveyed

- Male = 374
- Female = 310
- Total = 684

Number of tourists

Age (years)

14-17 18-24 25-39 40-54 55+

Figure 31  Origin of Gascoyne Tourists

- Intrastate: 70%
- Interstate: 17%
- International: 13%
who visits the Region mainly to relax in the sun in comfortable surroundings. A small but growing market is the ecotourist who visits the Gascoyne in order to view the wildlife and landscape. This interest in ecotourism is not confined solely to the last group, as aspects of nature viewing and appreciation attract members of most of the other market groups. Another underlying element which is common to many markets is the desire to see and appreciate aspects of Aboriginal culture. However, the conclusions of discussions by this author with some of the Region's Aboriginal communities suggests that they are not yet ready or willing to be involved in tourism to the extent of some of the communities in the Northern Territory (Altman 1988).

9.4.1 Results

There was strong agreement by both Gascoyne residents (72.9% agree) and tourists (77.7% agree) that the environment in general needs greater protection (Table 10). Although there was a clear call for greater environmental protection in the Region, respondents were split on their views as to whether there should be more national and marine parks. Many thought that there were enough already (45.9%) while others felt that there should be more (31.6%). Respondents who felt that the environment is looked after well stated that this is due to the efforts of local residents, pastoralists and fishermen. Others stated that credit should be given to the CALM, and a few noted that tourists help look after the environment.

A number of specific sites in the Region were suggested as being suitable for environmental protection including some popular tourist destinations. These are Yardie Creek in Cape Range National Park (80%
Table 10  Resident and Tourist Opinions on the Environment -Tourism Relationship

<table>
<thead>
<tr>
<th>Rank</th>
<th>Factor</th>
<th>Residents N=577 Mean %</th>
<th>Tourists N=684 Mean %</th>
<th>Combined N=1261 Mean %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Tourism should be integrated with conservation and land management in the region.</td>
<td>4.068 81.4</td>
<td>4.191 87.7</td>
<td>4.135 84.8</td>
</tr>
<tr>
<td>2.</td>
<td>The environment needs greater protection.</td>
<td>3.944 72.9</td>
<td>4.053 77.7</td>
<td>4.003 75.6</td>
</tr>
<tr>
<td>3.</td>
<td>Tourism developments should be encouraged provided they do not conflict with the environment.</td>
<td>4.037 81.4</td>
<td>3.853 76.8</td>
<td>3.937 78.9</td>
</tr>
<tr>
<td>4.</td>
<td>The economic gains of tourism are just as important as the protection of the environment.</td>
<td>3.357 57.9</td>
<td>3.275 53.5</td>
<td>3.312 55.5</td>
</tr>
<tr>
<td>5.</td>
<td>There should be more national and marine parks and reserves in this region.</td>
<td>3.032 39.2</td>
<td>3.443 51.5</td>
<td>3.255 45.9</td>
</tr>
<tr>
<td>6.</td>
<td>Tourism does not harm the environment.</td>
<td>2.314 27.5</td>
<td>2.713 31.2</td>
<td>2.511 29.3</td>
</tr>
</tbody>
</table>

1. Results represent results from 1261 respondents in the Gascoyne Region during 1990-91
2. Factors are ranked by means of combined values
3. Scale ranges from 1 = strongly disagree to 5 = strongly agree
4. Percent agreeing are those answering 4 or 5.

support), the Blowholes in the Shire of Carnarvon (75%), and Shell Beach in Shark Bay (73%). Shark Bay respondents supported the recently established parks and reserves and also suggested that the Monkey Mia Reserve needs further protection. To achieve this aim they seek a sanctuary zone around it combined with a daily quota of tourists during the peak season. Other areas singled out for protection include Shell Beach, Hamelin Pool, Dirk Hartog Island and Edel Land.

Carnarvon respondents suggested that the main areas for protection are the coastline (especially the coastal dunes) and the Gascoyne River (especially the river pools and the mangrove creeks). Specific areas nominated for environmental protection are The Blowholes, One Mile
Jetty, Coral Bay, Rocky Pool, Pelican Point, the Fascine and the Wooramel River. A small number of respondents felt that Coral Bay had reached saturation point regarding tourism and that the bay should be used for the landing of boats, with permanent moorings being revoked.

Of the three shires sampled Exmouth respondents showed the least support for more national and marine parks and reserves (28.3%). This is largely due to the close proximity to the town of both Cape Range National Park and Ningaloo Marine Park. Respondents indicated a preference for the road from Exmouth to Yardie Creek to be left unsealed in order to protect the Region's wildlife and natural character. Specific areas suggested for protection include Yardie Creek, the canyons and gorges, Bundegi Reef, the West side of the Cape, the Muiron Islands and Vlaming Head.

Those who felt that there were enough national and marine parks and reserves in the Region already noted the many existing parks and reserves including the recently created Shark Bay Marine Park, Francois Peron National Park and Hamelin Pool Marine Reserve. Also at the time of the surveys there were proposals by the Federal Government to nominate Shark Bay in the southern part of the Region as a World Heritage Area. This caused consternation amongst the local residents who thought that they were losing a certain degree of autonomy over the area. At one fiery public meeting held on the issue, 299 residents out of the 300 present voted against the World Heritage proposal (Chubb 1988) suggesting instead the implementation of the State generated Shark Bay Region Plan (SPC and CALM 1988).
Those who felt there were already a sufficient number of parks and reserves suggested that the real issue was not a question of more parks but rather one of greater protection of the existing ones. A large number of respondents suggested the need for more on-site management by increasing the number of park rangers (by CALM) and fisheries inspectors (WA Department of Fisheries). Others suggested the establishment of a public environmental awareness program with increased interpretive information in the form of leaflets and signs.

Residents and tourists agreed that the economic gains of tourism are just as important as the protection of the environment (55.5%). This view is more strongly supported in Carnarvon (63%) than in either Exmouth (55%) or Shark Bay (45%) because other industries are more predominant. Residents strongly supported tourism in the Gascoyne Region (Table 11). They indicated that tourists do not diminish their enjoyment of the area (60.7%). Most have considerable contact with tourists either directly through their job or as guests in their home (Figure 32). For other residents their relationship with tourists is either limited to contact in public places or is reasonably little or none at all. Residents also agreed that tourism is not a burden on local services. However, some felt that there is a burden placed on the community by tourists (23.0%) especially in relation to police, medical services and water supplies. Other problems stated include the increase in litter as well as congestion both in towns and at key recreational facilities such as boat ramps.

Residents agreed that tourism generates more money for the local people than other commercial activities (68.8%). They felt that economic benefits for the local community are generated 'more evenly' than pastoralism, commercial fishing or mining. Others added that the economic future of
### Table 11  Resident Opinions on Tourism

<table>
<thead>
<tr>
<th>Rank</th>
<th>Factors</th>
<th>Mean</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Tourism in the Gascoyne Region is based on its natural resources.</td>
<td>4.157</td>
<td>88.0</td>
</tr>
<tr>
<td>2.</td>
<td>Tourism generates more money for the local people than other</td>
<td>3.824</td>
<td>68.8</td>
</tr>
<tr>
<td></td>
<td>commercial activities.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Tourists do not diminish my enjoyment of the area.</td>
<td>3.503</td>
<td>60.7</td>
</tr>
<tr>
<td>4.</td>
<td>The environment of the region is well looked after.</td>
<td>3.223</td>
<td>46.4</td>
</tr>
<tr>
<td>5.</td>
<td>Tourism is a burden on local services.</td>
<td>2.370</td>
<td>23.0</td>
</tr>
</tbody>
</table>

1. Results represent responses from 577 residents in the Gascoyne Region during 1990-91
2. Factors are ranked by means of values
3. Scale ranges from 1 = strongly disagree to 5 = strongly agree
4. Percent agreeing are those answering 4 or 5.

### Figure 32  Resident Contact With Tourists

- 40% Through job
- 33% In public
- 14% Home guests
- 13% Little or none
the Region is closely tied to tourism, however, those who disagree (12.5%) stated that economic benefits are derived for only a relatively few people, mostly the towns' business people, and that tourism pushed up the cost of living for locals. Residents also stated unequivocally that tourism in their Region is based on its natural resources (88.0%), however, a lesser number believed the Region's environment was well looked after (46.4% agree, 23.2% disagree).

Of the four major commercial activities in the area both the residents and tourists agreed that the most environmentally compatible one is tourism (73.3% agree) ahead of pastoralism (58.6%), commercial fishing (57.6%) and mining (26.5%; Figure 33). Respondents point to overfishing, pastoral overstocking and the possibility of oil spills as reasons for incompatibility. Overall the residents viewed the activities as having a higher level of compatibility than the tourists and they also differed in their second preference by scoring fishing ahead of pastoralism. This is understandable as the livelihood of more people in the Region is dependent on this commercial activity. Tourism is supported provided adequate planning is invoked and on-site management provided.

The residents considered the main attractions of the Region to be the pleasant climate (79% agree), the opportunities for fishing (72%) and the relaxed lifestyle (66%). Others noted include the dolphins of Monkey Mia, the beaches, the marine parks and national parks. A lesser number include the Region's remoteness and wildlife watching. Specific recreational areas in each shire preferred by residents included Shark Bay - Monkey Mia, Little Lagoon and Eagle Bluff; Carnarvon - the Blowholes, Pelican Point and the Fascine; Exmouth - the Gulf Beaches, Vlaming Lighthouse and Ningaloo Marine Park. Gascoyne tourists also considered
the Region's pleasant climate to be its primary attraction (81%). Others include fishing (61%), the beaches (54%) and the dolphins of Monkey Mia (54%). The top twenty attractions visited by tourists are located throughout the Region. They include the dolphins of Monkey Mia, the natural coastal features of Bundegi Reef and Coral Bay, as well as the towns of Carnarvon, Exmouth and Denham.

Most of the residents' recreational activities take place in the outdoor marine environment. The most popular ones are fishing, swimming and sailing. Recreational activities undertaken by tourists in the Region also occur mainly on the coastline (Table 12). They include relaxing (87% of all tourists), sightseeing (84%), walking (69%) and wildlife watching (64%). Others include swimming, fishing, boating, whale and turtle watching, as well as off-road driving. Recreational activities favoured by a minority
### Table 12 Preferred Tourist Recreational Activities

<table>
<thead>
<tr>
<th>RANK²</th>
<th>ACTIVITY</th>
<th>DISTRIBUTION³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SB</td>
</tr>
<tr>
<td>1</td>
<td>Relaxing</td>
<td>205</td>
</tr>
<tr>
<td>2</td>
<td>Sightseeing</td>
<td>182</td>
</tr>
<tr>
<td>3</td>
<td>Walking</td>
<td>149</td>
</tr>
<tr>
<td>4</td>
<td>Wildlife watching</td>
<td>197</td>
</tr>
<tr>
<td>5</td>
<td>Swimming</td>
<td>149</td>
</tr>
<tr>
<td>6</td>
<td>Fishing</td>
<td>103</td>
</tr>
<tr>
<td>7</td>
<td>Boating</td>
<td>69</td>
</tr>
<tr>
<td>8</td>
<td>Whale watching</td>
<td>---</td>
</tr>
<tr>
<td>9</td>
<td>Off road driving</td>
<td>33</td>
</tr>
<tr>
<td>10</td>
<td>Turtle watching</td>
<td>---</td>
</tr>
<tr>
<td>11</td>
<td>Bird watching</td>
<td>28</td>
</tr>
<tr>
<td>12</td>
<td>Bush walking</td>
<td>14</td>
</tr>
<tr>
<td>13</td>
<td>Snorkelling</td>
<td>5</td>
</tr>
<tr>
<td>14</td>
<td>Cycling</td>
<td>19</td>
</tr>
<tr>
<td>15</td>
<td>Diving</td>
<td>0</td>
</tr>
<tr>
<td>16</td>
<td>Surfing</td>
<td>6</td>
</tr>
<tr>
<td>17</td>
<td>Sea-shell collecting</td>
<td>4</td>
</tr>
<tr>
<td>18</td>
<td>Scuba diving</td>
<td>3</td>
</tr>
<tr>
<td>19</td>
<td>Canoeing</td>
<td>2</td>
</tr>
<tr>
<td>20</td>
<td>Water skiing</td>
<td>0</td>
</tr>
</tbody>
</table>

1. Results represent responses from 684 tourists.
2. Activities are ranked by percentage of responses.
4. Whale and turtle watching surveyed only in Exmouth.

Included bush walking, snorkelling, cycling, diving, surfing, seashell collecting and scuba-diving.

Both residents and tourists gave a low level of support to the statement that tourism does not harm the environment (29.3%; Table 10). They suggested that the effects of a number of regional activities associated with recreation and tourism are environmentally harmful. These include littering (74%), overfishing (39%) and undersized fishing (37%), disturbance to and/or destruction of landforms, fauna and flora, as well as noise and water pollution. Many of these activities are ascribed to tourists...
rather than residents (Table 13). Those causing the litter are suggested to be campers and fishermen littering the bays, reefs and beaches with decapitated fish, offal, plastic bait bags and fish hooks. However, Carnarvon residents in particular aportion most of the blame for unsightly litter in their shire to other members of the community.

Other areas noted for their litter are the roadside verges which are suggested as being strewn with a whole host of items including glass, tins, plastic and other rubbish. Camping sites and roadside rest areas are also identified as attracting litter some of which is human excrement. Suggestions to overcome this despoilation of the countryside include the need for more bins especially at rest areas and camping sites, more shire litter officers, banning of the sale of non-returnable drink bottles, more anti-litter signs and a program of public awareness.

The second most mentioned regional recreational and touristic activity suggested as causing harm to the environment is overfishing and undersized fishing. Those against these detrimental activities especially single out 'net' and 'trap' fishing as well as the overuse of portable freezers to take fillets out of the region. Like the litter problem the respondents attributed most of the blame to the tourists. Reasons suggested for this include net-fishing from beaches, taking fish out of season, disregard for bag limits, and ignorance of the laws. Suggestions for reducing the problems include the need for more fisheries inspectors, education, a ban on freezers and more stringent bag limits.

The third most noted harmful suite of activities was the disturbance of sand dunes (29%), the destruction of vegetation (27%) and the disturbance of wildlife (21%). These are caused mainly by 4WD vehicles near the
Table 13 Resident and Tourist Opinions on the Effects of Adverse Environmental Activities

<table>
<thead>
<tr>
<th>Rank</th>
<th>Effect of Activity</th>
<th>Total</th>
<th>CBT³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Residents Percent</td>
<td>Tourists Percent</td>
<td>Both Percent</td>
</tr>
<tr>
<td>1</td>
<td>Litter</td>
<td>84</td>
<td>66</td>
</tr>
<tr>
<td>2</td>
<td>Overfishing</td>
<td>55</td>
<td>35</td>
</tr>
<tr>
<td>3</td>
<td>Undersized fishing</td>
<td>54</td>
<td>29</td>
</tr>
<tr>
<td>4</td>
<td>Disturbance of sand dunes</td>
<td>35</td>
<td>25</td>
</tr>
<tr>
<td>5</td>
<td>Destruction of vegetation</td>
<td>31</td>
<td>24</td>
</tr>
<tr>
<td>6</td>
<td>Disturbance of wildlife</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>7</td>
<td>Anchor damage to reef</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>8</td>
<td>Noise pollution</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>9</td>
<td>Water pollution</td>
<td>16</td>
<td>11</td>
</tr>
</tbody>
</table>

1. Results represent responses from 577 residents and 684 tourists in the Gascoyne Region during 1990-91
2. Impacts are ranked by mean resident and tourist percent responses
3. CBT = Activity or impact believed to be Caused By Tourists
4. Mean percentage of both residents and tourists responses.

Beaches and popular camp sites. Another concern is the removal of vegetation for firewood especially along the coastal strip from Carnarvon to Yardie Creek. Those who mentioned the disturbance of wildlife particularly note the killing of kangaroos and emus by motor vehicles, the disturbance of sea-life such as whales and dugongs by boats, the disturbance of turtles at Turtle Bay during the laying season, and the collection and removal of seashells (especially cowrie shells). Suggestions to reduce the incidence of adverse environmental impacts include more on-site management in national parks, interpretive information and environmental education.

Another environmental impact noted by respondents is the overcrowding at Monkey Mia by tourists watching the dolphins. It is suggested that this creates an undesirable social experience for the viewers as well as added stress for the dolphins. Other impacts considered to be adverse include the
damage to reefs caused by boat anchors and water pollution. These are attributed to motorized boats in the marine parks (especially at Coral Bay) and some creeks.

Noise pollution caused by tourist related activities was also noted as adversely affecting the Region. Aircraft noise in Carnarvon was attributed to the airport being too close to tourist accommodation. A few respondents also added that they felt that the airport, with its attendant noise problems and possible accidents, is located too close to the town's schools and hospital. Especially singled out was a hovercraft which transports tourists from Carnarvon to Monkey Mia. Respondents suggested that its particularly loud 'aircraft-type' engine disturbs marine, terrestrial and bird life in Shark Bay as well as creating unacceptable noise pollution for tourists who have come to the area primarily to enjoy the tranquillity of the natural environment. Suggestions made to overcome these activities included the need for stricter enforcement of existing laws and the provision of new ones where required.

A number of environmentally appropriate tourism activities were suggested for the Region (Table 14). These are photographic tours, fishing, camping and diving. Others are also sanctioned, especially activities which can be controlled by responsible operators. Uncontrolled activities associated with the indiscriminate use of 4WD vehicles were not supported. Adverse impacts attributed to the misuse of these vehicles is already well documented (eg. Crozier et al. 1977, Kay 1980; Slaughter et al. 1990).

Respondents agreed that tourism developments should be encouraged provided they do not conflict with the environment (78.9%; Table 10).
Table 14 Resident and Tourist Opinions on Environmentally Compatible Activities

<table>
<thead>
<tr>
<th>Rank</th>
<th>Activity</th>
<th>Residents %</th>
<th>Tourists %</th>
<th>Combined %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Rank</td>
<td>Rank</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Photographic Tours</td>
<td>82</td>
<td>78</td>
<td>80</td>
</tr>
<tr>
<td>2</td>
<td>Fishing</td>
<td>71</td>
<td>63</td>
<td>67</td>
</tr>
<tr>
<td>3</td>
<td>Camping</td>
<td>63</td>
<td>66</td>
<td>65</td>
</tr>
<tr>
<td>4</td>
<td>Diving</td>
<td>70</td>
<td>59</td>
<td>64</td>
</tr>
<tr>
<td>5</td>
<td>Windsurfing</td>
<td>65</td>
<td>52</td>
<td>61</td>
</tr>
<tr>
<td>6</td>
<td>Cycling</td>
<td>67</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>7</td>
<td>Canoeing</td>
<td>49</td>
<td>58</td>
<td>59</td>
</tr>
<tr>
<td>8</td>
<td>Boating</td>
<td>61</td>
<td>57</td>
<td>58</td>
</tr>
<tr>
<td>9</td>
<td>Yachting</td>
<td>67</td>
<td>49</td>
<td>56</td>
</tr>
<tr>
<td>10</td>
<td>Heritage Trails</td>
<td>60</td>
<td>51</td>
<td>55</td>
</tr>
<tr>
<td>11</td>
<td>Wildlife Tours</td>
<td>52</td>
<td>56</td>
<td>54</td>
</tr>
<tr>
<td>12</td>
<td>4WD Tours</td>
<td>38</td>
<td>30</td>
<td>34</td>
</tr>
</tbody>
</table>

1. Results represent responses from 577 residents and 684 tourists in the Gascoyne Region during 1990-91.
2. Activities are ranked by number of responses.
3. Response as a percentage of total respondents.
4. Mean percentage of resident and tourist responses.

Many suggested that it is important to ensure that the regional environmental character and social fabric should not be destroyed by tourism. Low-key tourist developments are preferred (78%). Suggestions include more camping and caravaning facilities especially outside the national parks, more boat launching ramps and moderately priced tourist accommodation. Also advocated is the need for tourist developments to blend in with their surroundings. Marinas (16%) are preferred to resorts (12%) but large scale tourist developments received very little support (6%). It was also advocated that such developments should be concentrated in existing developed areas to ensure that environmental impacts are minimized. This lends support to a similar suggestion recently made by the State's tourism and environmental departments (WATC/EPA 1989a).
A number of specific areas suggested by respondents for tourism development include the main towns of Denham, Carnarvon and Exmouth, as well as the secondary areas of Nanga Bay - a pastoral station which has established a thriving tourism industry, Monkey Mia - the home of the dolphins in Shark Bay, and Yardie Creek - also designated as a site for environmental protection. Other suggestions include the opening of an all-weather road up the coast from Carnarvon to Yardie Creek, a high level bridge over the Gascoyne River (so that residents and tourists are not cut off from the North during times of flood), as well as the establishment of Aboriginal arts and crafts workshops and retail outlets. A minority felt that there should be no further regional tourism development at all (7%).

The statement which was the most agreed upon by both residents (81.4%) and tourists (87.7%) was that tourism should be integrated with conservation and land management in the Region (Table 10). One respondent comments that 'tourism development is inevitable so it needs to be controlled and directed with careful negotiation by both local Shire authorities and State departments such as CALM'. Therefore it is evident that CALM should have a larger degree of input into the future planning and management of environmentally related tourism activities and developments. This should ensure that the concept of sustainable development is applied in the Region allowing tourism to grow and environmental conservation and protection to be achieved.

