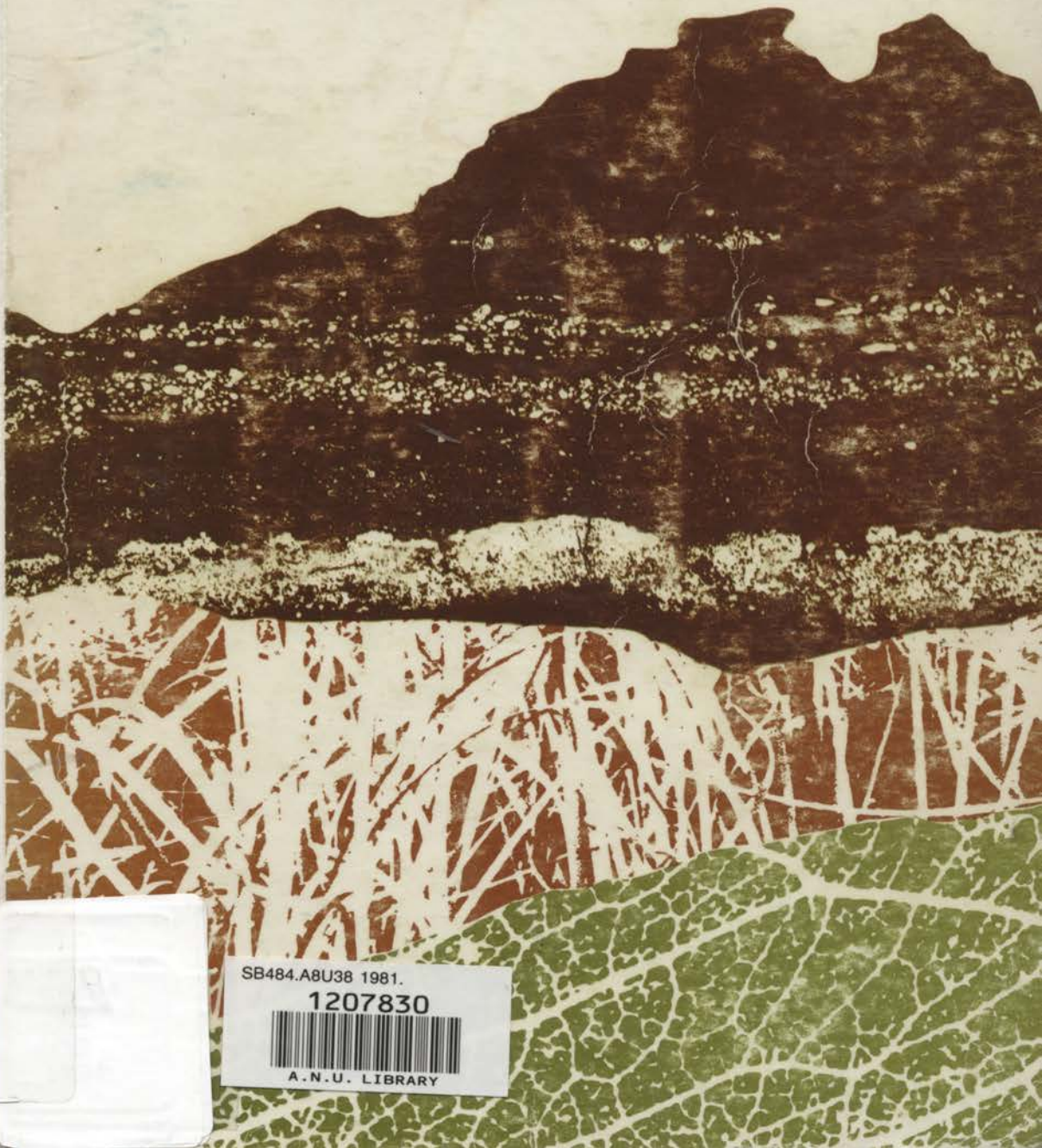
CRES Monograph 4

An economic evaluation of national parks

AM Ulph IK Reynolds



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PREFACE

The role of the Centre for Resource and Environmental Studies (CRES) is to undertake research and to provide objective information and analyses on matters relating to social and public policy issues in the resource and environmental fields. By these means it aims both to stimulate and to facilitate public discussion on issues of important public policy.