9.4.2 Discussion

The Gascoyne case study findings are consistent with many of those of earlier surveys on resident views of the environment - tourism relationship (eg. Liu et al. 1987, Schlüter and Var 1988; Table 15).
### Table 15 Residents' Perceptions on the Environment - Tourism Relationship in Selected Studies

<table>
<thead>
<tr>
<th>Statement</th>
<th>Hawaii¹</th>
<th>Wales¹</th>
<th>Turkey¹</th>
<th>Argen²</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Positive Impacts</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creates more parks for local residents</td>
<td>51.3</td>
<td>65.0</td>
<td>76.4</td>
<td></td>
</tr>
<tr>
<td>Has not contributed to environ. decline</td>
<td>49.6</td>
<td>56.5</td>
<td>45.6</td>
<td></td>
</tr>
<tr>
<td>Helps protect areas built environment</td>
<td>47.5</td>
<td>50.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Helps protect areas historic building</td>
<td></td>
<td></td>
<td>86.8</td>
<td></td>
</tr>
<tr>
<td><strong>Negative Impacts</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increases littering</td>
<td>51.7</td>
<td>84.9</td>
<td>97.0</td>
<td></td>
</tr>
<tr>
<td>Increases traffic problems</td>
<td>47.9</td>
<td>98.1</td>
<td>87.9</td>
<td></td>
</tr>
<tr>
<td>Increases congestion in parks etc.</td>
<td>38.0</td>
<td>45.3</td>
<td>49.0</td>
<td></td>
</tr>
<tr>
<td>Increases congestion in shopping centres</td>
<td>41.4</td>
<td>44.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increases vandalism</td>
<td>43.1</td>
<td>50.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increases noise pollution</td>
<td>12.7</td>
<td>30.4</td>
<td>63.6</td>
<td></td>
</tr>
<tr>
<td><strong>General</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long term planning can control impacts of tourism on the environment</td>
<td>90.4</td>
<td>66.9</td>
<td>[85.4]³</td>
<td>87.5</td>
</tr>
<tr>
<td>A lower standard of living is worth the cost of environmental protection</td>
<td>41.2</td>
<td>58.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>More money should be spent on envir. protection than tourism promotion</td>
<td>61.7</td>
<td>62.3</td>
<td>54.7</td>
<td></td>
</tr>
</tbody>
</table>

**NOTES**

1. Hawaii, USA; North Wales; and Istanbul, Turkey - after Liu *et al.* (1987)
2. Argentina - adapted from Schlüter and Var (1988)
3. Square brackets indicates an answer to a similar statement

However, in some it has been divergent. In addition the inclusion of tourists in the survey has allowed for a direct comparison of host-visitor views. Examination of the findings confirms the earlier ones that residents perceive tourism as improving the local economy and not
causing a burden on local services. This latter view is also endorsed by their belief that tourism does not diminish their enjoyment of the area. Their agreement with the statement that 'the economic gains of tourism are just as important as the protection of the environment' concurs with the earlier findings that they do not wish to see their standard of living drop in order to obtain increased environmental protection. Gascoyne residents do not share the view that tourism helps protect the environment (27.5% agree; previous studies 51.4%) and they strongly support the increased protection of the environment. However, the survey confirms the previous findings that there are a number of negative environmental impacts caused by tourism. Littering is cited as the foremost problem but the residents take a lot of the blame for it themselves. When asked if it is caused by tourists the residents only rank it fifth out of nine cited adverse environmental impacts. This view is similar to those of the Istanbul residents who strongly agree with the statement that residents litter more than the tourists (90.0%; 2nd out of eight statements).

In terms of planning and management the Gascoyne survey is in accord with the previous findings that long term planning can control the impacts of tourism on the environment (81.4% agree). The support for this statement was the highest overall and is very similar to that of the previous four surveys (83.6%). Gascoyne residents also believe that tourism developments should be encouraged providing they do not conflict with the environment (81.4%). Whilst the residents were not asked if tourism creates more parks for themselves, they did not give a high level of support to the suggestion to add more parks to the Region (39.2%). It is argued that this is due to the large number of existing and proposed parks and reserves in the Region.
The added dimension of the Gascoyne study is the inclusion of tourists in the survey. In most cases where statements were asked of both residents and tourists, the latter group generally had a higher level of agreement. Thus they more strongly endorsed the need for greater environmental protection (tourists \( t = 77.7\% \) agree, residents \( r = 72.9\% \)) as well as the need for more parks (\( t = 51.5\%, \; r = 39.2\% \)). However, while they gave greater support than residents to the notion that tourism does not harm the environment (\( t = 31.2\%, \; r = 27.5\% \)) they were less supportive of the economic gains of tourism being just as important as the protection of the environment (\( t = 53.5\%, \; r = 57.9\% \)). Therefore, it can be argued that while the overall levels of support for environment protection and tourism development are similar between residents and tourists, the residents have a higher level of support for tourism development while the tourists give greater support to environmental protection.

The above findings are similar to those of a recent study on the differences in attitude between differing use groups of park land in Canada (Saremba and Gill 1991). The study was conducted in British Columbia and focussed on examining the attitudinal views of local residents of the Whistler Mountain resort compared to those of users from the nearby city of Vancouver, in regard to the recreational use of park land adjacent to the resort. The findings indicate that the local residents favoured the development of the area whilst the Vancouver residents (that is, the Whistler tourists) gave greater support to the preservation of the area. The local residents view the park land as a resource with utility largely because their livelihoods are derived either directly or indirectly from tourism based on the recreational use of the region. However, for the Vancouver residents the highest utility of the region lies in its accessibility for backcountry recreation and wilderness experiences - hence their
support for its preservation. The Gascoyne findings support these Canadian views. These findings provide an interesting contrast with an earlier survey of Florida residents which uncovered a strong anti-tourism, anti-growth segment in the state prompting the researchers to propose that the state government devote a portion of its tourism promotion efforts toward community education on the benefits of tourism (Davis et al. 1988).

9.5 TOURISM ASSESSMENT

The tourism assessment aims to identify valued tourism resources. This is carried out by surveys of resident and tourist opinions, the classification of tourism categories as well as the selection, evaluation and mapping of tourism resources into clusters, corridors and service areas. Following the general regional tourism description, the findings are interpreted into a more meaningful form by the assessment of tourism significance carried out by the evaluation of tourism resources. The most common criteria are attractions, existing facilities, accessibility, land tenure, climate and physical conditions (Pearce 1989). Sometimes other factors are considered such as the availability of regional development incentives or carrying capacity considerations. Inherent linkages often exist between criteria such as climate and attractions or accessibility and attractions (Pearce 1989), or among existing facilities, accessibility and attractions. Criteria chosen for the EBT methodology include aspects of tourist attractions, services and accessibility. These are derived from determination of natural and cultural attractions, outdoor recreation opportunities, availability of accommodation and transport access.

The criterion of attractions is evaluated by tourist opinions, resident opinions and mentions in guidebooks. Both general and specific
attractions were taken into consideration for example, general characteristics such as pleasant climate, beaches and fishing were surveyed as well as specific and localised attractions related to a well determined place, for example, the Monkey Mia dolphins, the Blowholes and Mt Augustus.

9.5.1 Attractions

The assessment of tourist attractions in the Region involved the inclusion of tourist and resident opinions (taken during the surveys) as well as the numbers of mentions in guidebooks as a surrogate for industry and/or managerial opinion. Almost one hundred attractions were listed and ordered then combined with those noted by the tourists and residents. By combining and averaging all three views an overall index of attraction was gained for each site.

Since the questionnaires were designed on the basis of local or shire attractions and also because the sample sizes were not only different in each area but different in the number of residents and tourists surveyed, the number of responses to each attraction category was indicated as a percentage preference. This was further reduced to a scale of 1 to 10 and taken as an index of either tourist or resident demand. For example, a tourist preference score for an attraction might be 75 out of 100 samples. This is converted to a percentage, for instance 75%, which then becomes an index of 7.5. In order to determine supply each attraction was also evaluated according to how many tourist guidebooks it was reported in. Using regional, state and national tourist guidebooks all major features and attractions were inventoried and rated according to the number of books which reported it. The guidebooks chosen included five national
guidebooks of Australia, one state guide, three guides to WA's northwest and an industry magazine special issue on the Gascoyne Region (Appendix 7). An outstanding feature mentioned in all of the books would receive the full value of its category whereas another attraction, reported by only one or two books, would receive proportionally less.

Therefore an overall index of attraction of a particular tourist feature would be:

\[ I_y = \frac{\sum (T+R+G)}{3} \]

where:

- \( I \) = Index of Attraction of site \( y \)
- \( T \) = Tourist index
- \( R \) = Resident index
- \( G \) = Guidebook index.

The top thirty-two attractions visited are scattered all over the Region's four Shires. They include fourteen in the Shire of Carnarvon, eight each in the Shires of Shark Bay and Exmouth, and two in the Upper Gascoyne (Table 16). Of these the top six attractions visited by tourists are the dolphins of Monkey Mia, the natural coastal features of The Blowholes and Ningaloo Reef, as well as the towns of Carnarvon, Exmouth and Denham.

Once combined and ranked only those attractions which scored on all three surveys were kept for the final ranking of scores from 1-10. This final rating and ranking was then further divided into preference categories of moderate, moderately-high and high tourism significance (Table 16) and then illustrated by map (Figure 34).
### Table 16 Ranking of Tourist Attractions

<table>
<thead>
<tr>
<th>ATTRACTION</th>
<th>SHIRE²</th>
<th>GB</th>
<th>RES</th>
<th>TOU</th>
<th>AV³</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. MODERATE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B discerned and Dorré Is.</td>
<td>CA</td>
<td>5.0</td>
<td>2.7</td>
<td>1.5</td>
<td>3.1</td>
</tr>
<tr>
<td>OTC 'Big Dish'</td>
<td>CA</td>
<td>4.0</td>
<td>2.8</td>
<td>3.7</td>
<td>3.5</td>
</tr>
<tr>
<td>Lake MacLeod</td>
<td>CA</td>
<td>6.0</td>
<td>2.8</td>
<td>2.1</td>
<td>3.6</td>
</tr>
<tr>
<td>HEH Base</td>
<td>EX</td>
<td>4.0</td>
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<td>3.5</td>
<td>3.8</td>
</tr>
<tr>
<td>Hamelin Pool</td>
<td>SB</td>
<td>6.0</td>
<td>2.8</td>
<td>3.9</td>
<td>4.2</td>
</tr>
<tr>
<td>Nanga Bay</td>
<td>SB</td>
<td>6.0</td>
<td>4.2</td>
<td>3.3</td>
<td>4.5</td>
</tr>
<tr>
<td>Kennedy Range</td>
<td>UG</td>
<td>5.0</td>
<td>5.4</td>
<td>3.9</td>
<td>4.8</td>
</tr>
<tr>
<td><strong>2. MODERATELY-HIGH</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canyons and Gorges</td>
<td>EX</td>
<td>5.0</td>
<td>7.3</td>
<td>3.0</td>
<td>5.1</td>
</tr>
<tr>
<td>Milyering Centre</td>
<td>EX</td>
<td>4.0</td>
<td>4.2</td>
<td>6.8</td>
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</tr>
<tr>
<td>Eagle Bluff</td>
<td>SB</td>
<td>5.0</td>
<td>6.4</td>
<td>4.0</td>
<td>5.1</td>
</tr>
<tr>
<td>Mt. Augustus</td>
<td>UG</td>
<td>6.0</td>
<td>5.6</td>
<td>4.2</td>
<td>5.3</td>
</tr>
<tr>
<td>The Fascine</td>
<td>CA</td>
<td>4.0</td>
<td>7.8</td>
<td>5.4</td>
<td>5.7</td>
</tr>
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<td>Little Lagoon</td>
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<td>3.0</td>
<td>7.7</td>
<td>6.6</td>
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</tr>
<tr>
<td>Bundegi Reef</td>
<td>EX</td>
<td>2.0</td>
<td>7.2</td>
<td>8.5</td>
<td>5.9</td>
</tr>
<tr>
<td>The Plantations</td>
<td>CA</td>
<td>4.0</td>
<td>7.0</td>
<td>6.7</td>
<td>5.9</td>
</tr>
<tr>
<td>Peron Peninsula</td>
<td>SB</td>
<td>4.0</td>
<td>8.1</td>
<td>5.8</td>
<td>6.0</td>
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<td>8.1</td>
<td>5.8</td>
<td>6.0</td>
</tr>
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<td>Gascoyne River</td>
<td>CA</td>
<td>6.0</td>
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</tr>
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<td>SB</td>
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<td>6.9</td>
<td>6.4</td>
</tr>
<tr>
<td>Vlaming Lighthouse</td>
<td>EX</td>
<td>4.0</td>
<td>7.6</td>
<td>8.1</td>
<td>6.6</td>
</tr>
<tr>
<td>One Mile Jetty</td>
<td>CA</td>
<td>6.0</td>
<td>7.1</td>
<td>7.1</td>
<td>6.7</td>
</tr>
<tr>
<td>Yardie Creek</td>
<td>EX</td>
<td>6.0</td>
<td>6.8</td>
<td>7.8</td>
<td>6.9</td>
</tr>
<tr>
<td><strong>3. HIGH</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Coral Bay</td>
<td>CA</td>
<td>9.0</td>
<td>7.2</td>
<td>4.8</td>
<td>7.0</td>
</tr>
<tr>
<td>Cape Range N.P.</td>
<td>EX</td>
<td>9.0</td>
<td>7.0</td>
<td>5.3</td>
<td>7.1</td>
</tr>
<tr>
<td>Exmouth</td>
<td>EX</td>
<td>9.0</td>
<td>7.4</td>
<td>5.7</td>
<td>7.4</td>
</tr>
<tr>
<td>Denham</td>
<td>SB</td>
<td>10.0</td>
<td>5.3</td>
<td>8.8</td>
<td>8.0</td>
</tr>
<tr>
<td>Ningaloo Reef</td>
<td>EX</td>
<td>9.0</td>
<td>7.4</td>
<td>8.1</td>
<td>8.2</td>
</tr>
<tr>
<td>The Blowholes</td>
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<td>7.0</td>
<td>9.2</td>
<td>8.6</td>
<td>8.3</td>
</tr>
<tr>
<td>Carnarvon</td>
<td>CA</td>
<td>9.0</td>
<td>7.2</td>
<td>8.8</td>
<td>9.0</td>
</tr>
<tr>
<td>Monkey Mia</td>
<td>SB</td>
<td>10.0</td>
<td>8.1</td>
<td>9.1</td>
<td>9.1</td>
</tr>
</tbody>
</table>

### NOTES

1. Results represent mentions in 10 guidebooks (GB) as well as % responses of 577 residents (RES) and 684 tourists (TOU). Each is reduced to a score on an index of 0-10. Attractions have scored on all three categories to be included in this final list.

2. Shires - CA = Carnarvon, EX = Exmouth and SB = Shark Bay.

3. Areas ranked by averaged number of responses (AV) into moderate (0<4.9), moderately-high (5.0<6.9) and high (≥7.0) categories.
Figure 34  Attractions
9.5.2 Accommodation

The second criterion of accommodation was assessed according to the available number of bed spaces or camping sites. Data was gained from a touring and accommodation guide (Royal Automobile Club of WA 1991) as well as tourist pamphlets and brochures of the Region. Information gained from these sources was then crosschecked by either face-to-face discussion with the owners/managers during field surveys, or by correspondence. Once the number of bed spaces and/or camping sites had been compiled for each accommodation site they were then ranked for each locality. The highest number of available spaces and sites was in Carnarvon (2260) followed by Exmouth (1823), Denham (902) and Coral Bay (548). Monkey Mia (298) and Nanga Bay (238) were the only other major accommodation sites in the Region, the rest being either wayside motels on touring routes or small-scale accommodation on outback stations. The data was then reclassified into categories of tourism significance or 'potential status' because at present they do not meet the minimum criteria. The sites of accommodation significance were then mapped (Figure 35).

9.5.3 Access

Physical access to existing and potential tourist attractions and services was assessed by surveys of topographic and touring maps. The maps used included the 1:1 million International Maps of the World for the Region consisting of SF49 - Cloates, SF50 - Hamersley Range, SG49 - Carnarvon and SG50 - Meekatharra. These were then cross-checked with maps of the 1:250 000 scale National Topographic Map Series. In addition, information was gained from Royal Automobile Club maps covering the Region and
Figure 35  Accommodation
an inventory was then made of all regional state and national roads, ports and airports. Following the EBT methodology a list was compiled of all access routes and points, ratings were applied and then ranked and mapped according to three levels of significance (Figure 36).

9.6 VALUED TOURISM COMPONENTS

Once the individual assessments were made for the Gascoyne's attractions, accommodation and access they were then integrated by map overlay to indicate the valued tourism components of the Region (Figure 37). Summary classes of moderate, moderately-high and high tourism significance were supplemented by a fourth one of 'outstanding' tourism significance for sites of international import.

The main areas of significance lie along the coastal strip with concentrations around North West Cape in the north and Peron Peninsula in the south. The northern node of North West Cape is a large area of high tourism significance. The major attraction is the Cape Range/Ningaloo Reef interface which has support facilities in the town of Exmouth nearby. The southern node of Peron Penninsula is the only area in the Gascoyne Region which is of outstanding tourism significance. The wild dolphins of Monkey Mia constitute the major attraction of the Region and is complemented by the natural attractions of Peron Peninsula and Shell Beach. This destination is supported by limited on-site facilities as well as those in the nearby town of Denham.

Lying between these two major tourist nodes on the coastal Gascoyne is the Region's main town of Carnarvon and its nearby attractions. The main attraction cluster in Carnarvon consists of a combination of natural
Figure 36  Access
Figure 37  Overall Tourism Significance
and built features. There are also two touring corridors which exit the
destination zone. These are the inland road to Rocky Pool and the coastal
road to the Blowholes. The former route continues into the inland to the
service town of Gascoyne Junction and the interior's main attractions of
the Kennedy Ranges and Mt Augustus. The latter route forms the major
touring route leaving Carnarvon and includes the Blowholes, Quobba, the
HMAS Sydney II Memorial, Cape Cuvier, the Korean Star Shipwreck, Red
Bluff and Gnaraloo Station.
Chapter 10  The Region Plan

Once a quiet backwater, this extraordinarily beautiful region is fast becoming WA's premier destination.

Raffaele 1989a: 55

The previous three chapters have described and assessed the environmental and tourism components of the Gascoyne Region. In this chapter the interactions between the two are explored through examination of the significant features, critical areas and compatible activities leading to the overall environment - tourism plan.

10.1  INTRODUCTION

Following the identification of features of environmental and tourism significance the next task was to identify the spatial relationship between them. This was carried out by overlaying the overall summary map of environmental significance (Figure 28) with the overall summary map of tourism (Figure 37). The resultant map indicated areas of either environmental or tourism significance as well as critical areas where they coincided. The findings for the Gascoyne Region indicated that most of the areas which have a high level of environmental significance are also the ones of high tourism significance. However, this is to be expected since the Region's tourism is based almost exclusively on its natural resources. Therefore it is in the further examination of the zones of significance that their relative significance will become more apparent. This is carried out by examination of the existing and proposed conservation status of the areas as well as through the assessment of the environment in terms of the resource value given to them by the Region's residents and tourists.
There are a number of environmentally significant features in the Region. Most are also areas of tourism significance. All of the features have some degree of formal environmental protection through their tenure, vesting and management by the State Government. All national and marine parks and reserves in the State are vested in the NPNCA. Their land tenure is as either A, B or C class reserves with the level of classification reflecting the level of approval to alter their area or purpose. Class A reserves are the most secure because they need the approval of both Houses of WA Parliament. The Department of CALM is responsible for managing all lands and waters vested in the NPNCA of which there are five categories - nature reserves, national parks, marine nature reserves, marine parks and conservation parks. The primary purpose of nature and marine reserves is preservation whereas the primary purpose of the others lies in a combination of preservation and recreation, that is, conservation. The Gascoyne Region contains no conservation parks but has land in all other categories (Figure 15).

A number of sites with high or outstanding environmental significance have already been classified as existing or proposed nature reserves. These are mainly the small islands in and near Shark Bay. There are three national parks in the Region - Cape Range, Francois Peron and Mt Augustus. Kennedy Range will be established shortly and others proposed include Dirk Hartog Island, Edel Land, Heirisson Prong and the Zuytdorp Shipwreck site. Hamelin Pool is a Marine Nature Reserve which has been established to protect the stromatolites and marine parks have been established at Ningaloo and Shark Bay. The land and sea areas of Shark Bay were listed as a World Heritage Area in December 1991.
In addition to the above established or proposed parks and reserves are a number of other areas of environmental significance. These include large areas of the Shire of Exmouth, part of the Shire of Carnarvon coast, southern Shark Bay and a number of discrete scattered parts of the Shire of Upper Gascoyne. Almost all of these areas have a high level of environmental significance based on the criterion of naturalness. Most are on pastoral stations and are relatively inaccessible therefore they are unlikely to be developed as tourism resources. However, some areas of high environmental significance may increase in terms of tourism significance due to the close proximity of other tourism resources such as attractions, accommodation or roads. Areas where this could occur include parts of Giralia Range, the Lyndon River and the upper Lyons River. A similar situation occurs with the Gascoyne River which, for its lower reaches, has a moderately-high level of environmental significance. Nearby is a regional road, of moderately-high tourism significance, which links the Region's interior with Carnarvon. The Gascoyne River is not proposed for park or reserve status and therefore is environmentally at risk.

10.2 RESOURCE VALUES

A number of areas which have been assessed as being environmentally significant based on their intrinsic qualities, also gain support for environmental protection by the residents and tourists. All of the major environmental and tourism features in the Region were assessed in terms of their 'resource value' for either environmental protection or tourism development (Appendix 8). The 'environmental protection value' of each feature nominated by the respondents has been weighted by their level of support for the environmental protection of the region then ranked and
assigned a summary class in the same manner as the rating of environmental attributes.

All of the areas considered to be worthy of environmental protection by respondents have an environmental protection resource classification approximately equal to that of environmental significance (Table 17). This indicates a considered degree of concurrence between the scientific and social appraisal of the value of the Region's environment. Therefore, when zoning the Region these environmentally significant areas have strong endorsement from the residents and tourists for protection, a factor

<table>
<thead>
<tr>
<th>CLASS(^1)</th>
<th>AREA</th>
<th>RESOURCE VALUE(^2)</th>
<th>ENVIRON SIG(^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Moderate</td>
<td>--------------------</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Mod-High</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Edel Land</td>
<td>28.8</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Peron Peninsula</td>
<td>38.8</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Gascoyne River</td>
<td>45.1</td>
<td>Mod-High</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>High</td>
<td></td>
<td></td>
</tr>
<tr>
<td>West Side of Cape</td>
<td>52.3</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Dirk Hartog Island</td>
<td>53.3</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Muiron Islands</td>
<td>54.7</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Hamelin Pool</td>
<td>57.4</td>
<td>O/S</td>
<td></td>
</tr>
<tr>
<td>Bundegi Reef</td>
<td>59.5</td>
<td>High</td>
<td></td>
</tr>
</tbody>
</table>

1. Class = Moderate, Moderately-High and High
2. Results ranked by percent response
3. Five regions are ranked higher by environmental value than by their resource value. These are Edel Land, Peron Peninsula, West Side of Cape and Bundegi Reef. For the other four areas the resource value classification is the same as the environmental value.
which will influence the decision to allocate such areas to the preservation end of the zoning spectrum.

Five areas had similar classes of resource value, nominated by residents and tourists for environmental protection, and environmental significance as established in the EBT evaluation. These areas are the West Side of the Cape, the Muiron Islands, Bundegi Reef, Dirk Hartog Island and the Gascoyne River (Figure 38). Another three areas were nominated by residents and tourists for environmental protection but in each case the resulting environmental protection resource value class was one lower than that of its environmental significance. The areas include Edel Land, Peron Peninsula and Hamelin Pool.

In the Gascoyne case study all features nominated for environmental protection are classified as being either equal to, or within one class of, their environmental significance classification therefore no features are promoted or demoted between classes. However, the three features which have resource values lower than their environmental significance class are now each modified by a '-' sign on the summary map, reflecting the difference between the two values.

Virtually all of the Region's significant tourism features are contained within environmentally significant areas. However, they are usually discrete sites and seldom overlap entirely. A number of the areas of tourism significance which have been classified from the assessment of the tourism criteria have also been nominated for tourism development by residents and tourists. Assessments of their responses combined with a tourism development weighting has generated 'tourism development resource values' for a number of sites (Table 18). Four sites have resource
Figure 38  Resource Values
Table 18 Tourism Development Resource Values

<table>
<thead>
<tr>
<th>CLASS(^1)</th>
<th>AREA</th>
<th>RESOURCE VALUE(^2)</th>
<th>TOURISM SIG(^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>Little Lagoon</td>
<td>14.6</td>
<td>Mod/High</td>
</tr>
<tr>
<td></td>
<td>Bernier Island</td>
<td>16.1</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>Quobba</td>
<td>18.8</td>
<td>Potential</td>
</tr>
<tr>
<td></td>
<td>Steep Point</td>
<td>19.6</td>
<td>Potential</td>
</tr>
<tr>
<td>2</td>
<td>Bibbawarra Bore</td>
<td>27.4</td>
<td>-----------------</td>
</tr>
<tr>
<td></td>
<td>Miaboolya Beach</td>
<td>30.3</td>
<td>-----------------</td>
</tr>
<tr>
<td></td>
<td>Babbage Island</td>
<td>36.9</td>
<td>-----------------</td>
</tr>
<tr>
<td>Mod.-High</td>
<td>Nanga Bay</td>
<td>43.2</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>Town Beach</td>
<td>45.3</td>
<td>-----------------</td>
</tr>
<tr>
<td></td>
<td>Pelican Point</td>
<td>46.3</td>
<td>Mod/High</td>
</tr>
<tr>
<td></td>
<td>The Fascine</td>
<td>47.8</td>
<td>Mod/High</td>
</tr>
<tr>
<td>3</td>
<td>Denham</td>
<td>58.0</td>
<td>High</td>
</tr>
</tbody>
</table>

1. Class = Potential, Moderate, Moderately-High and High
2. Results ranked by percent response.
3. Seven areas are ranked higher by tourism development value than by their tourism significance value.

value classes equal to their tourism significance values. They are Bernier Island, Pelican Point and the Fascine, all in the Shire of Carnarvon, and Denham in the Shire of Shark Bay.

Seven areas have a tourism development resource value class higher than their tourism significance class. This finding may be attributed to the overall view that the residents and tourists have identified a number of potential tourism development sites. Three of the areas, Quobba in Carnarvon and Nanga Bay and Steep Point in Shark Bay, have a resource classification one higher than their tourism classification and therefore
they are shown on the summary map with a '+' sign denoting their superior value within the class. The other four areas have been proposed as tourism development sites with a moderately-high classification. Each is within or near a town and although they do not have a tourism significance classification the support from residents and tourists for their development is indicated on the summary map by their inclusion as areas of moderate tourism significance. These areas include Town Beach in Exmouth and a number of features in or near to Carnarvon (Babbage Island, Bibbawarra Bore and Miaboolya Beach). The final site allotted a tourism resource value is Little Lagoon which has been given a resource class one less than its tourism significance class and therefore is indicated on the map by a '-' sign.

A number of areas in the region have been assigned resource values by respondents both to environmental protection as well as to tourism development (Table 19). These areas are viewed as being more critical than the others because virtually in all cases they also have similar levels of classification of environmental and tourism significance. Both from an intrinsic and extrinsic stand point they generate conflicting values. The resource values of these areas have been calculated by subtracting the tourism development value from their environmental protection value. The higher the overall resource value, the higher the environmental value. Conversely, areas or features with low resource values have an overall lower environmental value. It must be noted that all areas are in conflict and a ranking of values does not indicate the relative degree of conflict. However, an approximation of relativity may be gained by plotting points on a scattergraph to show the relative relationships (Figure 39). Features of strong conflict are the Blowholes, One Mile Jetty, Monkey Mia and Rocky Pool. To a lesser extent Yardie Creek and Coral Bay
Table 19 Conflicting Resource Values

Areas Nominated by Residents and Tourists both for Environmental Protection and for Tourism Development

<table>
<thead>
<tr>
<th>AREA</th>
<th>RESOURCE VALUE</th>
<th>ENVIRON. SIG</th>
<th>TOURISM SIG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rocky Pool</td>
<td>21.9</td>
<td>Mod/High</td>
<td>Mod/High</td>
</tr>
<tr>
<td>Blowholes</td>
<td>23.6</td>
<td>Mod/High</td>
<td>High</td>
</tr>
<tr>
<td>One Mile Jetty</td>
<td>25.8</td>
<td>--------------</td>
<td>Mod/High</td>
</tr>
<tr>
<td>Vlaming Head</td>
<td>29.2</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Monkey Mia</td>
<td>29.6</td>
<td>High</td>
<td>O/S</td>
</tr>
<tr>
<td>Coral Bay</td>
<td>37.1</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Yardie Creek</td>
<td>41.0</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Shell Beach</td>
<td>56.1</td>
<td>O/S</td>
<td>Mod/High</td>
</tr>
<tr>
<td>Canyons/Gorges</td>
<td>57.4</td>
<td>High</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

1. Resource value = Environmental value - Tourism value.
2. Sig = Significance

represent areas of conflict whereas the canyons and gorges of Cape Range in the north and Shell Beach in the south are clearly weighted towards environmental protection.

10.3 ZONING

The resource values are now taken into consideration when the features of environmental and/or tourism significance are assigned to the various zones proposed in Step 1 of the framework. This is evaluated by application of The Environment-Tourism Resource Matrix (Figure 12). First the areas which have either environmental or tourism significance are plotted in the matrix in cells relative to their values. For example, a site with a high environmental value and a moderate tourism value is placed in its relative cell of the matrix. Where respondents have assigned either environmental protection and/or tourism development resource
Figure 39 Resource Values in Conflict
values to an area then this is taken into consideration when establishing its value for zoning.

In the Gascoyne Region the environmental and tourism features of significance have been assigned in the following ways. Sanctuary Zoning is accorded to a number of areas because of their relatively high environmental/low tourism significance which has been further endorsed by the residents and tourists assigning them a relatively high environmental protection resource value. These include Hamelin Pool, the Muiron Islands and Dirk Hartog Island (Figure 40). The Eastern Shore of Shark Bay is assigned to the zone based purely on its outstanding environmental significance classification. The canyons and gorges of Cape Range and Shell Beach are also allocated to this zone based on their environmental significance and the relatively high environmental components of their conflict resource values. It is clear that they are weighted by respondents more to overall environmental protection than to tourism development.

The Nature Conservation Zone consists of areas which are maintained as natural environments but which may support a range of selected compatible recreational activities. It is this zone in which many features or sites are placed according to a combination of their relative significance values as well as their resource values. The following areas have been assigned to the zone based on their high environmental significance and environmental protection resource value combination - Bundegi Reef and the West Side of the Cape. Edel Land is also included because although it has a high environmental significance classification it only has a moderately-high environmental protection resource value. Therefore it is placed in the lesser environmental zone of nature conservation as
Figure 40 The Gascoyne Environment - Tourism Resource Matrix

<table>
<thead>
<tr>
<th>ENVIRONMENTAL SIGNIFICANCE</th>
<th>POTENTIAL</th>
<th>MODERATE</th>
<th>MOD - HIGH</th>
<th>HIGH</th>
<th>O/S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern Shore of Shark Bay</td>
<td>Hamelin Pool</td>
<td>Shell Beach</td>
<td>Mt Augustus</td>
<td>West Side of the Coral</td>
<td>Monkey Mia</td>
</tr>
<tr>
<td>Dirk Hartog Island</td>
<td>C + G</td>
<td>Lake MacLeod</td>
<td>Little Lagoon</td>
<td>Coral Bay</td>
<td></td>
</tr>
<tr>
<td>Muiron Islands</td>
<td></td>
<td>Bernier Island</td>
<td></td>
<td>Yardie Creek</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kennedy Range</td>
<td></td>
<td>Viaring Head</td>
<td></td>
</tr>
<tr>
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<td>Nanga</td>
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<tr>
<td>Steep Point</td>
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<td>Qubba</td>
<td>Gascoyne River</td>
<td>The Blowholes</td>
<td></td>
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<tr>
<td></td>
<td>Rocky Pool</td>
<td></td>
<td></td>
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<tr>
<td>Babbage Island</td>
<td></td>
<td></td>
<td>One Mile Jetty</td>
<td>Carnarvon</td>
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<tr>
<td>Biobawara Bore</td>
<td></td>
<td></td>
<td>Pelican Point</td>
<td>Denham</td>
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<tr>
<td>Miaboolya Beach</td>
<td></td>
<td></td>
<td>The Fascine</td>
<td>Exmouth</td>
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<tr>
<td>Town Beach</td>
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</tbody>
</table>

TOURISM SIGNIFICANCE

SANCTUARY

NATURE CONSERVATION

OUTDOOR RECREATION

TOURISM DEVELOPMENT

The Region Plan 301
opposed to the more protective sanctuary zone. Bernier Island, Steep Point and Little Lagoon are included because of their high environmental significance classification and lower tourism development resource values. Lake MacLeod, Kennedy Range and Mt Augustus are assigned to the zone solely on the strength of their relatively high environmental/low tourism significance values.

The Outdoor Recreation Zone allows for more intensive recreational opportunities. The Quobba area is included because of its relatively high tourism resource classification combined with its lower environmental protection resource classification. Peron Peninsula is placed in this zone based on its moderately-high environmental protection resource value which is lower than its environmental significance value. Nanga Bay is included because although it could be classified in the Nature Conservation Zone, it has a higher tourism development resource value and already established tourism infrastructure. Pelican Point and the Fascine are included because of their moderately-high tourism significance classifications being supported by similar resource values. Babbage Island, Bibbawarra Bore and Miaboolya Beach (all near Carnarvon) and Town Beach in Exmouth are all included because of their moderately-high tourism resource classifications. Other sites have been included because of their relatively high environmental and tourism significance combined with conflicting resource values. These include One Mile Jetty, Vlaming Head, Yardie Creek, the Blowholes, Coral Bay and Monkey Mia. In addition all areas have some degree of tourism infrastructure, especially the last two areas which are reasonably highly developed. The Gascoyne River is included in this zone because although it has similar levels of environmental and tourism significance classification its preferred use (resource value) is for environmental protection rather than tourism.
development. Rocky Pool has similar levels of classification as the Gascoyne River but is included based on its relatively low conflicting resource value which favours tourism development.

The Tourism Destination Zone comprises the three major towns of Carnarvon, Denham and Exmouth. These are included largely because of their relative classification of significance but also because of their existing tourism infrastructure.

10.3.1 Nodes and Hinterlands

Five destination zones or development nodes have been identified in the region. They are Denham, Carnarvon, Exmouth, Coral Bay and Mt Augustus. Denham is the major node for tourism development in Shark Bay. It has a wide range of tourist accommodation, a sound infrastructure and growing facilities. It also gained the highest support from residents and tourists as an area for further tourism development and is the main town in the newly listed World Heritage Area. The town has previously been recommended as a major tourist centre by both the Tourism Development Plan (WA Tourism Commission 1986) and the Shark Bay Region Plan (SPC/CALM 1988). The town has potential to market the attractions of Shark Bay as a place for WA family holidays, interstate and Round Australia tourists, and international tourists wishing to see the dolphins and/or escape their winter. Its main activities offered are wildlife watching, recreational fishing and beach related activities.

Carnarvon is the Region's largest town and is centrally located. It attracts a large number of Round Australia tourists, 4WD adventurers who wish to visit the rugged and remote interior, and retired people who 'winter over'
each year. With an existing well developed infrastructure the town has
great potential to market its warm climate, historical features, rugged
environment and Aboriginal culture. It also has the potential to link
tourism with other commercial activities by promoting tours to
plantations and pastoral stations as well as commercial fishing and mining
operations.

Exmouth is well suited for tourism development with an abundance of
nearby natural attractions. With the closing of the joint US-Australia
Communications Station this year Exmouth is looking to tourism to
maintain its economy. However, the residents of the town are also keen
to protect their surroundings and hold the strongest views about the
environment of all the Region's residents surveyed (Dowling 1991).
Therefore any tourism development proposed will need to ensure that
any adverse environmental consequences have been thoroughly
investigated and addressed before being allowed to proceed. A recently
proposed coastal strategy plan for the area, which has incorporated many
of the findings of this dissertation, emphasizes the environment and
social compatibility of any proposed tourism development or activity
(Department of Planning and Urban Development 1992).

Coral Bay is a popular holiday destination for intrastate families.
Remoteness, the warm climate, white beaches and the Ningaloo Reef are
the main attractions but the small settlement is currently under stress
from the estimated 80 000 visitors per year. A planning strategy is
currently being prepared to implement a sustainable development
approach to the environment-tourism issues in the bay (Department of
Mt Augustus is the Region's only interior tourism node. With adequate protection for the area's Aboriginal sites and rare and endangered species the monocline should be able to withstand increased tourism due to the rugged nature of the landform.

10.3.2 Corridors

Within the Region there are a number of environmental and tourism 'corridors' which can be identified. The environmental corridors provide a link for fauna and flora in the modified pastoral landscape. The system of nature reserves and national parks in these areas comprises largely of a series of faunal and floral 'islands' in the altered environment. However, in some cases well defined corridors of largely natural vegetation and/or features such as salt lakes remain forming part of, or linking, reserves and parks.

Major corridors are the rivers which link the interior to the coast of which the largest is the Gascoyne. It joins the moderately-high environmentally significant central section of the Region with the coastline forming an east-west link from the higher inland Archaean Province to the Carnarvon Coastal Plain. The river pools and bankside vegetation are important watering points and habitats respectively for native fauna. In the central Gascoyne the Lyons tributary forms a similar link, providing a corridor from Mt Augustus National Park, through the environmentally significant lands of Cobra Station to its confluence with the Gascoyne River. In the north the Lyndon River links the environmentally significant areas of the north eastern Shire of Carnarvon with the proposed Class A Reserve of Lake MacLeod. Similarly the Minilya River
provides a discernable corridor from the northern part of the Kennedy Range National Park to Lake MacLeod.

Giralia Range connects the northern section of Lake MacLeod and the large environmentally significant area on the southern shores of Exmouth Gulf. In the southern part of the Region the Nerren Nerren East or Toolonga Nature Reserve is linked by the Murchison river to Kalbarri National Park, immediately south of the Shire of Shark Bay boundary. Cooloomia Nature Reserve and Zuytdorp National Park are linked to Freycinet Estuary on the southern shores of Shark Bay by an environmentally significant area which has been proposed as a nature reserve in the Shark Bay Region Plan.

Important marine corridors are the Ningaloo Reef Tract which links the exposed west side of North West Cape peninsula on the Indian Ocean with the more sheltered waters of Exmouth Gulf. The marine corridor of South Passage separates western Shark Bay from Dirk Hartog Island and is the southern entrance to Shark Bay allowing marine fauna to pass between the bay and the Indian Ocean. The Wooramel Seagrass bank on the eastern shores of Shark Bay acts as a corridor for marine fauna between the Indian Ocean, the outer reaches of Shark Bay and the inner reaches of Hamelin Pool.

Four major touring corridors may be identified in the Region. These corridors provide access through the region and are usually, though not always, a loop which allows the touring visitor to advance towards their final destination. The major road through the region is Highway 1, the North West Coastal Highway, which links Perth in the south to Darwin in the north. The first touring route leaves the main highway at the
Overlander Roadhouse and ends at Monkey Mia. The route is sealed along its entire length and has been developed as the Shark Bay Heritage trail by the WA Heritage Trails Network. The trail is a 130 km self-guiding drive which features sites of environmental and historical interest. The main attractions are the stromatolites of Hamelin Pool, Shell Beach, Eagle Bluff, Denham and Monkey Mia. An optional 4WD route traverses Edel Land to Steep Point (the most westerly point on the Australian mainland) and returns on a circular route via False Entrance.

The second touring route covers the inland. It starts at Carnarvon and transverses the inland for approximately 600 km before rejoining the main highway just outside the Region at Barradale Roadhouse in the north. The route follows the Gascoyne River to Gascoyne Junction then veers north to Cobra Station and Mt Augustus. An optional shorter route is to the Kennedy Range which is renowned for its gemstones. Both routes cross relatively remote pastoral stations and due to their length and poor road surfaces they usually only attract 4WD tourists.

The third touring route is situated along the coast north of Carnarvon. This 300 km return route begins and ends in the Tourism Destination Zone of Carnarvon and is usually undertaken as a day trip. Environmental and historical attractions along the route are The Blowholes, the HMAS Sydney Memorial, spectacular cliffs around Cape Cuvier, the 'Korean Star' shipwreck and Red Bluff, a scenic bay with an exposed fossil reef and an excellent surfing location. Tourists with 4WD vehicles can continue further north to Alison Point and then exit the area.

The fourth major touring route is the Learmonth-Minilya road which links Exmouth with the main highway. The 212 km route features Coral
Bay, Learmonth, the canyons and gorges of Cape Range, and Exmouth. From there the return journey can be made by two other roads. A 4WD route links Exmouth with Coral Bay through Cape Range National Park and pastoral stations to the south. The route follows the Ningaloo Reef and includes a number of historical sites such as Norwegian Bay (a former whaling station) and the sites of numerous shipwrecks. A second route exiting Exmouth traverses Giralia Range and joins the Learmonth - Minilya road with the main highway. It forms a shortcut for 4WD tourers travelling north.

10.4 RECREATIONAL ACTIVITIES

Following the allocation of critical areas to the various zones the next phase of the evaluation is to determine the outdoor tourism and recreational activities which are both environmentally and socially compatible. In the EBT planning approach all current recreational activities are inventoried and categorized. In the Gascoyne Region the activities were identified by tour guidebook designation, discussions with visitor centre and recreation managers, and through field survey. A resulting inventory of the primary outdoor recreation activities was then constructed. Each activity was then assigned to a biosphere component category according to whether it takes place primarily on land, in the water, or in the air based on a Canadian model (Marshall, Macklin, Monoghan 1980). Some activities were assigned to two additional categories being based on 'land and water' or on 'land and/or water'. Next each activity was assessed in terms of its potential for having a minor, moderate or major adverse environmental impact. The resulting activity/impact interaction is summarized in Figure 41.
<table>
<thead>
<tr>
<th>BIODISPHERE COMPONENT</th>
<th>ACTIVITY</th>
<th>ENVIRONMENTAL IMPACT</th>
<th>WATER Pollution</th>
<th>Damage to Reef</th>
<th>Litter</th>
<th>Disturbance of Wildlife</th>
<th>Destruction of Dunes</th>
<th>Destruction of Vegetation</th>
<th>Increased Fire Risk</th>
<th>Damage to Cultural Sites</th>
<th>Noise Pollution</th>
<th>Air Pollution</th>
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<tr>
<td></td>
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<td>★</td>
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</tr>
</tbody>
</table>

**Notes:**
1. Compiled from field surveys, residents' and tourists' opinions, discussions with managers and from information in Peerless (1987), Magee (1988) and Department of Regional Development and the North West (1989).

**Legend:**
- ★ Minor
- O Moderate
- ■ Major
- □ Not Available
10.4.1 Environmental Impacts

The major impacts are associated with land based activities such as off road driving, caravaning, camping and hunting. Land and/or water based activities have the potential to impact on a range of physical and biological features but their overall adverse impacts are considered to be either moderate or minor. Other activities with the potential for adverse impacts are, in descending order, water based, land and water based, and air based activities.