The establishment of national parks is an important instrument of Australian and State conservation policies in their objectives of meeting public demands, present and future, for recreation and wilderness benefits. The establishment of such parks involves costs as well as benefits at the national and regional level and the present study is designed to help in determining the relevant costs and benefits in any particular situation in which the establishment of a national park is proposed, and in attempting their measurement.

This study would not have been possible without the help of a great many people. First, it could not have proceeded without the willing cooperation of the New South Wales National Parks and Wildlife Service. In particular we acknowledge with thanks the help given by Dr Jack Giles and Mr Jim Burrell in Sydney, Mr Alan Morris, Ms Liz Edmondson in Coonabarabran and Ranger Dick Duggan and Mrs June Duggan and the rest of the staff at Warrambungle National Park.

In its formative stages the study, which was under the overall direction of Professor Stuart Harris, gained from discussions with a number of people in or associated with CRES who contributed in various ways, but particularly in defining the scope of the project and in clarifying concepts involved in the study. These included: Dr H.C. Coombs; Dr Alec Costin; Dr Max Day; Professor Frank Fenner; Dr Ian Ferguson; Dr John Hookey; Dr Ken Newcombe; Dr Hugh Saddler; Professor Tony Scott; Professor Ralph Slatyer; and Dr Peter Stephens.

The Centre is also grateful for the assistance given by Dr Robert Boden, Mr Vance Russell, Mr Mike Hinchey and Mr Alan Fox of the Australian National Parks and Wildlife Service in discussions on, and arrangements for, the successful completion of the study.

Finally, this project was funded by the Australian National Parks and Wildlife Service (ANPWS). I would like to acknowledge with thanks the support given by the ANPWS, and its Director, Professor J.D. Ovington, to the project. It should be emphasised that the views expressed in this study are not necessarily those of the Australian National Parks and Wildlife Service nor those of the Centre for Resource and Environmental Studies.

Geoff Taylor
Director.

AN ECONOMIC EVALUATION OF NATIONAL PARKS

SUMMARY

National parks are reserved for many different reasons - to provide recreation opportunities for people, to protect endangered or rare species and habitats, to protect watersheds, to provide opportunities for scientific research and so on. Yet the land potentially involved in a national park is often the subject of considerable commercial interest. How are these apparent conflicts to be resolved?

The biological and ecological criteria proposed to assist in park establishment decisions (such as minimum effective reserve size and adequate reserve diversity) cannot help at this point since they leave aside the specific issue of competition over the use of resources for different purposes. This type of problem is, however, of central concern in economics; consequently the application of analytical techniques developed by economists may be able to assist in resolving conflicts over the use of land.

Traditional economic analysis has often been judged to be biassed against national parks for various reasons. Probably the principal one is that it is believed to have ignored the value people place on the natural features of preserved areas. Often, this is because commercial interests can put forward a very effective case showing easily measured financial benefits from land development from their own point of view and this analysis is wrongly equated, in the minds of the general observer, with economic analysis.

It may frequently be the case, however, that with a proper economic analysis, the value of such preservation to the community can be seen to outweigh the community's gains from the commercial development of or in the land being considered for a national park. It remains true, however, that because of the difficulty of measuring intangible benefits such as those from national parks, such a complete economic analysis is often difficult to undertake. An adequate economic analysis, however, has to take into account all the benefits of the different forms of land use, not just those which can be easily measured. Equally an appropriate economic analysis of a national park proposal has to take into account the full costs of the park. These include not only the costs of operating

the park (maintenance and labour costs) but the opportunity cost of acquiring the land. This opportunity cost is measured by the value of the alternative land use that is foregone by establishing a park.

In this report we discuss the role economic analysis can play in assisting public choices about land use, particularly about national parks. In doing so, we explain the nature of cost-benefit analysis and how it can be used to consider the range of reasons for which a national park would be preserved by the community. The report details how the value of the various features of a park, such as its recreation use, can be measured and compared to the costs of the park in order to help determine whether a national park is a worthwhile use of the land concerned. In addition, the report considers the impact of a park on jobs and incomes in the park region. The theoretical issues are illustrated by a case study of the Warrumbungle National Park in N.S.W.

The standard approach to considering the costs and benefits of any project is cost-benefit analysis. This is normally simply a framework which sets out explicitly the comparisons between the costs and benefits of a project. In any decision-making involving choice, people make implicit assessments and evaluations of benefits and costs involved - all that the more formalised form of cost-benefit analysis seeks to do is to make such judgements explicit so that they can be subjected to critical appraisal.