The range of potentially adverse environmental impacts caused by recreational activities in the Gascoyne Region includes most of those identified as being significant environmental problems in Australian National Parks (Buckley and Pannell 1990). In the Gascoyne Region the environmental impacts of recreational activities have been noted as part of three previous studies (Table 20). In an environment - tourism survey of North West Cape a number of emerging major environmental problems were raised (Peerless 1987). These included the destruction of sand dunes by the use of 4WD vehicles and, to a lesser extent, by camping. Overfishing, underfishing and the collection of live shells and coral were also noted. Other environmental impacts included the disturbance of wildlife causing disruption to the feeding and breeding habits of nesting birds, marine turtles and rock wallabies. Littering of both land and sea is documented as well as water pollution by motor boats. A survey of Gascoyne tourists on recreation on pastoral lands found that 88% of respondents believed that recreation activities caused environmental damage (Magee 1988). Major impacts cited include the disturbance of sand dunes, the destruction of vegetation, litter and noise pollution. All of these are caused by 4WD vehicle use and outback camping and confirm
### Table 20  Adverse Environmental Impacts Caused by Recreation: Results of Selected Gascoyne Studies

<table>
<thead>
<tr>
<th>IMPACT</th>
<th>SURVEY</th>
</tr>
</thead>
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<tr>
<td>Litter</td>
<td>✓</td>
</tr>
<tr>
<td>O/U Fishing&lt;sup&gt;2&lt;/sup&gt;</td>
<td>✓</td>
</tr>
<tr>
<td>Disturbance of sand dunes</td>
<td>✓</td>
</tr>
<tr>
<td>Destruction of vegetation</td>
<td>✓</td>
</tr>
<tr>
<td>Disturbance of wildlife</td>
<td>✓</td>
</tr>
<tr>
<td>Noise pollution</td>
<td>✓</td>
</tr>
<tr>
<td>Water pollution</td>
<td>✓</td>
</tr>
</tbody>
</table>

1. Recorded in reference cited
2. O/U Fishing = Overfishing and undersized fishing.

The earlier findings of the damage caused by 4WD vehicles on the environment (Crozier et al. 1977, Kay 1980, Buckley and Pannell 1990). The impact of overfishing and undersized fishing in the region formed the basis of a series of participatory seminars held in 1989 (Department of Regional Development and the North West 1989). The major cause was attributed to visitors who catch large amounts of fish which they take out of the region on 'freezer trailers'.

When compared with the findings of the present study a number of impacts emerge as being more significant than others. Those which are noted in at least three of the four studies are litter, overfishing, the disturbance of sand dunes and the destruction of vegetation. While each impact may be attributed to different groups of visitors one group in particular has been identified in this study as contributing to all four. This
is the group of fishermen who travel by 4WD vehicle, camp along the coastline on remote pastoral areas, carry out their recreational fishing then return with large amounts of fish usually taken out of the area by freezer trailers. A second group identified by residents are elderly tourists who travel to the Gascoyne each winter, stay in caravan parks, and whose expressed aim is to catch enough fish to last them and their families for the following year. A third group identified as significantly contributing to adverse environmental impacts are the 4WD tourers who camp in the outback and cover the region in vehicle tracks. Continued use of these tracks by vehicles causes the destruction of sand dunes, prevents the regrowth of vegetation, causes disturbance to domestic stock and wildlife, introduces weeds and increases the risk of fire.

Apart from these primary impacts a number of secondary impacts may occur. These include the shooting of wildlife, removal of vegetation for firewood and the risk of fire from the lighting of camp fires. Left unabated an area can be covered in a multiplicity of tracks, eroded camp sites and changes in the vegetation both as a floristic assemblage and as a fauna habitat.

10.4.2 Compatible Activities

Conflicts exist between differing forms of recreation using the same resource at the same time. Where a resource can be positively managed for recreation, conflicts can usually be removed by separating the activities in space or time. However, in the Gascoyne Region much recreation takes place in the open countryside or outback away from the few managed parks, therefore, the solution is not as simple. For example only 34% of the residents and tourists in this survey supported 4WD recreation and
many more made comments about it in regard to adverse environmental impacts.

A common approach to segregating recreational activities by time or space is through their simple analysis in matrix form. Examples of compatibility matrices have been compiled by the Forestry Commission, England (Goodall and Whittow 1973) and the CSIRO, Australia (Laut and Yapp 1978). In WA a compatibility matrix has been devised for the northern forests (Department of Forests 1984). Analysis of activities in the WA report have been used to help determine the relative compatibilities of recreational activities in the Gascoyne Region (Figure 42).

10.5 STRATEGIES

The strategies devised to implement the EBT planning objectives in the Gascoyne Region include strategies for environmental protection, tourism development and tourist management.

10.5.1 Environmental Protection Strategies

Environmental protection and the conservation of environmental values underpins the EBT Plan in the Gascoyne Region not only for their intrinsic values but also because the environment forms the basis for the sustainable development, including tourism development, of the Region. Therefore a number of strategies are suggested to achieve this goal.

1. Implement the EPA recommendations for the establishment of conservation reserves within the Gascoyne Region. The criteria for recommending each reserve included its representation of the
## Figure 42 Recreation Compatibility Matrix for the Gascoyne Region

<table>
<thead>
<tr>
<th>ACTIVITIES</th>
<th>DESTINATION BASED</th>
<th>TOURING ORIENTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picnicking</td>
<td>Wildlife Viewing</td>
<td>Fishing</td>
</tr>
<tr>
<td></td>
<td>Recreation/Wildlife</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hunting</td>
<td>Off-road driving</td>
</tr>
<tr>
<td></td>
<td>Camping</td>
<td>Cycle touring</td>
</tr>
<tr>
<td></td>
<td>Caravanning</td>
<td>Bushwalking</td>
</tr>
<tr>
<td></td>
<td>Caving</td>
<td>Horse trekking</td>
</tr>
<tr>
<td></td>
<td>Swimming</td>
<td>Hang-gliding</td>
</tr>
<tr>
<td></td>
<td>Wind surfing</td>
<td>Flightseeing</td>
</tr>
<tr>
<td></td>
<td>Snorkeling</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SCUBA diving</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Canoeing/Rowing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sailing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Power boating/Skiing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fishing</td>
<td></td>
</tr>
</tbody>
</table>

**LEGEND**

- ☆ Compatible
- ◼ Compatible U/M
- ■ Incompatible
- × Not Applicable

### Notes:
1. Compatibility ratings have been compiled from field survey, discussions with residents, tourists and managers, and information in a similar matrix devised for Western Australia (Department of Forests 1984).
2. U/M = under management
3. Not Applicable = Unlikely to compete for the same areas or resources.
natural features of the region and the presence within it of unique or spectacular natural features. Existing reserves should retain their current vesting. Areas which have not yet been vested as reserves include Dirk Hartog Island, Edel Land, the Wooramel Seagrass Bank, Lake MacLeod and Kennedy Range.

2. Initiate biological research into the ecosystems within the region to identify areas outside of the established and proposed reserves, as well as environmental corridors to link existing and proposed reserves.

3. Areas of high conservation value which have been identified should be conveyed to pastoralists and other land managers and assistance provided for them to take appropriate conservation management actions.

4. A new nature reserve should be created by amalgamating the existing Cooloomia Nature Reserve, the undeclared Zuytdorp National Park, and the intervening land. This would protect the rich, varied and undisturbed vegetation of the area as well as the Zuytdorp cliffs, a significant landscape element of the area.

5. Implement the Shark Bay Region Plan's general recommendations for the marine environment, but apply them throughout the whole Gascoyne Region in order to foster protection of marine:

(a) habitats used by commercial and recreational fisheries species;
(b) animals and plants which have conservation values but which are not commercial or recreational fisheries resources; and
(c) formations which have scientific, educational or conservation values.

6. Historic and cultural features should be researched, interpreted and promoted providing such action has local community endorsement as well as suitable conservation measures.

10.5.2 Tourism Development Strategies

The principal aim of tourism development within the EBT Plan is to promote environmentally compatible tourism developments and associated recreational activities. Strategies to achieve this aim suggested for the Gascoyne Region are:

1. Integrate tourism development with the conservation and land management of the Region as proposed in the EBT zoning scheme (Figure 11). The characteristics of each zone are outlined in Table 2.

2. Market the Region's attractions and activities selectively to attract environmentally aware tourists. Markets identified in the study include family, retired, coach, resort and adventure markets.

3. Investigate the carrying capacities of natural areas under tourist pressure then set appropriate levels of tourism.

4. Concentrate major tourism developments in or near the present development nodes but elsewhere employ a balance of concentration and dispersion of small-scale developments.
5. All tourism development proposals should embrace the environmentally compatible tourism development guidelines produced by the WA Tourism Commission and the Environmental Protection Authority (WATC/EPA 1989a).

6. Tourism Corridors should be researched, interpreted then promoted where considered environmentally and socially acceptable.

7. Tourism development must reflect the wishes of the local community.

8. Environmentally compatible ecotourism activities should be promoted.

9. The demand for the involvement of Aboriginal communities in the tourism industry should be raised with them for their consideration.

10.5.3 Tourist Management Strategies

Tourist management in natural areas serves two main objectives - the reduction of adverse environmental impacts and the enhancement of tourist experiences. To be acceptable to tourists, management intervention should be low key and persuasive. Explanation and education through interpretation is the key to affecting tourist behaviour in ways considered to be environmentally and socially acceptable. Tourist management measures have been described as involving a spectrum of approaches from soft, to intermediate and hard (Jim 1989; Ruschmann 1992). Soft techniques are aimed at influencing user behaviour, intermediate techniques focus on redistributing use and hard techniques are those
which are regimented and aim at rationing use (Table 21). Such a spectrum of tourist management approaches is offered for consideration and possible application at individual sites within the Region.

The high diversity and attractiveness of flora, fauna and landforms of the Region, present many opportunities for environmental education programs to enhance the quality of visits. The underlying thrust of any environmental education program should be to foster environmental awareness, empathy and action. Many areas are suitable for information centres, interpretive signs or the establishment of heritage or nature trails. Some events such as turtle nesting, coral mass spawning and the passing of the humpback whales could lend themselves to special educational tours.

Educational programmes should seek to:

1. Promote understanding of terrestrial and marine ecosystems;

2. Provide information which will guide tourists on the Region’s natural resources and strategies to protect conservation values;

3. Provide information and activities which will enrich tourist enjoyment, experience and safety in the Region;

4. Promote awareness of environmental impacts which human activities may have in these ecosystems; and

5. Provide information which assists in achieving management objectives.
<table>
<thead>
<tr>
<th>MEASURE</th>
<th>MANAGEMENT OBJECTIVES</th>
<th>TECHNIQUES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SOFT</strong></td>
<td>To change user attitudes and behaviour</td>
<td>Using environmental</td>
</tr>
<tr>
<td>Influencing use</td>
<td>Determination of tourist preference by market research</td>
<td>information and education</td>
</tr>
<tr>
<td>behaviour</td>
<td>Determination of tourist use by observation, visitor books etc</td>
<td>Establishment of a Code of Ethics</td>
</tr>
<tr>
<td><strong>INTERMEDIATE</strong></td>
<td>To reduce the contrast between heavily used and lightly used areas over time</td>
<td>Concentration versus dispersion</td>
</tr>
<tr>
<td>Redistributing</td>
<td>To raise lower use levels to match carrying capacity levels</td>
<td>Information dissemination</td>
</tr>
<tr>
<td>Use</td>
<td>To redistribute uses so that their desired preference is matched by more appropriate settings</td>
<td></td>
</tr>
<tr>
<td><strong>HARD</strong></td>
<td>Controlling tourist numbers relative to type, place + time</td>
<td>Information dissemination</td>
</tr>
<tr>
<td>Rationing use</td>
<td></td>
<td>Advanced reservation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>by permit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Differential pricing, fees + queueing</td>
</tr>
</tbody>
</table>
10.6 THE EBT PLAN

The synthesis of the planning framework occurs with the allocation of zones. Here lies the integration of the environmental and social elements of the study. Summary maps have been prepared to show areas of overall environmental significance (Figure 28) and overall tourism significance (Figure 37). In addition critical areas have been further evaluated in terms of their environmental protection value, tourism development value, or if assigned to both, their conflicting resource values (Figure 38). The map of the EBT Plan for the Gascoyne Region includes two major sections - areas designated for environmental protection and/or conservation, as well as areas for outdoor recreation and tourism development (Figure 43). Both sections contain areas recommended as corridors - either environmental or touring. Examples of environmentally appropriate developments and tourism activities in the Gascoyne Region are shown in Appendix 9. Specific aspects of the zoning framework developed for the Gascoyne include the following.

1. Sanctuary Zone

This zone provides for environmental protection but also allows for strictly controlled tourism activities:

(a) Special viewing areas where flora and fauna may be observed free of any form of interference (eg. The Mangrove Birdhide in Cape Range National Park and a number of small sanctuary zones in Ningaloo Marine Park - Appendix 9);
Figure 43 The Gascoyne Region Environment - Tourism Plan
(b) Special protection areas for wildlife such as nesting or nursery areas (eg. The Cooloomia Nature Reserve in southern Shark Bay);

(c) Reference areas for scientific study (eg. The stromatolites of Hamelin Pool and the Wooramel Seagrass Bank, both in Shark Bay);

(d) Replenishment areas which may provide recruits to re-populate (eg. Dirk Hartog Island and the Nerren Nerren East Nature Reserve); and

(e) Other areas which are over-fished or have become degraded (eg. Shell Beach).

Restrictions on certain activities including the type of equipment or gear used, the method of fishing and the taking of certain species or classes of animals, may apply over the whole or any declared part of the zone.

2. Nature Conservation Zone

This zone provides for environmental conservation but also allows for a selected range of environmentally compatible and socially acceptable small-scale developments and outdoor recreational activities. This zone is designed to limit development and to promote enjoyment of the Region's attractions in more natural conditions. A large nature conservation zone may include smaller pockets within it which are either sanctuary zones (for environmental protection) or outdoor recreation zones (for more intensive tourism developments and/or activities). An example in the Gascoyne Region is the Cape Range/Ningaloo Reef Nature Conservation Zone which contains the smaller Sanctuary Zone of the canyons and
gorges of Cape Range National Park, as well as the Outdoor Recreation Zone at Coral Bay.

Preferred tourism developments in this zone in the Gascoyne are those which are small scale and blend in with their natural environment (eg. the Milyering Bicentennial Visitor Centre in Cape Range National Park, Appendix 9). Preferred recreational and tourism activities are those which have been identified as having only moderate or minor environmental impacts (Figure 41), are compatible with other recreational uses (Figure 42), and have community support (Table 14). These include swimming, diving, wildlife watching, windsurfing, sailing, and the development of walking, cycle, heritage and dive trails. Controlled tourist activities are preferred such as the boat tour to the pearling farm in Shark Bay which successfully markets a commercial activity as a tourist attraction right in the middle of an environmentally sensitive area (Appendix 9).

3. Outdoor Recreation Zone

This zone provides for a broad range of education, outdoor recreation opportunities and related facilities. Intensive tourism developments and activities are acceptable provided they are environmentally compatible and do not conflict with existing uses. Areas in the Gascoyne which are zoned for outdoor recreation include Rocky Pool, Monkey Mia and Nanga Bay.
4. Tourism Development Zone

In this zone are tourist centres which provide facilities and accommodation from which day visits may be made to nearby natural attractions. Tourism Development Zones serve as:

(a) Destination nodes from which to explore the surrounding region;
(b) Tourist infrastructure necessary for serving tourists; and
(c) Information centres.

In the Gascoyne Region two levels of tourism development zone have been recognized. The first are major tourist centres incorporating all levels of tourist infrastructure to be found in a tourism development zone (eg. Carnarvon, Denham and Exmouth). The second are moderate tourist centres featuring some accommodation and services on a smaller scale (eg. Mt Augustus, Gascoyne Junction and Steep Point). Both Coral Bay and The Blowholes are also designated as tourism destination zones with a strong outdoor recreation orientation.

5. Other Zones

These include the travel routes which form part of the touring or longer-stay destination subsystems as well as the hinterland which surrounds either sanctuary or tourism destination zones.

The implementation of the plan requires careful consideration in regard to local, regional and national policies on environmental, social and sustainable development goals for the Gascoyne Region. However, aspects of the EBT approach have already been adopted in the planning of several
areas within the region, for example, Coral Bay (Department of Planning and Urban Development (1991) and North West Cape (Department of Planning and Urban Development (1992; Appendix 10). In addition, some of the suggested management strategies have been already been put into practice in Shark Bay - at Monkey Mia and Shell Beach. Finally, following on from this dissertation will be a detailed regional environment - tourism plan prepared for the WA Departments of conservation and tourism.
Chapter 11 Conclusions

Future tourism expansion cannot take place without vigorous resource protective action.

Gunn 1991a: 3

11.1 INTRODUCTION

The aim of this research was to explore the environment - tourism relationship and develop an environmentally based planning approach for tourism development in natural areas. It was prompted by a general concern that tourism development in natural areas has usually been the prerogative of tourism planners or regional planners whose aims lie primarily with increasing regional economic advantage.

Three major objectives were set pertaining to the above aim. The first objective was to investigate the environment - tourism relationship in order to determine its nature and therefore significance for planning. The second objective was to examine traditional regional tourism development planning approaches as well as regional environmental protection planning frameworks in order to determine whether or not the two approaches could be integrated to form a regional environmentally based tourism development planning framework. The third objective was to apply the planning framework in a field situation where there is a need for case studies. This chapter briefly summarizes the study, outlines the conclusions drawn in relation to the objectives and underlying hypothesis, then provides suggestions for further research derived from the conclusions.
11.2 SUMMARY

The dissertation has been written in four parts. The first part, the Introduction or Chapter 1, outlines the purpose of the study which was to investigate whether an environmental survey method used for identifying environmentally significant areas can underpin a traditional, area- development tourism model to form an environmentally based tourism planning framework. Three specific objectives were outlined in relation to the study. These were to explore the nature of the environment - tourism relationship, to develop an environmentally based tourism planning model, and to test its application in a natural area.

Part 2 of the dissertation (Chapter 2) explores the nature of the environment - tourism relationship. The evolution of the environment - tourism relationship is traced over the last four decades. The advent of mass tourism since WW II is related to the growing global environmental awareness. Two aspects of the environment - tourism relationship are identified and described. The first is that the two have symbiotic and even synergistic possibilities in which the relationship is mutually beneficial. The second is that they are in conflict and that tourism is destroying its very foundations. The conclusion is drawn that elements of both symbiosis and conflict are everpresent in the environment - tourism relationship. Therefore it is suggested that the symbiotic or ideal view be tempered by the realistic acceptance of tourism and the environment's potential and actual conflicts. This in itself leads to an integrative approach which minimizes adverse impacts and enhances positive outcomes through integrated planning and management.
Part 3 (Chapters 3 - 6) examines environmental and tourism planning approaches and develops an environmentally based tourism planning framework. This part begins with an examination of tourism planning approaches (Chapter 3) and outlines its evolution from one with primarily economic objectives to one incorporating social aspects and more recently, environmental considerations. Ten tourism planning principles are advanced which have direct application to environment - tourism planning. They include essential, spatial and temporal dimensions. Environmental planning approaches involving preservation and conservation values are then examined (Chapter 4). It is noted that some approaches are best suited to discrete areas under the control of one authority such as a national park. Carrying capacity considerations are set aside as having inherent problems of quantification and application. An emerging trend is noted involving the incorporation of the values of society in determining environmental planning outcomes.

Chapter 5 draws together some of the findings of the previous two chapters and outlines social and spatial aspects common to both tourism planning and environmental planning approaches. It discusses the increasing emergence of community planning and advocates the need to include the opinions of both residents and tourists in any environment - tourism planning approach. Spatial aspects of both approaches are reviewed and it is suggested that another similarity lies in the recognition of points, areas and lines that underpin spatial frameworks. The final chapter of Part 3 (Chapter 6) describes an environmentally based regional tourism planning framework which incorporates the social and spatial elements identified previously.
The fourth part (Chapters 7 - 10) of the dissertation describes the application of the environment - tourism planning framework in a case study. Chapter 7 introduces the case study area - the Gascoyne Region of Western Australia. The abiotic, biotic and cultural attributes of the Region are described as well as the land use for conservation. An environmental assessment of the Region is made in Chapter 8. It focuses on the selection of the chosen attributes, their evaluation and an overall summary of the Region's valued environmental components. This is followed by the description and assessment of the region's tourist resources (Chapter 9). The final section of this part of the study draws together aspects of both the environmental assessment and tourism assessment to provide an overall environmentally based tourism plan for the region (Chapter 10). The plan embraces both the social values and spatial aspects identified in Part 3 of the study. Social values are addressed through the incorporation of the Region's resident and tourist opinions. Spatial aspects include the identification of environmental and tourist nodes and corridors within the overall zoning plan. A number of strategies are identified for environmental protection, tourism development, and tourist management to provide a guide for the overall plan implementation.

11.3 CONCLUSIONS

This study examined the environment - tourism relationship in order to develop an environmentally based tourism planning framework which was then tested in a case study of the Gascoyne Region of Western Australia from 1989 - 1991. The study argued the need to bring together the divergent themes of conflict and symbiosis in the environment - tourism relationship, the reversal of the traditional emphasis on tourism planning to start from an environmental perspective, and the benefits of
incorporating social views in the planning process as well as spatial differentiation in the final plan. The case study demonstrated that this approach can be used successfully to bring about environment - tourism integration. What became especially clear for the first time through this study is that it is possible to underpin a traditional area development tourism planning model with an environmental tourism planning model with an environmental planning framework. Rather than being restrictive the planning procedure identified areas which could be opened up for future tourism developments as well as environmentally compatible tourism activities.

With the current boom in ecotourism the timing and location of the Gascoyne case study were significant and suggestive of areas where further research is needed. The location of the study area was favourable, the Gascoyne currently emerging as a popular state, national and international destination with the attraction of the Monkey Mia dolphins. The timing of the case study was also favourable with the establishment of Shark Bay as WA's first World Heritage Region in December 1991, and the withdrawal of the US from the Joint Communication Station in Exmouth in December 1992 which is causing a shift of economic dependence from defence to tourism.