There are three stages in a formal cost-benefit analysis. The first is to identify all the relevant changes in physical and biological inputs and outputs resulting from the project concerned. (For a national park this would include inputs like land and the services of rangers and outputs such as recreation undertaken in the park.) The second stage of the analysis, commonly the subject of much misunderstanding, is to value all these things in a common unit; this unit, for practical purposes, is usually money but it is worth emphasising that any other numeraire or common unit could be used. The final stage is to compute the difference between costs and benefits (the net value of the project) at each point in time over the life of the project. Since people typically prefer to receive benefits now rather than later, the future net values of the project must be discounted to the present. The sum of all these discounted net values is termed the net present value of the project. If

this is positive it indicates that the benefits derived from the project outweigh the costs and that the community would be better off if the project were undertaken.

Cost-benefit analysis of this kind can be used as a broad guideline only since the results of the analysis are often sensitive to the assumptions and methods used in it. In particular, objections have been raised frequently against using cost-benefit analysis in an environmental context since it is believed that valuing things like the conservation status of a park or its recreation potential in money terms is either impossible or too difficult. For example, it is often maintained that measurement of these kinds of benefits is impossible because they are somehow "intangible". The benefits of any activity are intangible, however, since they are simply the effects on the well-being of the individuals concerned and experience has shown that people can be asked how much of one form of benefit they are prepared to give up in order to get more of another. A trade-off of this nature is the basis of the economic evaluation of the items involved. The problem is that indirect means (such as sample surveys) must be used to determine what values people place on the items since the values are not directly observable like ordinary prices. This leads to the second objection - that valuation of these sorts of things is too difficult.

Surveying people to determine what they think the benefits are worth can be complex and unless care is taken, one cannot be sure that the respondents will give accurate answers about their valuations, or that the questions do not themselves lead to particular answers. These difficulties arise especially where the information available to those being surveyed about the nature of the benefits they are being asked to value is incomplete. Of course, these problems are not fundamental flaws in cost-benefit analysis itself; rather they are pragmatic problems which must be overcome when the need arises in undertaking that analysis.

Because of some of these difficulties, a comprehensive cost-benefit analysis of a park proposal in which all the benefits and costs of the park are evaluated could be costly in financial and other resources. In these circumstances, the use of a formal cost-benefit analysis may only be justifiable in major cases where the alternative uses of the resources involved, such as a mine or a park, have significant values

attached. In many instances, the environmental values of a park may clearly outweigh the commercial values of the alternative use (or vice versa) and for these cases, a complex cost-benefit analysis may not be necessary. A simple inspection of physical and biological impacts may be sufficient information on which to take a decision.

Furthermore, if a cost-benefit analysis is undertaken it may not be necessary to evaluate all the benefits and costs involved. For example if, after valuing all park costs, the valuation of one benefit alone, say recreation, is enough to outweigh the costs then the decision can be made on this basis alone and valuation of such other benefits as the park's worth as a conservation area need not proceed. One would only need to continue measuring the other benefits if there were a possibility that they would change the decision. It is frequently believed that cost-benefit analysis is biassed against national park use since it typically measures only those things readily converted into money values. Yet this is not what we have said - we have argued that difficult valuation exercises need not be undertaken if enough information is already available to enable a decision to be made with confidence.

Obviously, the way we measure the benefits of a national park is crucial to the outcome of the analysis and consequently the report discusses the methods used at some length. Essentially, what we seek to determine is how much each individual is willing to pay to obtain the benefit whose value we are measuring. This can be done directly by using questioning techniques or indirectly by examining, for example, how much time and money people spend in order to visit a park. A method using this latter procedure (the "travel cost" method of measuring recreation benefits) is used in this report to evaluate the recreation undertaken in the case study area, Warrumbungle National Park. Using the travel-cost procedure, the value of park recreation can be measured in terms directly comparable with park costs.

A crucial part of a cost-benefit analysis of a park proposal is the evaluation of the recreation, conservation and other benefits of the park in the future. The "travel cost" technique is not suitable for measuring future benefits as it relies on observations of current visitors to derive the value. Moreover, it only measures the value of recreation. Because of this, several different ways of measuring the value of future park benefits have been devised.

The first method relies on a direct questioning approach and consequently the results are subject to a considerable amount of uncertainty. The responsdent may be unsure of whether he will use the park for recreation and, if so, how often; and uncertainties about the nature of, say, conservation benefits to be gained from the park will lead to uncertainties about the values expressed for such benefits as well.

A second method of valuing future recreation benefits only focusses on the relationship between the characteristics of current parks and the recreation undertaken in them and examines the proposed park and its recreation potential in terms of an addition to the park system.

The third method, applicable to all types of park benefit, avoids an explicit valuation. Instead, as a first step, a benchmark value is derived using park costs. This can then be looked upon as the amount which the value of recreation, conservation and so on must exceed if the park project is to be economically justified. Which of these three methods it is appropriate to use to value future benefits in any particular case depends on the type of park involved and the time and money available for decision-making.

The case study undertaken in this report involves Warrumbungle National Park in north western N.S.W. It is a multiple-use park whose main feature is its recreation value, although it does have some scientific and wildlife habitat significance. The evaluation of park benefits concentrated on the park's recreation value. Some 85,000 visitor days per year are currently recorded in the park. A visitor survey was undertaken in the May and August-September school holidays of 1978; questionnaire returns represented about 8% of the annual visitation. Average length of stay was about 3.5 days and average group size a little less than 4 people. Bushwalking and camping were the predominant activities undertaken in the park. Visitors responding to the questionnaire were generally of higher income and education levels than the Australian population as a whole. "Travel cost" was used to measure the value of park recreation. Considering both money and time costs, the average value of a visitor day was calculated to be about $100. Park costs would be covered by a value of between $3.95 and $5.44 per day. So, on the basis of a cost-benefit analysis considering only the value of park recreation and no other park benefits, it is safe to

conclude that, even allowing for a considerable margin of error in measuring the value of the recreation, the benefits of park use of land far outweighed the costs of that use.

The cost-benefit analysis undertaken thus supports the decision to establish a park in the area and confirms the implicit cost-benefit analyses made when the decisions to reserve the land were taken.

Many people oppose parks not because they believe that a park may not be a valid or beneficial use of the land concerned but because they fear a regional loss of jobs and income may occur if the park displaces the current land use. Perhaps just as frequently, parks are supported on the grounds that they lead to the creation of new jobs and give rise to new income in an area. Often these statements seem to be made with little substantive justification. An economic analysis of the regional income and employment effects of parks will help clarify this argument in specific cases. A general case for or against parks on these grounds cannot be made since the effect of a park on a region will depend both on the nature of the park concerned (for example whether significant levels of tourism are expected or whether the park is to be reserved for mainly habitat conservation purposes) and on the nature of the region itself, as will be pointed out below. Consequently, an economic analysis would need to be conducted for each park proposal in order to determine its effect on the regional economy.

An important reason for conducting such an analysis is that a park may have adverse regional effects. If this were the case it would be useful to know beforehand what the impact on employment and incomes would be so that appropriate policies could be formulated.

We argue in the report that it is incorrect to evaluate national park proposals on purely regional grounds as this ignores their importance on a broader, perhaps national, scale. Moreover, it may be inappropriate to count some of the regional costs and benefits of national parks as costs and benefits on a state-wide or national scale since they may simply be transfers from or to other areas. Nevertheless, for the reasons outlined above, an economic analysis of the regional impacts of a park may be a desirable component of any park proposal.

In assessing the regional impact of a park, the direct effect of the park on incomes and jobs must first be estimated. The direct effect

on incomes can be found by conducting surveys of the regional expenditure by park tourists and expenditure within the region on the operation of the park (for example wages for park staff). Similarly, the direct employment impact can be estimated by a survey of park employment and employment created in related industries such as tourist accommodation establishments.

The second step in regional impact assessment is to trace these initial effects as they filter through the regional economy. For example, money spent on tourist accommodation may then be respent on purchasing food supplies from local producers who in turn might buy fertilisers from local agents. These latter effects are often termed "multiplier" effects and are usually calculated using income or employment multipliers for the region. If the overall income multiplier of a region was 1.5 then for each $1 spent in the region an additional 50 cents income would be created in the region. Thus to estimate the regional income impact of a park project we would simply multiply the estimated regional park expenditure by 1.5. Similarly, an employment multiplier of 1.2 would indicate that the regional employment impact of a park would be given by multiplying the direct employment created by the park by 1.2.

Obviously, the magnitude of the multiplier(s) used will have a critical influence on the results of the analysis. The size of a relevant multiplier will depend on several factors. First, it is generally true that the more economic sectors there are in the region, the larger the multiplier, as there will be greater scope for linkages between sectors so the money spent will tend to circulate more within the region rather than leak to the outside. Hence it is usually the case that the larger the region the greater will be the multiplier values for that region.