The major conclusions from each inquiry are reviewed separately then drawn together to address the underlying question which has been the focus of the research, that is, 'whether it is possible to integrate both environmental planning and tourism planning approaches to form a regional environmentally based tourism planning framework'.
11.3.1 The Environment-Tourism Relationship

The environment - tourism relationship has evolved through several phases over the last four decades, as outlined in Chapter 2. At first it was viewed as being one of coexistence (Zierer 1952). Over the next three decades this belief was replaced by two others which regarded the relationship as one of either symbiosis (Budowski 1976) or conflict (Mathieson and Wall 1982). Those who were in favour of a close environment - tourism link advanced tourism's role in fostering natural and cultural conservation whereas others argued that tourism's adverse environmental impacts were unacceptable. It is suggested in this study that neither view is all-embracing and that in practice, elements of both permeate the environment - tourism relationship. Therefore, it is argued that a new orientation to the relationship be adopted in which both the environment and tourism are viewed as making a unified whole. This is the state of 'integration' where the possibilities of coexistence, conflict and symbiosis are recognized, but where environmentally appropriate tourism opportunities are advanced. This view of the integration of the environment and tourism advanced in this study provides the underlying basis for evaluating environment - tourism planning. It is advanced that an environment - tourism planning framework should foster both the conservation of environmental values as well as environmentally appropriate tourism.

11.3.2 Environment - Tourism Planning

The review of regional tourism planning approaches in Chapter 3 has shown that in the past, traditional tourism planning has focussed solely on the pursuit of economic gain. Achievement of this goal has usually
been through the preparation and development of 'one-off' area development plans. However, the goals of recent tourism planning approaches also incorporate social and environmental components. A range of criteria are available to evaluate the significance of tourism resources. The review concludes that there are ten tourism planning principles which are of direct application for environment - tourism planning. They include essential, spatial and temporal elements.

The review of environmental planning (Chapter 4) indicates that there are a variety of approaches to planning for both environmental protection and conservation. There exists a wide range of criteria to evaluate the significance of natural areas which include elements of abiotic, biotic and cultural attributes. An emerging trend within environmental and ecological planning approaches is the inclusion of the values of society determined by resident and user survey.

In bringing together the conclusions drawn in the reviews of tourism planning and environmental planning approaches a number of points emerge (Chapter 5). The first is the growing trend towards the incorporation of social values. It is established that the involvement of the local community is becoming an integral part of the planning and decision making process of tourism. It is also noted that public participation, which is an integral part of the environmental impact assessment process, is also being advanced for environmental and ecological planning. Therefore, any environment - tourism planning approach should incorporate community views. However, it has also been argued in this study that it is important to consider the views of tourists too as they are the end users of any environmentally appropriate and approved tourist developments and activities.
A second conclusion drawn from the review of tourism planning and environmental planning is their similarity in spatial differentiation. Gunn (1988a) describes the spatial components of a tourism plan as consisting of attraction clusters, community areas and touring corridors. Similar elements, but in an ecological context, have been described as patches, matrices and corridors (Forman and Godron 1986). Therefore it is suggested that an environment - tourism planning approach should identify and incorporate environmental and tourism nodes, hinterlands and corridors which represent significant features and processes in the natural and cultural landscape.

In the light of the above review of tourism planning and environmental planning it is concluded that in future, environment - tourism planning be couched in an integrated environment - tourism approach, incorporate community and tourist views, and embrace the inherent components of spatial differentiation of points, areas and lines. Permeating such an approach is the underlying assumption that the environment must be the governing factor determining tourism development in natural areas. It has been suggested throughout this study that in the past, tourism planning in natural areas has traditionally started with, and been driven by, economic viability (that is, the profit motive), incorporated social aspects such as public participation often only after demands from the local community, and finally addressed selected environmental protection and conservation concerns.

In this study it has been argued that tourism planning in natural areas should take the form of a process completely opposite to the one outlined. The process should be reversed so that it begins with an environmental evaluation, incorporates social concerns, then finally investigates
economic opportunities in the light of the already established environmental and social considerations. This view represents a fundamental shift in thinking about, and planning for, tourism development in natural areas as it focuses on environmental attributes rather than tourism resources. The underlying concern is for the sustainable use of resources with environmental conservation the governing aim. In this manner the whole planning approach is influenced by determining what environmental features are considered to have utility as resources and those which should not. The approach also emphasizes the role of people as part of the environment and hence it includes their views as part of, and not separate from, the overall environmental evaluation.

11.3.3 The EBT Plan

The plan developed during this study has been described (Chapter 6) and tested (Chapters 7 - 10) in an arid, coastal region of Western Australia. The results of the case study demonstrate that the potential for tourism planning in natural areas should begin with, and be determined by, environmental evaluation. To this end a primary consideration concerns the selection of and justification for the criteria chosen to determine the evaluation. The EBT model presents a range of possible criteria by which to carry out the evaluation. However, it suggests that the range includes a mix of ecological and cultural criteria, diversity and rarity, as well as criteria more applicable to smaller and larger sites. While the Gascoyne case study was able to utilize most of the proposed criteria it is suggested that the criteria mix used will be different according to the available data and that able to be acquired. For example, in the Gascoyne the criterion of landscape condition was used as a surrogate for naturalness. The non-
compensatory, disjunctive approach to multicriteria evaluation used in
the EBT method has proved to be a useful way of determining significance
and overcomes the problem of combining values of different criteria
identified by Margules (1989).

Tourism criteria utilized in the EBT approach are also guided by the
availability and/or ease of data acquisition. The Gascoyne criteria probably
represents a 'minimum set' for evaluative purposes and other case studies
may wish to include more criteria. For example, in an evaluation of
tourist resources of South Africa, the six criteria chosen were accessibility,
admission, fragility, importance, popularity and seasonality (Ferrario 1979).
However, it must be remembered that whereas the environmental
evaluation focused on the determination of environmental attributes, the
tourism evaluation focussed on determining tourism resources. As such
it should be kept in mind that for planning and decision-making purposes
it is the relative importance of one location to another that is important
rather than the absolute values (Pearce 1989).

The spatial representation of data by mapping is a key part of the land
planning process and also is fundamental to the EBT planning framework.
Pearce (1989) has indicated that simple cartographic methods, for example,
those used by Piperoglou (1967), are adequate for tourism planning. A
conclusion gained from this study is that while the freehand drawn maps
are adequate for the evaluations being made, greater accuracy and
flexibility can be gained from the GIS technique. By extension it is obvious
that optimal use of the GIS system can be gained by the input of the raw
data (environmental attributes and tourism resources) from which the
evaluated data is derived and from which the final analysis (summary
plan) is made. A major benefit of the GIS approach for environment -
tourism planning is that the initial resource data is captured as points, polygons or lines (Gunn 1988b). This lends itself well to the EBT planning approach of identifying environmental and tourism nodes, hinterlands and corridors.

The Gascoyne study has confirmed many of the findings of earlier resident surveys (eg. Liu et al. 1987; Schlüter and Var 1988) but in some it has been divergent. In addition the inclusion of tourists in the survey has allowed for a direct comparison of host-visitor views. Examination of the findings confirms the earlier ones that residents perceive tourism as improving the local economy and not causing a burden on local services. This latter view is also endorsed by their belief that tourism does not diminish their enjoyment of the area. Gascoyne residents did not share the view that tourism helps protect the environment and they strongly supported the increased protection of the environment. However, the survey confirmed previous findings that there are a number of negative environmental impacts caused by tourism. In terms of planning and management the Gascoyne survey was in accord with previous findings that long term planning can control the impacts of tourism on the environment. Gascoyne residents also believed that tourism developments should be encouraged provided they do not conflict with the environment.

An added dimension of the Gascoyne study was the inclusion of tourists in the survey. In most cases where statements were asked of both residents and tourists, the latter group generally had a higher level of agreement. Thus they more strongly endorsed the need for greater environmental protection as well as the need for more parks. However, while they gave less support than residents to the notion that tourism harms the environment they were also less supportive of the economic
gains of tourism being just as important as the protection of the environment. Therefore, it can be argued that while the overall levels of support for environment protection and tourism development are similar between residents and tourists, the residents have a higher level of support for tourism development while the tourists give greater support to environmental protection. The above findings confirm those of a recent study on the differences in attitude between differing use groups of park land in Canada (Saremba and Gill 1991) but provide an interesting contrast with an earlier survey of Florida residents which uncovered a strong anti-tourism, anti-growth segment in the state prompting the researchers to propose that the state government devote a portion of its tourism promotion efforts toward community education on the benefits of tourism (Davis et al. 1988).

Ap’s (1990) survey and review of resident perceptions on the social impacts of tourism concluded that the overall descriptive nature of the inquiries were indicative of a field of study at an early stage of development. He suggested that future research should attempt to link the central concepts to some explicit theory. While agreeing with Ap’s conclusions it is suggested in this study that our understanding of host community views on tourism’s environmental impacts is minimal and is not even at a satisfactory descriptive stage. It has been further suggested that even less is known about tourist perceptions on the environmental impacts of tourism.

11.4 FURTHER RESEARCH

The generation of the EBT planning framework and its application in the Gascoyne Region of WA has raised as many questions as it has answered.
The outcome of the application of the EBT Planning Framework in the Gascoyne Region has indicated that many large gaps exist in the present model. Overall the framework tended to reflect the status quo and it could clearly benefit from the incorporation of some aspects of other approaches. Refinements which could be made include the testing of a wider range of environmental and tourism criteria, an increased analysis of markets, finding methods of gaining a greater input from the indigenous people, the infrastructure required to convert potential tourist resources to actual resources, the role of institutional and planning process adjustments and the monitoring of tourism’s impacts. Another area of useful research could examine the relationship between Gunn’s (1988a) ‘zones’ of physical and program factors and the EBT’s zones based on land functions.

In some areas the framework has both agreed with previous findings but also indicated the need for further research. For example, the Gascoyne study has confirmed some of the earlier findings in regard to resident views. These include tourism’s dual nature of being capable of causing either environmental conflict or having the potential for a symbiotic relationship. It also validates the integration of regional environmental and tourism planning. The inclusion of tourists in the survey has allowed for some interesting and useful comparisons of host-guest views. Surprisingly the two groups concur on most findings but the residents tend to view the destination area with more utility than the visitors. However, further research still needs to be carried out and more case studies are needed at the descriptive level. Concepts need to be defined and linked to explicit theory, data characteristics need to embrace greater use of social survey instruments and techniques of sampling, and data analysis needs to progress beyond the univariate level. The WA study has
been a simple, descriptive level case study. Its value lies in its addition to the relatively scant knowledge base.

If the EBT planning model is to be effectively utilized as a planning tool for natural area tourism then it must be based on reliable data. A recent natural area tourism development tool has emphasized the critical importance of reliable, current, comprehensive data for planning (Butler and Waldbrook 1991). They suggested that residents' attitudes to tourism development in natural areas should be incorporated in the planning process. It has been further argued in this thesis that their views also need to be sought on environmental and social elements and so the EBT planning framework has included these aspects in the resident surveys. Butler and Waldbrook (1991) also asserted that more research needs to be carried out on the travellers to a region as markets are continually changing. One of the features of this study has been an attempt to include the views of tourists into the planning process. However, further understanding is required on the relative weight the residents could or should have in relation to the tourists within the overall planning process.

Regional planning issues not addressed by the EBT approach which could form the direction of useful research are how to deal with the factor of 'time' and the 'issue of uncertainty' when planning for landscape change. The former refers to the dichotomy between some land use types which require a high degree of stability in space and time and the dynamics of rapid or 'fast track' planning outcomes. The latter refers to the uncertainties caused by changes in public opinion and consequent shifts in policy. Already trialled in The Netherlands in relation to rural landscapes (Sijmons 1990) the same issues have application to tourist landscapes.
The EBT plan does not quantify the level of use in various environments. However, the carrying capacity concept is partially addressed through the use of zoning. It is through zoning that environmental and tourism qualities are maintained and managed. The plan offers a general guide for the management of specific areas whose values can be altered if changes occur in the quality of the environment caused by visitor use. The approach also accommodates the values visitors have given to recreational activities and through the use of zoning values can be altered and appropriate activities provided. In this way tourist resources may be managed to create and maintain benefits for people which foster both unique and common recreational opportunities. While carrying capacity is considered to be a management issue in the EBT approach, further research could be made to identify ways in which environment - tourism planning can embrace carrying capacity factors in a meaningful manner.

Finally, the EBT planning framework focuses solely on environmental and tourism aspects. However, decisions are seldom made on these two landscape elements in isolation. Therefore, just as the EBT framework has arisen from the perceived need for environment - tourism integration, so too does this framework need to be integrated into a wider setting when the environment and/or tourism is one of a number of land use options. A useful next step will be to find pathways to integrate the EBT framework into a broader approach which encompasses other land use requirements and economic considerations related to local, regional and national contexts.
APPENDICES
Appendix 1

List of Reports Published During the Study


Appendix 2  Glossary

Abiotic - non-living features of the environment, eg. geology, landforms, soils, water and climate.

Access - includes both physical and market access to tourism destinations.

Attractions - are both natural and cultural resources which provide physical place settings for meeting tourists' experiences.

Attribute - a property or feature belonging to the environment

Biotic - living features of the environment, eg. animals and vegetation.

Carrying Capacity - is the level of use beyond which impacts exceed acceptable levels specified by evaluative standards. It includes four different types within tourism and recreational settings - ecological, physical, facility and social capacities.

Compatible Activities - are outdoor tourism recreational activities which are considered to be both environmentally and socially compatible.

Conservation - the management, protection and preservation of the earth's natural resources and environment.

Critical Areas - are those in which environmental and tourism features are in competition and possible conflict.

Diversity - describes the number of species (richness) and their relative abundance.

Ecotourism - is the conservation of the natural environment and the wellbeing of local people through responsible travel.

Environment - all aspects of the surroundings of humanity, affecting individuals and social groupings.

Environmentally Sensitive Areas - are so named because of their unusual importance for geologic, scenic hydrologic, vegetation, wildlife, archaeological, historic or other reasons.

Essential Perspectives - of tourism planning are comprehensive in scope and comprise environmental, social, economic, technological, political, legal, and institutional elements.

Fragility - of a natural area refers to its susceptibility to perturbation, most often human-induced.
Functional Differentiation - the separation of tourism or environmental areas based on the function or purpose its use.

Integration - of the environment - tourism relationship occurs when the possibilities of coexistence, conflict and symbiosis are recognized, but environmentally appropriate tourism opportunities are advanced.

Naturalness - refers to a natural condition which implies freedom from human influence.

Planning - is the practical process by which a detailed scheme or method is achieved. It is a multidimensional activity and seeks to be integrative.

Preservation - of nature and natural areas usually occurs in protected reserves or sanctuaries from which human use is excluded.

Process Models - of tourism are those oriented towards planning and management processes.

Rarity - is the absence or presence of species based on geographic (restricted area) and demographic (low numbers) criteria.

Representativeness - is the representation in protected areas of the range of ecological variation.

Significant Features - are either environmental attributes which are valued according to their level of diversity, uniqueness or representativeness, or tourism features valued for their resource value.

Spatial Considerations - of tourism planning refer to responsive dimensions from local to international in scale.

Symbiosis - close association of two species or things that are dependent on one another (e.g. tourism and the environment in natural areas).

Temporal Elements - of tourism planning include past, present and future aspects which are progressive in time.

The Region - the Gascoyne Region of WA consisting of the Shires of Carnarvon, Exmouth, Shark Bay and Upper Gascoyne.

Theoretical Models - of tourism seek to conceptualize the functioning of the tourism system either in parts or as a whole system.

Tourism - the temporary movement of people to destinations outside their normal home and workplace, the activities undertaken during the stay and the facilities created to cater for their needs.
## Appendix 3 Abbreviations of Terms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>AGPS</td>
<td>Australian Government Printing Service</td>
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<tr>
<td>ANPWS</td>
<td>Australian National Parks and Wildlife Service</td>
</tr>
<tr>
<td>CAD</td>
<td>Computer Aided Design</td>
</tr>
<tr>
<td>CALM</td>
<td>Department of Conservation and Land Management (WA)</td>
</tr>
<tr>
<td>CART</td>
<td>Centre for Advancement of Responsive Travel</td>
</tr>
<tr>
<td>CSIRO</td>
<td>Commonwealth Scientific and Industrial Research Organization</td>
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<tr>
<td>CTRC</td>
<td>Conservation Through Reserves Committee (WA)</td>
</tr>
<tr>
<td>DAS</td>
<td>Department of Aboriginal Sites (WA Museum)</td>
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<tr>
<td>DOLA</td>
<td>Department of Land Administration (WA)</td>
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<tr>
<td>DPA</td>
<td>Development Possibility Analysis</td>
</tr>
<tr>
<td>DPUD</td>
<td>Department of Planning and Urban Development (WA)</td>
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<tr>
<td>DRDNW</td>
<td>Department of Regional Development and the North West (WA)</td>
</tr>
<tr>
<td>EBT</td>
<td>Environmentally Based Tourism (Planning Framework)</td>
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<td>EPA</td>
<td>Environmental Protection Authority</td>
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<tr>
<td>GIS</td>
<td>Geographic Information System</td>
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<tr>
<td>GRIM</td>
<td>Groene Ruimte (Green Space) in Midden-Gelderland, Netherlands</td>
</tr>
<tr>
<td>HMAS</td>
<td>His (or Her) Majesty's Australian Ship</td>
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<tr>
<td>HMS</td>
<td>His (or Her) Majesty's Ship</td>
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<tr>
<td>IBP</td>
<td>International Biological Project</td>
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<tr>
<td>IUCN</td>
<td>The World Conservation Union, formerly the International Union for the Conservation of Nature and Natural Resources</td>
</tr>
<tr>
<td>IUOTO</td>
<td>International Union of Official Travel Organizations</td>
</tr>
<tr>
<td>LAC</td>
<td>Limits of Acceptable Change</td>
</tr>
<tr>
<td>MAB</td>
<td>Man and the Biosphere</td>
</tr>
<tr>
<td>NPNCA</td>
<td>National Parks and Nature Conservation Authority (WA)</td>
</tr>
<tr>
<td>NSW</td>
<td>New South Wales</td>
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<tr>
<td>OECD</td>
<td>Organisation for Economic Cooperation and Development</td>
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<tr>
<td>ROS</td>
<td>Recreation Opportunity Spectrum</td>
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<tr>
<td>SPC</td>
<td>State Planning Commission (WA)</td>
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<tr>
<td>SSC</td>
<td>Species Survival Commission (WCU)</td>
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<tr>
<td>UET</td>
<td>Ultimate Environmental Threshold</td>
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<tr>
<td>UNEP</td>
<td>United Nations Environment Programme</td>
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<tr>
<td>USA</td>
<td>United States of America</td>
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</table>
WATC    Western Australian Tourism Commission
WTO     World Tourism Organization
WWF     World Wide Fund for Nature; formerly the World Wildlife Fund

asl     Above sea level
cm      Centimetres
eg      For example
km      Kilometres
km/hr   Kilometres per hour
km²     Square kilometres
m       Metres
m³      Cubic metres
mg/l    Milligrams per litre
mm      Millimetres
mybp    Millions of years before the present
°C      Degrees celsius
pa      Per annum
ppt     Parts per thousand
sp      Species
Appendix 4  Fauna of the Gascoyne Region

A description of the terrestrial, marine and rare fauna of the Gascoyne Region.

1. TERRESTRIAL FAUNA

Mammals

A number of mammals occur in the region. The most common are the marsupials including the Red Kangaroo (*Macropus rufus*) and Euros (*M. robustus*). Red Kangaroos are more widely distributed and occur in greater numbers and have become tame and abundant in Cape Range National Park (CALM 1988). They are plentiful in areas with a good grass and herb cover and where some trees or shrubs are available for shade (Payne et al. 1987). Less prevalent is the Western Grey Kangaroo (*M. robustus*) which occurs in the region at its northernmost limit in Australia. Another marsupial found in the region is the Rock Wallaby (*Petrogale penicillata*) which occurs as a small population inhabiting Yardie Creek gorge, Cape Range National Park.

Dingoes (*Canis familiaris dingo*) are prevalent especially in inland areas as well as along the Lyndon and upper Minilya Rivers. Some dingoes occur to the south of this area in the Kennedy Range and occasionally in other areas such as the upper Wooramel River. Other species recorded include the Echidna (*Tachyglossus aculeatus*), the Spinifex Hopping - Mouse (*Notomys alexis*) and the Sandy Mouse (*Pseudomys hermannsburgensis*). Populations of the last also still survive on some of the islands in Shark Bay (Burbidge and George 1978).

In addition a number of rare or endangered species live on the islands of Shark Bay. They inhabit the spinifex-covered Bernier and Dorre Islands which provide an ideal refuge for species that either no longer exist on the mainland or are found only in isolated habitats. Among these are the banded (*Lagostrophus fasciatus*) and rufous (*Lagorchestes hirsutus*) hare-wallabies and the western barred bandicoot (*Perameles bougainville*). Even more specialised in its range is the tiny, but distinctive Shark Bay mouse (*Pseudomys fieldi*) which is restricted to Bernier Island (Figgis and Mosley 1988). A number of bats have been recorded in the region. These include Gould’s Wattled Bat (*Chalinolobus gouldii*) and the White-striped Bat (*Tadarida australis*). In addition a peculiar form of a widely distributed little bat (*Eptesicus* sp. nov) is found in Shark Bay (Hall 1988).

Introduced mammals in the state have been described by Long (1988). In the Gascoyne Region seven introduced mammal species have been recorded (Payne et al. 1987). Goats (*Capra hircus*) are widely distributed throughout the region usually with higher numbers near the coast. They are also concentrated along the Gascoyne and Wooramel Rivers as well as
the country inbetween. European rabbits (*Oryctolagus cuniculus*) are found along the whole of the coastal strip, usually within 10km of the coast, although their range extends inland during more populous seasons (Wood 1984).