Secondly, the multiplier would not be the same for initial expenditure or employment in different sectors of the economy as each sector will have different links to the rest of the regional economy when compared with all other sectors. So to estimate correctly the regional impact of, say, expenditure we would need to know not only the magnitude of that expenditure but also where it would be spent and the multipliers for expenditure in those different sectors.

The various ways of deriving multipliers are described in the report. The data requirements for determining the true regional multipliers are large and in many cases an approximation using less

accurate methods will have to be used.

Due to the limitations on resources available for this project, regional income and employment multipliers could not be derived for the particular case study region - Warrumbungle National Park and the nearby town of Coonabarabran. Instead, a comprehensive literature survey was conducted to try to identify likely multiplier values for the region and the survey effort was concentrated on obtaining good estimates of the initial income and employment impacts in the area. As a result of this it was concluded that, in 1978, recreation in and the operation of the park contributed over $0.5 million and 39 jobs to the economy of Coonabarabran. Of course, this is only a partial analysis in that the creation of the park could have led to the loss of some jobs in the agricultural sector. This could not be assessed precisely due to the lack of records from the relevant time period but the results show that a national park can play a significant positive role in a regional economy.

As for the cost-benefit study undertaken in this report, the regional impact analysis also deals with a park which has been operating for some time and has measurable current economic impacts. The question would then arise as to what would be the economic impact of a new park in a region. This is not easy to determine precisely since we would need to know both the future direct impacts of the park and also have a detailed knowledge of the future structure of the regional economy so that appropriate multipliers could be derived.

The future direct impacts could be estimated in conjunction with estimating future levels of visits to the park, the latter being necessary in order to do a cost-benefit analysis of the proposal. Creating a new park in an area will necessarily change the structure of the regional economy so that former multipliers will no longer be entirely appropriate. However, if the park only leads to small changes in the structure of the regional economy in the short term, the present multipliers may not be greatly affected and could be used to estimate the future impact of the park.

The report thus examines both the theoretical and practical issues involved in applying cost-benefit and regional economic analysis to decisions about national parks. It demonstrates how economic analysis can make a useful contribution to the debate surrounding the

establishment and economic effects of national parks. The cost-benefit analysis undertaken in the case study reported here confirmed that the decision to reserve Warrumbungle National Park on the basis of its recreational potential was correct, while the regional analysis indicated that park tourism and operation were playing a significant role in the economy of Coonabarabran. While those results cannot be generalised to other parks in other areas because of differing park and regional characteristics, the results illustrate that an economic study may provide useful input to national park decisions. While other criteria may influence the outcome, it is not clear that these should involve a waste of resources. Hence an economic analysis should still be an important but not necessarily the only part of decisions about national parks.

CHAPTER 1

THE NATURE OF NATIONAL PARKS

1.1 Introduction

An economic evaluation of any project must be based on a comprehensive knowledge of the parameters of that project. Accordingly, before detailing the economic approach taken in this report, the general nature of national parks and equivalent areas[1] will be discussed. Decisions regarding the establishment of parks will also be critically examined (in Chapter 2) and the place of an economic evaluation in this decision process examined.

1.1.1 Land management in national parks

Within a given national park a variety of uses will typically be permitted and in general, the mix of uses will vary from one park to the next. For example, if an area is designated for the conservation of the species found in it, total exclusion of people may be enforced. Another area may be designated for scientific research in which case entry by research personnel only may be permitted. Within the class of recreation areas, a wide range of areas with corresponding use restrictions is possible from wilderness recreation areas through to land developed for intensive recreation such as barbecue and picnic usage. Each usage will be attended by different levels of management. Where little human presence is allowed, developments can be kept to a minimum but where intensive recreation is permitted, large investments in equipment and maintenance may have to be made to prevent deterioration of the amenity values of the area (for example, concrete surrounds near picnic tables to prevent erosion).

Clearly these different land uses are, to varying extents, in conflict with each other and the normal method of overcoming the conflicts is by zoning the parks into areas for specific purposes. To be effective,

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1 "Equivalent areas" in this report is taken to mean all areas set aside for conservation and/or outdoor, natural recreation purposes. Thus the term includes fauna and flora reserves, nature reserves, environmental parks and so on. The term "national park" will be used in this report to cover all these different types of area.

such zoning should provide areas large enough such that conflicts are minimised (by totally containing uses within the zone) while the provision of buffer areas between zones is also desirable. All this may require extensive areas of land in order to be effective; in a small park, zone size may have to be contracted, buffer zones eliminated or zoning abandoned completely with the result that the park would not adequately cater for any particular use at all.