Red Foxes (*Vulpes vulpes*) are also widely distributed throughout the region but are in greater numbers closer to the coast. They pose a threat to native fauna and may have caused the local extinction of some species (Christensen 1980). In Shark Bay and Cape Range, predation by foxes on turtle eggs occurs. Donkeys (*Equus asinus*) occur in small numbers on the lower Wooramel River but larger groups are found in the central and eastern part of the region. Camels (*Camelus dromedarius*) exist in the inland and in addition there is an isolated mob at the southern end of Shark Bay Shire (Payne et al. 1987). Feral cats (*Felis catus*) are widely distributed and common throughout the Gascoyne Region and are suggested to be a threat to populations of native animals (Fitzgerald and Veitch 1985). Wild cattle (*Bos taurus*) are also widespread in the region.

Cave deposits in Cape Range contain fossil fauna which differ from modern fauna. In addition, evidence that the woillie (*Bettongia pencillata*), which is now restricted to small areas of the southwest of Western Australia, once inhabited parts of Shark Bay. This has been recorded on Faure Island, off the east coast of Peron and Nanga (Australian Heritage Commission 1989).

**Birds**

The region is rich in birdlife with over 100 species having been recorded in Shark Bay (Nevill and Lawrence 1985) and 144 species in Exmouth (May et al. 1983). The birds of the region have predominantly widespread or mainly arid zone distributions. The birds of the northern part of the region have been listed by Storr (1984) and in the southern part by Carter (1917), Davies and Chapman (1975), Abbott (1977), Burbidge and George (1978), and Burbidge et al. (1980). Because the region is bounded by the sea on its western edge approximately one-third of the birds are seabirds and waders. The largest of them are the white-bellied sea-eagles (*Haliaeetus leucogaster*) and the ospreys (*Pandion haliaetus*) which build their nests on headlands along the entire Gascoyne coastline. Also frequently seen in the region is the wedge-tailed eagle (*Aquila audax*). It is Australia's largest bird of prey, and is a carrion eater usually more associated with the inland.

In the northwest of the region around North West Cape many of the species are seabirds. The mangroves at Mangrove Bay, Cape Range support eight species of birds which are at their southern limit in Western Australia (May et al. 1983). These are the barshoulder dove (*Geopelia humeralis*), mangrove robin (*Eopsaltria pulverulenta*), mangrove heron (*Butorides striatus*), white-breasted whistler (*Pachycephala lanioides*), mangrove grey fantail (*Thipidura fuliginosa phasiana*), dusky flyeater (*Gerygone tenbrosa*) and yellow white-eye (*Zosterops lutea*). The long-term survival of these birds is directly related to the continued existence of
the mangroves (Johnstone 1980). Cape Range is the northernmost limit of the field wren (Calamanthus fuliginosus) and is the habitat for the common spinifexbird (Eremiornis carteri), the white-winged fairy-wren (Malurus leucopterus), emu (Dromaius novaehollandiae) and the white-backed swallow (Cheramoeca leucosternum). In addition many other birds may be found in the area (Marr 1986).

The ponds of Lake MacLeod are also important wildlife refuges. Birds are usually present in large numbers and include the black swan (Cygnus atratus), pelican (Pelecanus conspicillatus), pied cormorant (Phalacrocorax varius), as well as numerous terns, ducks and wading birds. A survey of the lake's birds has revealed over 3,000 transequatorial migratory waders and it appears to be an important resting place for flocks of waders migrating between Asia and Australia (Australian Heritage Commission 1989).

In the southernmost part of the region are seven species of South West birds which are at the northernmost limit of their range (Burbidge et al. 1980, Hopper 1980). These are the brown-headed honeyeater (Melithreptus brevirostris), fan-tailed cuckoo (Cuculus pyrrhophanus), golden whistler (Pachycephala pectoralis), malleefowl (Leipoa ocellata), red wattle bird (Anthochaera carunculata), southern scrub robin (Dymodes brunneopygia), and the western yellow robin (Eopsaltria griseogularis). A bird which reaches its southern limit on Peron Peninsula is the yellow silvereye (Zosterops lutea).

On the small islands of Shark Bay breeds the Wedge-tailed Shearwater (Puffinus pacificus). White bellied birds of the species which breed here are the only known population with this plumage in Australia. It often shares the islands with terns, gulls and other seabird species. The pelican (Pelecanus conspicillatus) is also common in this habitat and nests on platforms of sticks and plant matter on beaches or sandbars. Shark Bay is almost at the northern limit of the Pacific gulls' (Larus pacificus) range. This is the largest of Australian gulls and is remarkable for its deep, bulky, red-banded bill (Flannery and Rodd 1988). Another common bird is the pied cormorant (Phalacrocorax varius). On Dirk Hartog Island is a colony of Southern Emu Wren (Stipiturus malachurus) which is generally found in the southwest corner of the State.

Reptiles

The region forms the habitat of many species of reptiles including geckos (Gekkonidae), legless lizards (Pygopodidae), dragon lizards (Agamidae), skinks (Scincidae), monitor lizards or goannas (Varanidae) and snakes (Colubridae).

Shark Bay, on the edge of the western desert, has become a refuge area for a diverse reptilian fauna. It supports thirteen reptile families and 92 species, the distribution of which is largely determined by soil types (Storr and Harold 1978, 1990). Many of the reptiles are only known from a few
specimens and much remains to be discovered about their biology and habitat requirements (Dale 1988). The shingleback (*Trachydosaurus rugosus*) is the most conspicuous of the many skinks in the Shark Bay area. It grows to more than 40cm long, and is an omnivore, feeding on flowers, fruits, snails and carrion. Geckos, including *Diplodactylus michaelensi*, snakes such as the blind-snake (*Typhlina leptosoma*), dragon lizards and big goannas such as *Varanus panoptes rubidus* are common in the region. Ten of Australia's thirty dragon lizard species occur in the Shark Bay vicinity. Some reptile species are typical of arid central WA and others are at the northern limit of their southwest distribution.

Endemics include a small rare striped skink (*Lerista humphriesi*), the scincid lizard (*Menetia amaura*) and the legless lizards *Aprasia haroldi* and *Pletholax gracilis edelensis*, all of which are found in Edel Land. The scincid lizard *Aprasia haroldi* and the python *Aspidites ramsayi* are endemic to Peron Peninsula. The Baudin Island Skink or spiny-tailed subspecies of Gidgee Skink (*Egernia stokesii aethiops*) only occurs on Baudin Island and the skink (*Ctenotus youngsoni*) is endemic to Dirk Hartog Island. Two skinks which reach their northernmost limit in Shark Bay are *Egernia multiscutata* (Bernier Island) and *Morethia obscura* (Storr et al. 1981).

A survey of the Carnarvon area has recorded thirty-one reptiles from Callagiddy and Brickhouse stations (Brooker and Estbergs 1978). Further north the Cape Range area is extremely rich in the number of species of dragon lizard (Australian Heritage Commission 1989). The tropical skink (*Carlia foliorum*) is at its southernmost habitat in the area. The very small smooth tailed skink *Notoiscincus ornatus ornatus* reaches its southern limit in Exmouth Gulf and the northern inland Gascoyne. Two very large heavily built skinks which are at the northern limits of their distribution in Carnarvon and the central Gascoyne are *Tiliqua occipitalis* and the Bobtail (*T. rugosa*) which is Australia's best known skink (Storr et al. 1981).

Dragon species found in the North West Cape area include the red desert dragon (*Ctenoporus rubens*) and the netted dragon (*C. nuchalis*). They are common in the red sand dune country where day temperatures are intense (Pearson 1991). As the Australian arid region has a higher number of herpetofauna compared with that of arid regions elsewhere in the world (Cogger 1984) further studies in the Gascoyne area will no doubt lead to the discovery of new reptile species.

**Amphibians**

Several species of amphibians are recorded the most common being Ground Frog (*Leptodactylidae*). On the southern edge of the region is a rare and unusual land frog (*Arenophryne rotunda*) which has adapted to its semi-arid environment.
Invertebrates

Little is known about the invertebrate fauna of the region. However, extensive research is being carried out on the fauna of the caves of Cape Range by the Western Australia Museum (Humphreys 1989, 1991). To date large numbers of troglobitic arthropods have been recorded including micro-whip scorpions, pseudoscorpions, millipedes, spiders, slaters, beetles, amphipods and many others (Humphreys 1991). The first described Australian Schizomid (Schizomus vinei) has been recorded in the caves of the range (Vine et al. 1988; Humphreys et al. 1989) and the land snail (Pleuroxia ruga) is endemic to the area (Wilson 1987). Spiders are numerous and twenty-five species have been recorded so far (York Main 1990).

2. MARINE FAUNA

The coastal waters of the Gascoyne support an extremely rich and diverse marine fauna. These include whales, sharks, dolphins, turtles, rays, dugong and giant cod. This unusual richness is supported by Ningaloo Reef in the north and the Wooramel Seagrass Bank along the eastern shore of Shark Bay, in the south. The numerous species of seagrass provide both a source of food and an important foraging environment.

Marine Mammals

The waters of the Gascoyne Coast are an important area for marine mammals, particularly cetaceans (May et al. 1983). A large variety of whales, some rare or endangered, migrate through the waters annually on their way between the Antarctic feeding grounds and their breeding area on the North West Shelf (CALM 1988). Others such as the humpback whale (Megaptera novaengliae) use the regions sheltered waters as a wintering area. Earlier this century whaling occurred in the area both from ships in Shark Bay as well as from a shore based station which operated at Norwegian Bay until 1962. Today this commercial activity has been replaced by whale watching tours and whales are slowly increasing in numbers after their earlier brush with extinction.

The area also supports a large population of the rare and endangered Dugong (Dugong dugon). These quiet, bottom-feeding sea cows have been hunted to extinction in most parts of their tropical Indo-Pacific range, but in the Gascoyne waters, there is a large and apparently healthy population of them (Wilson 1989). It is estimated that there are more than 70,000 dugongs in Australian waters of which 10,000 are in Shark Bay and a further 2000 are in Exmouth Gulf and Ningaloo Reef (Marsh 1991). Shark Bay is the most southerly point at which the dugong occurs year round and their biology and status have been reported on by Prince et al. (1981), Anderson (1982a+b, 1985)
The waters also support a large number of Bottlenose Dolphins (*Tursiops truncatus*) which are the subject of ongoing biological and sociological research being carried out by several universities in Australia and the U.S.A. A pod in Shark Bay has gained international significance for their interaction with humans (Raffaele 1989a+b; CALM 1989; Edwards 1989; Fox 1991). Since 1964 up to twenty dolphins have visited a beach at Monkey Mia to be handfed coming for human contact as much as for feed since there are ample fish in the surrounding waters (Fox 1991:56).

Green turtles (*Chelonia mydas*) and Loggerhead turtles (*Caretta caretta*) are common along the coast with several extensive rockeries in the shores of Ningaloo Reef and Shark Bay. In the latter area they nest in significant numbers on the northern beaches of Dirk Hartog Island and the Peron Peninsula (Dale 1988). In addition Hawksbill turtles (*Eretmochelys imbricata*) and Leatherback turtles (*Dermochelys coriacea*) sometimes frequent the coastal area (WA Turtle Newsletters 1989-91).

The waters are also an important habitat for a number of species of sea snakes. These include the Bar-bellied sea-snake (*Hydrophis elegans*), Olive-headed sea-snake (*H. major*), and two other species (*H. Kingii* and *H. ocellatus*). Shark Bay is the habitat of two endemic species (*Aipysurus laevis* and *A. pooleorum*). Seasnakes in the area forage for fish among the prolific seagrass beds.

Shark Bay was originally named 'Sharks Bay' after the numerous sharks seen in the area by William Dampier, the first English visitor to Australia who spent seven days in the area in 1699. The numerous sharks still seen in the bay are the small Bay Whalers (*Carcharhinus obscurus*), Tiger Sharks (*Galeocerdo cuvier*) and the Hammerhead Sharks (*Sphyrrna mokarran* and *S. zygaena*).

**Fishes**

The fish fauna of Australia is composed of two separate groups correlated with sea temperatures (Allen and Swainston 1988). The southern temperate fauna inhabits the western coast from Shark Bay south while the larger northern tropical fauna occurs from Shark Bay northwards. At the junction of the two zones is a transition area containing a mixture of both temperate and tropical fishes as well as a number of unique species. This transition zone occurs from about Lancelin (south of the Gascoyne) to Point Cloates which is within it. Thus the Gascoyne waters are an important habitat for both temperate and tropical species as well as for endemic species in the transitional area.

The coastal waters of the Gascoyne Region are rich in fish. From the North West Cape area alone the number of species recorded is 464 belonging to 234 genera and 81 families (Allen 1980). In the waters of Ningaloo Reef and Exmouth Gulf the majority of the fishes are coral dwelling species with distributions ranging across the tropical Indo-Pacific. More than 500 species of fish have so far been recorded by scientists in the waters of Ningaloo Marine Park (CALM 1988). These fishes represent one
of the most diverse Indo-Pacific reef communities in Western Australia, making the area unique in that it is as rich as many parts of the much larger Great Barrier Reef (Talbot 1979). Fish surveys of Shark Bay have recorded numerous species - 323 from South Passage in April 1979 (Hutchins 1990) and 58 from the near shore seagrass and sandflat habitats at Monkey Mia in February and June 1983 (Black et al. 1990). Characteristic of the area are large populations of north-west snapper and emperor, belonging to the families Lethrinidae and Lutjanidae. These predatory fish feed primarily on molluscs, crustaceans and other small fishes.

In Shark Bay the scale fish are so numerous that they support a major industry. The principal commercial species are whiting (Sillago sp.), snapper (Chrysophrys sp.) and mullet (Mugil sp.). The snapper fish appear to show speciation in Shark Bay (Dale 1988). Netting for whiting and mullet is carried out mainly in sublittoral sandflat environments. Whiting populations use methaline (salinities 40-53 ppt) areas as nurseries and large numbers of young are found in the southern parts of the bay (Lenanton 1977).

Ningaloo reef supports a limited echinoderm fauna with 56 genera and 90 species having so far been recorded (Marsh 1980). Most are widespread Indo-Pacific coral reef species at or near the southern limit of their distribution. The most conspicuous and abundant starfish are the blue Linckia laevigata and a brown species Nardoa galatheae. The large oreasterids (Protoreaster nodulosus and P. lincki) occur in the lagoon, the latter only known elsewhere from the Western Indian Ocean and Indonesia. The small population of this spectacular starfish on the Ningaloo Reef is in a delicate balance. Feather stars, (crinoids) brittle stars (ophiuroids) and sea urchins (echinoids) are not plentiful except for Echinometra mathaei in some areas. Some species of sea cucumbers (Holothurians) are also prevalent.

A common sight in the waters of Ningaloo Reef and North West Cape are the Whale Sharks (Rhiniodon typus). These are the largest shark species and are the biggest fish in the oceans. Research has shown that there is an exceptional number of whale sharks in the area (Taylor 1991). The sharks feed on hugh aggregations of a zooplankton crustacean which is a Euphasid or Krill. Also feeding on this are a diverse and abundant population of manta rays (Manta birostris). In Shark Bay the rays also are found in the shallow protected waters as well as along the northeastern side of Dirk Hartog Island.

Molluscs

A number of molluscs occur in Shark Bay and a preliminary examination has recorded 218 species (Slack-Smith 1990). However, limited surveys carried out in Exmouth Gulf and on the western side of the North West Cape have yielded approximately 600 species (Wells 1980a) with a large number being restricted to either the open coastline or the more sheltered waters of the Gulf. Comparatively few species have been recorded from
both areas. During these surveys many species were recorded for the first
time in Western Australia. The greatest abundance and diversity of
molluscs occur in areas which are not rich in living corals, that is, on rock,
dead coral and sand substrates, and in or adjacent to areas of high plant
diversity (Wells 1980b). The Burrowing bivalve (*Fragum erugatum*) is
endemic to the west coast of WA and forms the shell deposits of Hamelin
Pool and Shell Beach (CALM 1989). The bivalve is particularly prevalent
in Hamelin Pool where it has been the subject of inwashing from Shark
Bay (Simons 1987).

**Crustaceans**

The waters of the region are also the habitat of numerous crustaceans. So
far 232 species have been recorded in Shark Bay of which 115 are tropical,
seventeen are temperate and sixteen are endemic to WA (Jones 1990). The
Western Rock Lobster (*Panulirus cygnus*) is endemic to the Western
Australian coastline and supports a major commercial fishery. Other
species are the ornate rock lobster (*P. ornatus*) and the coral or painted
rock lobster (*P. versicolor*). At Mangrove Bay in Ningaloo Marine Park
thirteen species of crab have been recorded (George and Jones 1987).

**Coral**

The Ningaloo Reef is extremely rich and diverse in coral fauna and is as
spectacular as any in the world (Wilson 1988b). Fifty-four genera and more
than 220 species have been recorded many of which are typical of the
tropical Indo-Pacific region and do not occur further south in WA (CALM
1988; Readers Digest 1991). The reef crest is dominated by the corals
Acropora and Platygyra but numerous others also occur (Wells 1978).
Patch reefs and large bombies (*Porites sp*) also occur particularly in the
coral rich areas of Point Maud, Tantabiddi and Mangrove Bay (May *et al.*
1983). The coral is under threat from the marine snail *Drupella cornus*
which is present in vast numbers in some parts of the reef and already has
caused extensive damage (Stoddart 1989). There are no coral reefs in or
around Shark Bay and consequently it has a depauperate coral fauna
compared with Ningaloo Reef with intensive collecting yielding only
eighty species in scattered coral communities (Marsh 1990).

3. **RARE FAUNA**

The rare fauna of the Gascoyne Region are classified according to their
level of threat being either 1 = potentially vulnerable, 2 = vulnerable, or 3
= endangered.

1. **Potentially Vulnerable**

A number of species of mice which are potentially vulnerable to extinction
are found in the region. These are the Ash-grey mouse (*Pseudomys*
albocinereus *squalorum*), the Desert mouse (*P. desertor*), the Sandy Inland
mouse (*P. hermannsburgensis*) and the Western chestnut mouse (*P. nanus*). The Ash-grey mouse and the Sandy inland mouse are small mice of the sand substrate habitats of the south-west and the arid zones respectively. Thus the Sandy inland mouse is the ecological vicar species of the Ash-grey mouse and replaces it across the Shark Bay area with the change from the southwest to the arid zone. Their distributions intermingle on the western side of Shark Bay with the Ash-grey mouse restricted to the white sands bearing south-western plant species and the Sandy inland mouse occurring on the red dunes (Baynes 1990). Both species still occur on Dirk Hartog Island where they occupy the same habitat (Burbidge and George 1978). The Desert mouse and Western chestnut mouse still frequent the arid inland zone of the Gascoyne Region.

A few birds which are designated as being potentially vulnerable in Australia are found in the Gascoyne Region. They include the Australian Bustard (*Ardeotis australis*) and the Bush Thick-knee (*Burhinus magnirostris*), Southern Emu-wren (*Stipiturus malachurus hartogi*), Variegated Fairywren (*Malurus lamberti bernieri*) and the Wedge-tailed shearwater (*Puffinus pacificus*). A subspecies of the Wedge-tailed shearwater breeds on the numerous small islands of Shark Bay (Conservation Through Reserves Committee 1974). The white bellied birds of this species which breed here are the only known population with this plumage in Australia.

A number of terrestrial reptiles in the region are endemic and geographically restricted. Some are therefore potentially vulnerable to extinction although they have not been classified as such on the Australian list (Kennedy 1990). These reptiles include four rare lizards restricted to Peron Peninsula. These are the legless species *Aprasia haroldi*, which is one of only nine species of this genus of worm lizards found in Australia (Flannery and Rodd 1988). These small sand burrowers grow to about fifteen centimetres long and are not entirely legless as they have minute vestigial hind limbs. Another legless species found in the region is *Pletholax gracilis edelensis* (Conservation Through Reserves Committee 1974). Two scincid lizards (*Ctenotus zastictus* and *Tymanocryptus parviceps butleri*) are restricted to the coastal dunes on Edel Land (Storr et al. 1990). Another skink is *Ctenotus youngsoni* which is endemic to Dirk Hartog Island (Australian Heritage Commission 1991). The legless lizard (*Aprasia smithi*) is endemic to the southern Shark Bay area (Burbidge et al. 1980; Storr 1970) while *Aprasia fusca* is found on the coast only between Yardie Creek and Gnarakoo. In the southernmost part of the Shark Bay are four rare subspecies of the skink (*Leurista sp.*). One, *Leurista humphriesi*, is only known to occur very locally in the area (Hopper 1980) while *Menetia amaura* is only known from a single specimen recorded at Carrarang Station (Conservation Through Reserves Committee 1974).

The land snail *Pleuroxia ruga* is also potentially vulnerable (Wilson 1987). Once more widespread it is now found only on Cape Range where it spends the hot dry periods stuck on the underside of stones. In addition
the first described Australian schizomid (Chelicerata: schmizomida) *Schizomus vinei* has been recorded from two caves in Cape Range although over sixty caves were surveyed (Humphreys et al. 1989).

A number of potentially vulnerable marine animals are found in the waters of the Gascoyne Region. They include the Pigmy Sperm Whale (*Kogia breviceps*) as well as a variety of turtles found at their southern limit on the western side of the continent. They are the flatback turtle (*Chelonia depressa*), the green turtle (*C. mydas*), hawksbill turtle (*Eretmochelys imbricata*) and the loggerhead turtle (*Caretta caretta*). The flatback turtle is normally found in the shallow coastal waters of northern WA, the Northern Territory and Queensland. Although it is not quite as vulnerable as other marine turtles as it is not sought after for its meat, large numbers of eggs are collected and eaten by Aborigines (Kennedy 1990). Flatback turtles have been recorded in the waters of Exmouth Gulf and this is the most southern limit of their recorded range on the west coast of Australia (WA Turtle Research Newsletters 1989-91).

Green and loggerhead turtles are recorded from throughout the area in both the north and south. Nesting sites have been recorded in the north from Ningaloo Marine Park and on South Muiron Island (WA Turtle Research Newsletter 1989). The Green Turtle is very common in the Ningaloo Reef lagoon and it has several extensive breeding rookeries between Yardie Creek and Northwest Cape (May et al. 1983). In Shark Bay both species are abundant on Green Turtle Flat, north of Faure Island as well as around the northern ends of Peron Peninsula and at Turtle Bay on Dirk Hartog Island (Nevill and Lawrence 1985). Both species are recorded on the national list of Australia's endangered species (Kennedy 1990) as well as in the International Red Data Book (IUCN 1988). In addition they are listed by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) as species which are or may be affected by trade and are therefore threatened with extinction (CITES 1990).

The Shark Bay sea-snake (*Aipysurus pooleorum*) is endemic to the Shark Bay area and is potentially vulnerable (Australian Heritage Commission 1991). A number of molluscs in the North West Cape area are vulnerable to long term local extinction and are in need of protection (CALM 1989). These are the Giant conch (*Syrinx aruanus*), the Baler Shell (*Melo amphorus*) and the volute (*Aulicina oblita*).

2. Vulnerable

Birds which are vulnerable in the region include the Little Tern (*Sterna albiglrons sinesis*), Malleefowl (*Leipoa ocellata*) and the Peregrine Falcon (*Falco peregrinus*). The Little Tern reaches its southern limit on the west coast of Australia on the islands of Exmouth Gulf. It occurs in coastal waters, bays and shallow inlets as well as on salt or brackish lakes. The Malleefowl is a large sedentary bird which is mostly found in inland mallee and other dry scrubs. In Shark Bay it reaches the northern end of
its range. The Peregrine Falcon is not common in the region but in the past it was hunted as a pest.

The Round or Sandhill Frog (*Arenophryne rotunda*) is a vulnerable amphibian species found in the southern part of the Gascoyne Region. (Tyler *et al.* 1980). It is known only from two sites in Southern Shark Bay - the False Entrance Well Site in the coastal sanddunes on Carrarang station and from the Cooloomia Nature Reserve (Hopper 1980). It is a burrowing frog which spends most of its time underneath the surface emerging to feed on insects only during the night dew or when it rains. It has adapted to the arid climate with the frogs changing from eggs to baby frogs entirely within the egg capsule and missing out the water borne tadpole stage. This adaptation is an achievement for frogs which are, of course, normally aquatic in lifestyle. Although the species is common in Edel Land it has a restricted distribution and therefore needs special protection (CALM 1989).

A rare snake known as Woma or Ramsay's Python (*Aspidites ramsayi*) occurs on Peron Peninsula (Fyne 1981). Although it is found in several parts of Australia its numbers have declined (Smith 1981) to the extent that it is now listed as needing special protection on the WA Rare Fauna List (1990).

The coastal waters of the region also support a population of rare and endangered mammals. These include the Australian Sealion (*Neophoca cinerea*), the Dugong or 'sea cow' (*Dugong dugon*) and the Minke Whale (*Balaenoptera acutorostrata*). The Australian Sealion's habitat extends south from North West Cape around to Kangaroo Island in South Australia. They inhabit marine inshore waters, colonising sandy beaches or rocky shores of the coast and small offshore islands. The species was heavily hunted last century and today their population is estimated to be less than 5000.

The Dugong in the waters of the Gascoyne are of international interest (Shepherd 1989). The population of 12,000 is amongst the world’s largest and it is the only large population not exploited by legal hunting (Fox 1991). A single young dugong is usually born about a year after mating and will not by itself be capable of reproducing before it is about ten or more years old. This slow rate of reproduction has made the dugong vulnerable to extinction in areas where it is not protected (Flannery and Rodd 1988). Undisturbed the dugong lives a slow, peaceful life and is the only herbivorous mammal that is strictly marine, feeding almost exclusively on seagrasses. During all seasons dugongs occupy the warmest water available to them. Fluctuations by water temperature variations cause seasonal migration of herds of dugongs. During summer, in the warm waters of Shark Bay, the dugongs feed in the shallows of the Gladstone - Faure Sill area as well as the Freycinet Inlet. In winter they move to warmer areas on the eastern side of Dirk Hartog, Bernier and Dorre Islands. Shark Bay is located at the southern limit of the dugongs range. The limiting factors appear to be temperature, interacting with food supply and Shark Bay is a thermally marginal dugong habitat (Prince *et al.* 1981).
Thus the Shark Bay Dugong group appears to be one of critical importance for both scientific study and the preservation of the species.

The Minke Whale (*Balaenoptera acutorostrata*) which is also vulnerable and occurs in all waters around Australia has been recorded in the waters of the Gascoyne Coast (May et al. 1983; Taylor 1991).

3. Endangered

The Gascoyne Region and in particular its southern part of Shark Bay, has an international reputation for its habitat of endangered species. The land areas are home to four endangered terrestrial mammals found nowhere else in the world. These animals of special conservation significance are the Banded Hare-wallaby (*Lagostrophus fasciatus*), the Burrowing Bettong (*Bettongia lesueur*) the Shark Bay Mouse (*Pseudomys fieldi*; formerly known as *P. praeconis*) and the Western Barred Bandicoot (*Perameles bougainville*).

The Banded Hare-wallaby survives only on Bernier and Dorre Islands. Fossil remains from Aboriginal middens and a single specimen collected in South Australia last century show that it once extended right across the southern Nullabor Plain (Flannery 1990). The last mainland specimen was obtained in 1906. Its loss from the mainland is thought to be due to predation by cats and through competition from rabbits. It seldom has access to fresh water and survives on moisture from heavy dew and food. As the only surviving member of a kangaroo subfamily containing the extinct short-faced kangaroos, it is of immense biological importance (Flannery and Rodd 1988).

The Burrowing Bettong previously had one of the largest mainland distributions of any Australian mammal. The stocky marsupial used to be found in most of Western Australia, South Australia and the Northern Territory, as well as parts of New South Wales and Victoria. However, the species has been extinct on the mainland since the 1940s. Since then it has also become extinct on Dirk Hartog and Boodie Islands and today survives only on Bernier and Dorre Islands within the region as well as on Barrow Island just to the north. The remaining island populations are still endangered and plans are being made to re-introduce the species to the mainland. The bettong are strictly nocturnal, only emerging from their burrows at dusk (Stodart 1966).

The Shark Bay Mouse (*Pseudomys praeconcis*) has recently been given the scientific name *Pseudomys fieldi* (Baynes 1990). It was first discovered on the Peron Peninsula in 1858. Since then no other has been seen on the mainland and today it only survives on Bernier Island where it inhabits sandy dunes among clumps of spinifex grass. It is thought to feed on flowers, as well as the stems and leaves of plants. The small rodent is distinguished by its blunt nose, black-flecked brown back, as well as its white sides and belly. It is also called the 'shaggy mouse' because of its long shaggy coat (Flannery 1990).
The Western Barred Bandicoot is today found only on Bernier and Dorre Islands where it is still common. It was once widespread throughout the semi-arid areas of the southern half of Australia but is presumed to be extinct on the mainland. Now confined to the two offshore islands, its extinction on the mainland probably resulted from habitat destruction as well as competition from, and predation by, foxes. Its restricted habitat and the potential for disaster through fire, introduced predator or disease always pose a threat to its population. It spends its days on sand dunes in a nest lined with twigs and other plant matter, in a well-hidden burrow. At dusk it emerges to feed on small invertebrates, seeds and fruit.

In addition the land and water areas of the region in general, and Shark Bay in particular, are home to a number of other species found in other parts of the world but which are endangered. These include the Black-footed Rock-wallaby (Petrogale lateralis), the Greater Stick-Nest Rat (Leporillus conditor) and the Rufous Hare-wallaby (Lagorchestes hirsutus).

The Black-footed Rock-wallaby is found in the cliffs of Yardie Creek. Although it is found in other places in Australia it is considered to be rare and is now geographically restricted to only a few places. The rock-wallabies are under threat from a number of sources, the main one appearing to be feral goats (Kinnear et al. 1990). Goats feed on the coastal plain and shelter in the same rocky gorge as the rock-wallabies. A dense layer of goat droppings carpets the gorge, fertilising the rock-wallaby habitat. The food plants of rock-wallabies may thus be displaced by unpalatable plant species. This means that the rock-wallabies will eventually have to forage further away from their rocky shelters, becoming more vulnerable to foxes. In other arid areas of Australia goats compete directly with rock wallabies for food during dry conditions due to the very high overlap of their diet (Dawson and Ellis 1984).

The Greater Stick-Nest Rat and the Rufous Hare-wallaby are two of Australia’s most highly threatened vertebrates (Kennedy 1990:18). The Greater Stick-nest Rat was once found across the entire southern half of Australia but it has not been sighted on the mainland since 1933. Until recently it was found only on the Franklin Islands off the coast of South Australia where there are approximately only 1,000 still surviving. However, it has just been introduced to Salutation Island in Shark Bay where it will hopefully re-establish the species on the western side of the continent (Burbidge and Friend 1990). Its near relative the Lesser Stick-Nest Rat (Leporillus apicalis) was last sighted in 1933 and is presumed extinct. The Rufous Hare-wallaby is a marsupial species which has declined significantly on the mainland and remains highly endangered. Today it is found only in two places in Australia. A single colony is located in the Tanami Desert of the Northern Territory while a larger group have their habitat on the Bernier and Dorre Islands. The subspecies identified on these islands are (L. h. bernieri) and (L. h. dorreae). The species is rufous above and paler below with long, soft fur. The animals dig short burrows to protect themselves from the heat of the day and they feed on spinifex seeds, perennial shrubs and sedges. It seems likely that
competition with rabbits, the pressure of newly arrived predators such as the fox and cat, and the grazing of introduced stock, all contributed to the decrease in abundance and distribution of these native mammals (Low 1984).

In addition a number of endangered birds have their habitats in the area. They include a subspecies of the White-winged Fairy-wren, the Black and White Wren *(Malurus leucopterus leucopterus)* which is restricted to Dirk Hartog Island (CALM 1989). The white-winged fairywren is widely distributed over most of the inland but only occurs in a black form on Dirk Hartog Island. Elsewhere the male is a bright cobalt blue. Throughout its entire range the adult female has pale brown plumage with a dull blue tail. These birds build covered nests of grasses in bushes or tall grass tussocks. The Variegated Fairy-wren *(Malurus lamberti bernieri)* is found only on Bernier Island. The Grey Falcon *(Falco hypoleucos)* is also occasionally found in the area as well as the rare Thick-billed Grasswren which is only found in a few places in Australia. One subspecies *(Amytornis textilis textilis)* is confined solely to Shark Bay and is particularly vulnerable (Curry 1986; Kennedy 1990). Absent from most of its previous range and extinct on Dirk Hartog Island, only one small population survives on Peron Peninsula (CALM 1989).

Two reptiles in the region are endangered. They are the Baudin Island Skink or Spiny-tailed subspecies of Gidgee Skink *(Egernia stokesii aethiops)* which is found only on Baudin Island and the Yinietherarra Rock-dragon *(Ctenophorus yinnietherarra)* whose habitat lies in the central Gascoyne.

In addition to the endangered terrestrial mammals of the region there are a number of marine mammals in need of special protection as well. At least four endangered whales inhabit the area. They are the Blue whale *(Balaenoptera musculus)*, which is the largest animal ever to inhabit the earth, the Fin whale *(B. physalus)*, the Humpback species *(Megaptera novaengliae)* as well as the Southern Right Whale *(Eubalaena australis)*. The Southern Right Whale can be seen wintering over in Shark Bay at the northern limit of its habitat (Nevill and Lawrence 1985, Hall 1988). All have been recorded in the waters of the Ningaloo Marine Park (May et al. 1983) and the Humpback has additionally been recorded in the waters of Shark Bay (Baynes 1990). All four species previously had Southern Hemisphere numbers in excess of 100,000 whereas today the combined total of their Antarctic populations is less than 7,000 (Kennedy 1990). The whales annually migrate northwards up the coast to warmer waters from June till August returning southwards during September and October.

The Leathery Turtle *(Dermochelys coriacea)* is presumed to be in the coastal area of the Gascoyne Region (May et al. 1983). It is the largest turtle in the world, growing up to 3m in length. It has a small number of breeding grounds worldwide and these are heavily pillaged. Therefore this species is endangered and needs to be given full protection in Australian waters (Kennedy 1990).
Two endangered fish in the region are the Synbrachid or Blind Cave Eel (Ophisternon candidum) and the Blind Gudgeon or eleotrid fish (Milgerringa veritas) both of which inhabit the subterranean waters of Cape Range (Allen 1980, 1982). The Blind Cave Eel lives in dark caverns and fissures beneath the coastal plain on the western side of Cape Range, between North West Cape and Yardie Creek. Only four specimens have ever been collected and the species appears extremely rare. However, because its habitat is so inaccessible, population numbers are difficult to assess. The Blind Gudgeon has only been sighted at nine localities between 1944 and 1980. So little is known about the biology, population and specific habitat requirements of this species that it is difficult to predict likely threats and suggest appropriate conservation (Kennedy 1990).

REFERENCES


Conservation Through Reserves Committee (1974) Conservation reserves in Western Australia: a Report to the Environmental Protection Authority. Department of Conservation and Environment, Western Australia.


Johnstone, R.E. (1980) Birds of the coastal fringe and seas from North West Cape to Point Cloates, Western Australia. In Biology of the Ningaloo Reef around Low Point, North West Cape, Weaver Oil and Gas Corporation, Australia.


WA Turtle Research Newsletters (1989-91) Wildlife Research Centre, Department of CALM, Perth.


Wells, F.E. (1980b) Molluscs of the inter-tidal zone. In Biology of the Ningaloo Reef around Low Point, North West Cape. Weaver Oil and Gas Corporation, Australia.


Appendix 5 The Residents' Questionnaire
(Example from Shark Bay)

WHAT DO YOU THINK ABOUT

TOURISM AND THE ENVIRONMENT

IN SHARK BAY?

Dear Resident,

This questionnaire is designed to discover how you feel about tourism and the environment in the Gascoyne Region, specifically in the Shark Bay area. The survey is being carried out as part of a project in the Environmental Science Department at Murdoch University, Perth. Your input is vital to help determine the future of this region. You are invited to spend a few minutes of your time sharing your thoughts on the subject with us.

Almost all of the questions can be answered by placing a tick in the box next to the category which is closest to your opinion but a few questions seek brief written comments. On the back page is a map of the area for your information.

Thank you for your cooperation.

Ross Dowling
Environmental Science
Murdoch University
Perth WA 6150
Ph: (09) 360 2738
There are 19 questions. Most simply require a tick in the box which best represents your answer.

1 How long have you lived in this area? _____ Months/Years

2 What is the single most important factor influencing your decision to live here? Tick one of the following boxes only.

   Born and raised in the area   □
   Job opportunities or employment □
   Pleasant climate              □
   Desirable place to live/retire □

   Other (specify)               

3 Which of the following statements best describes your contact with tourists in the area?

   Direct contact through my job □
   Guests in my home             □
   Limited to contact in public places □
   Little or no contact          □

   Comments                      

4 What do you consider to be the main attractions of the region? Please tick as many items as appropriate.

   Pleasant Climate □ Beaches □
   Relaxed lifestyle □ Fishing □
   The Dolphins     □ Remoteness □

   Other (specify)                     

5 What places do you visit for recreational purposes and how often do you visit them? Please tick the appropriate boxes.

<table>
<thead>
<tr>
<th>PLACE</th>
<th>FREQUENCY OF VISIT</th>
</tr>
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<tbody>
<tr>
<td></td>
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</tr>
<tr>
<td>Big Lagoon</td>
<td></td>
</tr>
<tr>
<td>Little Lagoon</td>
<td></td>
</tr>
<tr>
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<tr>
<td>Eagle Bluff</td>
<td></td>
</tr>
<tr>
<td>Shell Beach</td>
<td></td>
</tr>
<tr>
<td>Steep Point</td>
<td></td>
</tr>
<tr>
<td>Dirk Hartog Island</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

Comments

---

6 What evidence have you seen of harm being done to the region's environment? Tick appropriate boxes and write down where this took place. Please tick the box on the far right hand side if you think these were 'Caused By Tourists' (CBT).

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>LOCATION</th>
<th>CBT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Litter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Destruction of vegetation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disturbance of wildlife</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disturbance of sand dunes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over-fishing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undersized fishing</td>
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</tr>
<tr>
<td>Water pollution</td>
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<td></td>
</tr>
<tr>
<td>Noise pollution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments

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The next set of questions asks that you rate the following statements according to your own views using the scale below. Please tick the box that most closely represents your feelings about each statement.

| Strongly agree | SA |
| Agree         | A  |
| Neutral       | N  |
| Disagree      | D  |
| Strongly disagree | SD |

7 TOURISM

(a) Tourism generates more money for the local people than other commercial activities.

☐ ☐ ☐ ☐ ☐

(b) Tourists do not diminish my enjoyment of the area.

☐ ☐ ☐ ☐ ☐

(c) Tourism is a burden on local services.

☐ ☐ ☐ ☐ ☐

Comments

________________________________________________________________________
________________________________________________________________________

8 THE ENVIRONMENT

(a) The environment needs greater protection.

☐ ☐ ☐ ☐ ☐

(b) There should be more national and marine parks and reserves in this region.

☐ ☐ ☐ ☐ ☐

(c) The environment of the region is well looked after.

☐ ☐ ☐ ☐ ☐

Comments

________________________________________________________________________
________________________________________________________________________
9 TOURISM AND THE ENVIRONMENT

(a) Tourism in the Gascoyne Region is based on its natural resources. □ □ □ □ □

(b) Tourism does not harm the environment. □ □ □ □ □

(c) Tourism developments should be encouraged provided they do not conflict with the environment. □ □ □ □ □

(d) Tourism should be integrated with conservation and land management in the region. □ □ □ □ □

(e) The economic gains of tourism are just as important as the protection of the environment. □ □ □ □ □

Comments

10 Rate the following commercial activities in this area according to whether you feel they are compatible with the environment of this area. Please use the scale at the top of page 3 and tick the appropriate box for each question:

SA A N D SD

Commercial Fishing □ □ □ □ □

Mining □ □ □ □ □

Pastoralism □ □ □ □ □

Tourism □ □ □ □ □

Comments
11 Tourism **developments** compatible with the environment that I would suggest for the region are:

- Low key tourist developments
- Large scale tourist developments
- Marinas
- Resorts
- No developments at all

Comments

Go to Q.13

12 Specific areas which could be developed for tourism are:

<table>
<thead>
<tr>
<th>Denham</th>
<th>Nanga Bay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eagle Bluff</td>
<td>Peron Peninsula</td>
</tr>
<tr>
<td>Hamelin Pool</td>
<td>Shell Beach</td>
</tr>
<tr>
<td>Little Lagoon</td>
<td>Steep Point</td>
</tr>
<tr>
<td>Monkey Mia</td>
<td>Other</td>
</tr>
</tbody>
</table>

Comments

13 Tourism **activities** compatible with the environment that I would suggest for the region are:

**GUIDED TOURS**

- Camping
- Diving
- Photographic
- Wildlife safaris

**HIRE**

- Boating
- Canoeing
- Windsurfing
- Yachting

14 Specific areas which should be protected because of their outstanding natural features include:

- Dirk Hartog Island
- Edel Land
- Hamelin Pool
- Monkey Mia
- Peron Peninsula
- Shell Beach
15 Are you:

Female □
Male □

16 What is your age?

Years
14 - 17 □
18 - 24 □
25 - 39 □
40 - 54 □
55 and over □

17 Using the age groups listed below please provide the age of the members of your household. Place numbers in appropriate boxes.

<table>
<thead>
<tr>
<th>AGE</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
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<td>□</td>
<td>□</td>
</tr>
<tr>
<td>14-17</td>
<td>□</td>
<td>□</td>
</tr>
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<td>18-24</td>
<td>□</td>
<td>□</td>
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<tr>
<td>25-39</td>
<td>□</td>
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<tr>
<td>40-54</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>55 and over</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

18 What is the highest level of education you have attained?

Primary school □
High school □
Trade/Technical Certificate □
Diploma/Degree □

19 What is your usual occupation?

THE END

You have now completed the questionnaire. Thankyou for your participation. Your contribution is very much appreciated.
Appendix 6  The Tourists' Questionnaire
(Example from Exmouth)

WHAT DO YOU THINK ABOUT

TOURISM AND THE ENVIRONMENT

IN EXMOUTH?

Dear Visitor,

This questionnaire is designed to discover how you feel about tourism and the environment in the Gascoyne Region, specifically in the Exmouth area. The survey is being carried out as part of a project in the Environmental Science Department at Murdoch University, Perth. Your input is vital to help determine the future of this region. You are invited to spend a few minutes of your time sharing your thoughts on the subject with us.

Almost all the questions can be answered by placing a tick in the box next to the category which is closest to your opinion but a few questions seek brief written comments. On the back page is a map of the area for your information.

Thank you for your cooperation.

Ross Dowling
Environmental Science
Murdoch University
Perth WA 6150
Ph: (09) 360 2738
There are 24 questions. Most simply require a tick in the box which best represents your answer.

1. Is this your first trip to the region?
   Yes
   No

2. How many times have you visited the region before?
   Once only
   2 - 4 times
   5 or more times

3. What is the main reason for your visit to the Exmouth Area?
   To go fishing
   New destination
   Good climate
   Round Australia trip
   Visiting friends and relatives
   Just passing through
   Other (specify)

4. How long will you be staying in the Gascoyne Region?

<table>
<thead>
<tr>
<th>EXMOUTH</th>
<th>NIGHTS (number)</th>
<th>GASCOYNE</th>
<th>NIGHTS (number)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exmouth</td>
<td></td>
<td>Carnarvon</td>
<td></td>
</tr>
<tr>
<td>National Park</td>
<td></td>
<td>Denham</td>
<td></td>
</tr>
<tr>
<td>Coral Bay</td>
<td></td>
<td>Mt Augustus</td>
<td></td>
</tr>
</tbody>
</table>

5. How did you travel to the area?
   Private vehicle
   Rental vehicle
   4WD vehicle
   Campervan
   Commercial bus or coach
   Air
   Other (specify)
6. Did you bring any of the following? (Tick one or more)
   Caravan  □
   Trailer □
   Boat  □
   Tent □
   None of the above □
   Other (specify) ____________________________

7. In what types of accommodation are you staying?

   TYPE                      NIGHTS (number)
   Camping out  □
   Caravan park □
   Holiday house □
   Hotel or motel □
   With friends or relatives □
   Other (specify) ____________________________ □

8. What do you consider to be the main attractions of the region? Please tick as many items as appropriate.

   Climate □
   Beaches □
   Fishing □
   Other (Specify) ____________________________________
   Canyons/Gorges □
   Marine Park □
   National Park □

9. Which of the following attractions have you seen or intend to see during your stay? Please tick as many items as appropriate.

   EXMOUTH                      GASCOYNE
   Bundegi Area □
   Ningaloo Reef □
   Milyering Centre □
   Yardie Creek □
   Communications Base □
   The Lighthouse □
   Coral Bay □
   Kennedy Range □
   Mt Augustus □
   Carnarvon □
   Monkey Mia Dolphins □
   Other □

________________________________________
10 What activities have you taken part in whilst in the region and where did these take place?

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sightseeing</td>
<td></td>
</tr>
<tr>
<td>Swimming</td>
<td></td>
</tr>
<tr>
<td>Relaxing</td>
<td></td>
</tr>
<tr>
<td>Walking</td>
<td></td>
</tr>
<tr>
<td>Bush Walking</td>
<td></td>
</tr>
<tr>
<td>Bird Watching</td>
<td></td>
</tr>
<tr>
<td>Turtle Watching</td>
<td></td>
</tr>
<tr>
<td>Whale Watching</td>
<td></td>
</tr>
<tr>
<td>Boating</td>
<td></td>
</tr>
<tr>
<td>Fishing</td>
<td></td>
</tr>
<tr>
<td>Surfing</td>
<td></td>
</tr>
<tr>
<td>Off Road Driving</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td>Comments</td>
<td></td>
</tr>
</tbody>
</table>

11 What evidence have you seen of harm being done to the region’s environment? Tick appropriate boxes and write down where this took place. Please tick the box on the far right hand side if you think these were “Caused By Tourists” (CBT).

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>LOCATION</th>
<th>CBT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Litter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Destruction of vegetation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disturbance of wildlife</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disturbance of sand dunes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over-fishing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undersized fishing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anchor damage to reef</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water pollution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise pollution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comments</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
12 The next set of questions asks that you rate the following statements according to your own views using the scale below. Please tick the box that most closely represents your feelings about each statement:

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>A</td>
</tr>
<tr>
<td>Neutral</td>
<td>N</td>
</tr>
<tr>
<td>Disagree</td>
<td>D</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>SD</td>
</tr>
</tbody>
</table>

(a) The environment needs greater protection. □ □ □ □ □
(b) There should be more national and marine parks and reserves in this region. □ □ □ □ □
(c) Tourism does not harm the environment. □ □ □ □ □
(d) Tourism developments should be encouraged provided they do not conflict with the environment. □ □ □ □ □
(e) Tourism should be integrated with conservation and land management in the region. □ □ □ □ □
(f) The economic gains of tourism are just as important as the protection of the environment. □ □ □ □ □

Comments

13 Rate the following commercial activities in the region according to whether you feel they are compatible with the environment. Please use the scale above and tick the appropriate box for each question:

<table>
<thead>
<tr>
<th>Commercial Fishing</th>
<th>SA □ □ □ □ □</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining</td>
<td>□ □ □ □ □</td>
</tr>
<tr>
<td>Pastoralism</td>
<td>□ □ □ □ □</td>
</tr>
<tr>
<td>Tourism</td>
<td>□ □ □ □ □</td>
</tr>
</tbody>
</table>

Comments

Comments
14 Tourism developments compatible with the environment that I would suggest for the region are:

- Low key tourist developments
- Large scale tourist developments
- Marinas
- Resorts
- No developments at all

Comments

15 Specific areas which could be developed for tourism are:

- Bundegi Area
- Town Beach
- Canyons/Gorges
- Coral Bay
- Tantabiddi Creek
- Turquoise Bay
- Vlaming Head
- Yardie Creek

Comments

16 Tourism activities compatible with the environment that I would suggest for the region are:

<table>
<thead>
<tr>
<th>GUIDED TOURS</th>
<th>HIRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camping</td>
<td>Boating</td>
</tr>
<tr>
<td>Diving/Snorkelling</td>
<td>Canoeing</td>
</tr>
<tr>
<td>Photographic</td>
<td>Windsurfing</td>
</tr>
<tr>
<td>Wildlife Safaris</td>
<td>Yachting</td>
</tr>
</tbody>
</table>

Comments

17 Specific areas which should be protected because of their outstanding natural features include:

- Bundegi Reef
- Canyons/Gorges
- Muiron Islands
- West side of Cape
- Vlaming Head
- Yardie Creek

Comments
**Background Information**

18  Are you:  
Female    ○    Male    ○

19  What is your age?
   ○  25 - 39
   ○  40 - 54
   ○  55 and over

14 - 17 years    ○
18 - 24    ○

20  Where is your usual place of residence?

   WA    ○    Locality    _____________    _____________
   Interstate    ○    State    _____________    _____________
   Overseas    ○    Country    _____________

21  What is your usual occupation?    _____________

22  What is the highest level of education you have attained?

   Primary school    ○
   High school    ○
   Trade/Technical Cert.    ○
   Diploma/Degree    ○

23  Are you visiting the region:

   With family and friends    ○    If so how many?    ________
   With a commercial tour    ○    If so how many?    ________
   Other (specify)    _____________

24  Using the age groups listed below please provide the age of the members of your group. Place numbers in appropriate boxes.

<table>
<thead>
<tr>
<th>AGE</th>
<th>Males</th>
<th>Females</th>
<th>AGE</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 13</td>
<td>○</td>
<td>○</td>
<td>25-39</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>14-17</td>
<td>○</td>
<td>○</td>
<td>40-54</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>18-24</td>
<td>○</td>
<td>○</td>
<td>55 and over</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

**THE END**

You have now completed the questionnaire. Thankyou for your participation. Your contribution is very much appreciated.
Appendix 7 Guidebooks Used in the Inventory of Tourist Attractions


MAPco (1991) *Northern Western Australia*, 3rd edn. MAPco of Western Australia, Perth.


Travelwest (1991) *Travelwest: Tourist News from Western Australia*, No. 54, August.

Appendix 8  Calculation of Resource Values

In the initial analysis of the environment, the value of environmental attributes is made on the basis of intrinsic qualities, that is, consideration of the environment for its own sake. In the second assessment the environment is valued as a resource from an extrinsic standpoint and is assigned value for either protection or use.

The concepts upon which this approach is based were first proposed by McHarg (1969). He developed a method to identify the values that society as a whole, or individuals in that society, assign to natural resources in their environment. These values were gained from people living in a region and were proposed in regard to what they considered necessary for their health and prosperity. The values of society have been formulated by the World Conservation Strategy as being the maintenance of essential ecological processes, the preservation of genetic diversity and the sustainable utilization of resources (IUCN 1980). These have been referred to as primary resource values. A group of individual or secondary values has also been recognised (Juneja 1974) and applied (Tinley and Van Riet 1978). In a recent application the value to individuals has been classified as desirable natural features and features affecting the cost of construction (Van Riet and Cooks 1990 a,b+c).

In the EBT methodology the value to individuals is classified as the resource value, that is, the value assigned to a particular area according to how it could be used. This is an expression of the desirability of use of environmental attributes or natural features.

Resource Value Assessment

The assessment of resource values is drawn from an analysis of resident and tourist opinions. These are gained from the surveys in which views are sought on general perceptions of resource use as well as on the protection or use of specific sites in the region. Respondents rate a number of statements regarding the environment, tourism and the environment-tourism relationship. This includes the statement 'the environment needs greater protection'. It is accepted that responses to such statements are heavily conditioned by the specific statement itself, peoples' antecedent knowledge, and a whole range of other factors. However, it is felt that there are more benefits to be gained by keeping such a statement as simple as possible than by using a lengthy, all encompassing statement which may still invite a number of different responses. Statements are rated on a five point scale from strongly disagree to strongly agree. Their rating is converted to a numerical score of 0.2 to 1.0 which becomes their general environmental protection weight ($W_{ep}$). This then is a constant factor or coefficient which is then multiplied by 1 for each specific site nominated by the respondent for protection. Therefore, the environmental protection value (EPV) nominated by respondent 1 ($R_1$) for site 1 ($S_1$) is expressed as:
\[ EPVR_1S_1 = W_{ep} \times x \]

\( x = \) the value of the \( S_1 \) variable. It is equal to a numerical of either 1 (agree) or 0 (disagree).

If the respondent nominates the site for environmental protection then the expression simply becomes \( EPVR_1S_1 = W_{ep} \), that is, the environmental protection value for a particular site becomes the value of the rating given to the general environment by the respondent. Conversely, if the respondent does not nominate the site for protection then the expression is equal to zero.

The overall resource value of a particular site is found by totalling the data values and dividing them by the number of respondents to that item. Therefore, the overall environmental protection value of site one (EPVS\(_1\)) is expressed as:

\[ EPVS_1 = \frac{\sum W_{ep}S_1 \times 100}{n} \]

where

\( \sum \) = the sum of:
\( W_{ep} \) = the environmental protection weight
\( S_1 \) = the value of site 1 (=1 or agree)
\( n \) = the number of respondents who agreed with the site’s protection.

The overall mean resource values are then calculated for all sites nominated for environmental protection and ranked to provide relative standings. The rankings are divided into categories similar to those used to determine levels of significance. They are then applied to the areas of environmental significance by the following process. If they are of the same rating level (for example, moderately-high environmental significance and moderately-high resource value) then the status of the environmental significance classification does not change.

If, however, the resource value class were 'high' then an in-class modifier is applied of the type used in the resource assessment for recreation and tourism (Cocklin et al. 1990). This is indicated by the symbol '+', indicating that the environmental significance of the area is superior to the indicated class, but not by a sufficient degree to warrant its promotion to the next class. If the resource value class is 'outstanding' then the environmental classification of the area's significance is promoted to the next class, that is to an environmental significance class rated 'high'. Likewise, a resource value class of a level one below the indicated environmental significance class modifies the class and is shown by a '-' sign. If the resource value classification is two or more beneath that of the class of environmental significance then the significance class is lowered to the class below.

An expression of the overall value of tourism development attributed to a particular site is also gained in a similar way. First a general tourism
development weight \( W_{td} \) is calculated for a respondent based on the rating of the statement 'Tourism developments should be encouraged provided they do not conflict with the environment'. This is then multiplied by the site value nominated for development to gain a Tourism Development Value (TDV).

\[
TDVR_{1S1} = W_{td} \times
\]

For any particular site nominated by respondents the overall tourism development value of site one (TDVs\(_{1}\)) is expressed as:

\[
TDVs_{1} = \sum_{i=1}^{n} W_{td} \cdot S_{1} \times 100
\]

where \( \sum \) = the sum of:

- \( W_{td} \) = the tourism development weight
- \( S_{1} \) = the value of site 1 (=1)
- \( n \) = the number of respondents who agree with the development of that site.

If however the resource value class were 'high' then an in-class modifier is applied in a similar manner to that of the environmental assessment. This is indicated by the symbol '+', indicating that the tourism significance of the area is superior to the indicated class, but not by a sufficient degree to warrant its promotion to the next class. If the resource value class were 'outstanding' then the tourism classification of the area's significance would be promoted to the next class, that is to a tourism significance class rated 'high'. Likewise, a resource value class of a level one below the indicated tourism significance class modifies the class and is shown by a '-' sign. If the resource value classification is two or more beneath that of the class of tourism significance then the significance class is lowered to the class below.

Areas which are accorded value both to environmental protection and tourism development are assigned an overall value by subtracting the smaller of the two values from the greater. This then becomes the substantive resource value for that area in terms of either environmental protection or tourism development. To gain a better idea of the relativity of these areas their protection and development values are plotted by scattergraph to show the relative relationships.

Once the resource values have been calculated and the areas ranked according to social desirability for either protection or development then the next step it to incorporate these values with those of significance. For example, a feature rated moderately-high in terms of environmental significance may contain within it an area of high resource value for environmental protection. This now provides a more informed situation in which to allocate the area to a zoning class, probably within the nature conservation or sanctuary zones. Where other situations exist, for example, a tourism area of high significance but of high environmental
protection resource value, then these areas are 'set aside' for further analysis of their compatible activities before being assigned to a planning zone.
Appendix 9

Examples of Environmentally Compatible Tourism Developments and Activities in the Gascoyne Region

Small sanctuary zones incorporated into the planning and management of the environmentally sensitive Ningaloo Marine Park, North West Cape.

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More protection for Ningaloo

By MICHAEL ZEKULICH

EIGHT sanctuary zones will be incorporated into Exmouth's Ningaloo marine park — from which collecting or catching any sort of marine life will be banned.

The move, to come into effect for the 1991 tourist season, is designed to restore areas of the over-exploited reef to their natural state.

Conservation and Land Management Exmouth district manager Doug Myers said it should enable visitors to see the reef as it once was.

He said the zones would provide for:

* Viewing areas where fauna and flora could be observed free of interference.
* Special protection areas for wildlife.
* Reference areas for scientific study.
* Nursery areas to populate other areas which were over-fished or had become degraded.

The Ningaloo park is made up of 4000sq km of state and Commonwealth waters and was gazetted in 1987.

The sanctuary zones will make up about 25 per cent of the reef shore-line.

This may cause resentment from people who have been holidaying and fishing in some areas for many years.

Penalties for breaching the zones are still being considered.

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REEF READING: Mr Myers studies details of the sanctuary zone at Bundegi Reef at the south boundary. Picture: GUY MAGOWAN
The Milyering Bicentennial Visitor Centre serving Cape Range National Park and Ningaloo Marine Park. Opened in 1988 it is an example of a small scale tourism interpretation facility which has been designed to be environmentally compatible.

Well Designed - Naturally

For park visitors seeking to learn more about the land and marine environments, and the plants and animals living there, an information centre has been built at Milyering in Cape Range National Park. It is called the Bicentennial Visitor Centre in recognition of the funding received from the Australian Bicentennial Authority.

The Visitor Centre serves as a focus for a wide range of interesting activity programmes. There you can find information about the parks and their wildlife, and directions for the nature trails developed throughout the parks.

The building is designed and constructed to provide comfortable living and working conditions in the arid environment and harsh climate of the north-west. A policy of energy conservation was adopted in constructing the centre and many features have been incorporated to ensure there is minimal impact on the environment from the building and occupants.

Natural lighting and ventilation are used wherever possible, and solar panels and storage batteries provide power. The thick, rammed earth walls reduce the fluctuations between night and day temperatures in the building, and the deep verandahs ensure shade even at midday. Water is a precious commodity in the north, so composting toilets mean no flushing. The toilets also provide a safe rich fertiliser for the garden, which is watered by runoff from bitumised areas at the centre. Truly a house of the future.

(CALM 1988a: 27)
The Shark Bay floating pearl farm at Monkey Mia in Shark Bay. An example of a low key tourism activity combined with another commercial activity. This type of activity is preferred by both residents and tourists.

PEARLY WHITES: NSW visitor Susan Perry shows off cultured shells with pearl implants, during her visit to the Shark Bay floating farm. Picture: GUY MAGOWAN

Pearlers return to Shark Bay

By MICHAEL ZEKLICH

A FLOATING tin shed in the waters of Shark Bay not far from Monkey Mia is the focal point for the rebirth of a local pearling industry.

Each day, hundreds of shells are collected and seeded. This year, 30,000 pearls are expected and numbers will rise to about 200,000 when full production is achieved within two years.

Technician Peter Brown, 21, said the pearls were worth $10 to $40, depending on colour and quality.

He told French and eastern states travellers visiting the shed, five kilometres north-west of Monkey Mia, that there was international demand for the pearls.

A review of the Shark Bay pearling industry by Dr D.A. Hancock says the pearl oysters were first recorded at Shark Bay in 1699 by William Dampier.

In 1850, 75,000 shells were gathered from January 14 to February 12, marking the beginning of the WA industry.

By 1940 no boats were operating because shell numbers had declined.

Mr Brown said 50,000 shells had been gathered around Dirk Hartog Island to provide stocks for the latest commercial development.

Last century, Chinese settlers walked out into the shallows to gather shells in their thousands each day.

Today, diver Craig Burgess 26, collects thousands for seeding, with the shells hung in baskets for pearl development.

It is estimated 8000 to 10,000 tourists have visited the floating farm this year as well as the world-famous dolphins of Monkey Mia.
Appendix 10 Exmouth Coastal Planning Strategies

(Department of Planning and Urban Development 1992)

The Exmouth Coastal Strategy has been prepared by the Department of Planning and Urban Development on behalf of the Exmouth Shire Council. The coastal area covers a small but significant part of the Gascoyne Region and the strategy contains many of the findings and directions resulting from the wider EBT Plan.

In part, the Strategy is based on detailed assessment of community (residents and tourists) aspirations for the North West Cape coast. Community views were gathered from a community workshop held in Exmouth, research into resident and tourist opinions on tourism and the environment, and public submissions.

Specific planning strategies have been developed for each coastal sector. The principal recommendations are:

1. Limit tourist development, in the form of resorts or formal accommodation facilities, on the western coast of the Cape (north of the Cape Range National Park) to those areas which have no overriding environmental constraints and where it can be demonstrated that development has significant social and economic benefits for Western Australia.

2. Ensure that all development proposals are subject to rigorous environmental assessment, including consideration of the impact on management of Ningaloo Marine Park, Cape Range National Park and coastal conservation reserves, and that there is demonstrable evidence of their economic viability.

3. Ensure that any development proposal outside the township is considered in light of its impact on the viability of Exmouth and is of economic benefit to that community.

4. Consolidate tourist and recreational development in the township and in discrete nodes of activity as recommended in the Exmouth Structure Plan. Development should be restricted to stable landforms and have regard to the constraints of the area (e.g. drainage).

5. Consolidate recreational facilities at Tantabiddi, given the site’s relative stability and existing facilities.

6. Protect the views to and from Vlamingh Head given the landscape and viewed significance of this feature. Council should restrict any further development at Vlamingh Head, with the exception of consolidation in the immediate vicinity of the existing caravan park.

7. Ensure that both CALM and Council have regard for the strategies and recommendations of this report when preparing a detailed management plan for the Jurabi and Bundegi Coastal Parks.

8. Consolidate and upgrade the recreational facilities and related tourist activities near the Sea Search and Rescue building at Bundegi.

9. Marine industrial development should be consolidated in the existing areas south of the township. The development of tourist facilities around these sites is not supported given the types of industry involved and the potential for conflict.

10. Encourage the development of sites for tourism along the east coast south of the township to Wapoo Creek. Quailing Pool offers an attractive location for tourist development. Development in this location will need to comply with sound coastal planning and environmental principles.

11. Limit development in the mangrove forests to informal recreational use subject to control and management of access.

12. Recognise that aquaculture proposals for waters within the Gulf present attractive opportunities for the diversification of the economic base of Exmouth and have the potential to provide benefits to the town. Ensure that all aquaculture proposals comply with sound coastal planning and environmental principles.

The Strategy also recommends a series of development guidelines for the variety of uses and facilities likely to occur in the area. It concludes with an action plan and recommendations for organisations involved in coastal planning in the Exmouth area.
REFERENCES
References


Australian Academy of Science (1962) National Parks and Reserves in Western Australia. Report of the Western Australian Sub-Committee of the Australian Academy of Science Committee on National Parks, Perth.


Batty, J.S. (1915) History of the North-West of Australia. V.J. Jones and Coy, Australia.


Conservation Through Reserves Committee (1974) *Conservation reserves in Western Australia: a Report to the Environmental Protection Authority*. Department of Conservation and Environment, Western Australia.


Department of Land Administration (1990) Point Quobba: Planning and Management Strategy. Department of Land Administration, Western Australia.


Department of Regional Development and the North West (1988a) Gascoyne Regional Profile. Department of Regional Development and the North West, Western Australia.


Environmental Protection Authority (1975) *Conservation Reserves for Western Australia: Systems 4,8,9,10,11,12*. Department of Conservation and Environment, Western Australia.


Gentilli, J. ed. (1979) *Western Landscapes*. The University of Western Australia Press, Perth.


Gunn, C.A. (1979b) Tourism Development: Assessment of Potential in Texas. Bulletin MP-1416, Texas Agricultural Experiment Station and Recreation and Parks Department, College Station, Texas A&M University, Texas.


Hong, E. (1985) *See the Third World While it Lasts: the Social Environmental Impact of Tourism with Special Reference to Malaysia*. Consumers' Association of Penang, Malaysia.


for Action? A workshop to consider strategies for sustainable development. CEMP, Valletta, Malta, 4-10 March.


Leiper, N. (1990a) Tourism systems: an interdisciplinary perspective. Occasional Paper 1990 No. 2, Department of Management Systems, Faculty of Business Studies, Massey University, Palmerston North, NZ.


Rosenow, J.E. and Pulsipher, G.L. (1979) *Tourism the Good, the Bad, and the Ugly*. Media Productions and Marketing Inc, Nebraska, USA.


School of Travel Industry Management (1987) *The Impact of Tourism on the Commonwealth of the Northern Mariana Islands*. The School of Travel Industry Management, University of Hawaii at Manoa, Hawaii.


References


Stynes, D.J. (1979) A simulation approach to the determination of recreation carrying capacity. Proceedings of the National Workshop on Computers in Recreation and Parks, National Recreation and Parks Association, St. Louis.