An alternative to the multiple-use park concept is to provide a range of distinct areas, each with only one use. For example, parks providing for different types of recreation might be established near cities while strict conservation and scientific study areas might be situated further away. In this way recreationers would tend to be filtered from the system before coming into contact with areas where their presence would be undesirable. The multiple or single use issue is, however, very complex and outside the scope of the present project for which it is sufficient to note that national parks are not stereotypes but involve a wide range of management strategies. Consequently an economic evaluation of national parks cannot be applied to all areas in exactly the same way but the basic approach will need to be modified for each area considered.

1.1.2 The type of park considered in this study

Only one national park was studied in the project - Warrumbungle National Park in the north west of New South Wales. It is a multiple use park providing areas for fairly intensive recreation, (such as picnic grounds), bushwalking and habitat conservation.

The main "feature" of the park is its outstanding scenic value and initial establishment was primarily a response to its recreation potential as a bush-walking area rather than its conservation potential although the area is now recognised as an important one which samples the boundary between western and eastern habitats. Reservation was first advocated in the 1930's and began in the early 1950's. Subsequent additions to the park have increasingly been made in order to reserve a large sample of the habitats in the area rather than to provide more recreation areas. Until a more detailed inventory of species within the

park is completed, its real value as a conservation area will not be known. However, in broad terms,there is a good sample of eucalypt woodland in the park with perhaps some rare or uncommon plants - in this respect the reservation of more of the western flora is important. Rather than being an area for the conservation of the more specialised species (as agricultural use of surrounding areas has probably caused these to disappear) the park constitutes a good basis for the conservation of more robust and widespread species.

A related issue is the scientific value of the park. Again, little can be said on this until a more detailed inventory of park resources is available but at this stage it appears that the area of most contribution is in the park geology and perhaps the study of the western habitats sampled in the region. The existence of remnant animal populations would also be important but the probability of this is low.

At present, though, the main value of the park to the public seems to lie in its recreation value. Hence, the subsequent economic evaluation concentrates on this aspect of the park. Where the importance of values in other parks is different (for example, scientific value may be most important and recreation least) the economic analysis will need to be given a different emphasis. A corollary to this is that the results of this study should not be generalised to other parks without a critical examination of the similarities and differences of those parks to the Warrumbungle National Park.

1.2 The objectives of the land management practices undertaken in national parks

As noted above, most national parks are multiple use in nature. Each use will provide different sorts of benefits to the users and it is the object of the management undertaken in the park to maximise the benefits to the users (subject to costs). This will be easier for a single use area than for one where several uses are combined in the one park as in the latter case, the costs to one use of increasing levels of another use need to be assessed in order to ascertain the maximum possible benefit level. For example, for a two use park with developed recreation and wilderness recreation, increasing the area available for developed recreation may be satisfactory up to a point. This point would

be (other things being equal) the point where the additional benefits derived from increasing developed recreation by one more unit were offset by the loss of benefits experienced by wilderness recreationers by the additional unit of developed recreation. Clearly, comparisons of this kind are difficult as they involve what may be very different benefits and the situation becomes more difficult when increasingly dissimilar benefits, like recreation and scientific values or conservation and mining, are considered. Yet the comparisons must be made somehow if rational decision is to be made. We return to this problem subsequently but before any economic evaluation of parks can be made, the benefits and costs to be considered must be identified.

1.3 The benefits provided by national parks

National Parks provide many benefits to society. Following is a list of such benefits. The list is not exhaustive but is intended to indicate the range of benefits which natural areas can give and it will readily be seen that many of the benefits are highly inter-related.

1.3.1 Recreation

National Parks offer the possibility of a wide range of out-door recreation activities. These pursuits range from wilderness recreation through hiking on prepared trails (both of which may involve overnight camping), to day-use of some areas for picnicking and outdoor games. (Passive recreation such as sight-seeing from cars can also be carried out within parks. This is a form of non-user benefit as the park resources such as space and picnic facilities may not be used and is further discussed below under aesthetic benefits).

Each recreation type will have a different complex of effects on a natural area, depending on the characteristics of the area and on user numbers, user intensity and frequency, and user characteristics. Beyond a given level of use, however, the natural attributes of an area may be impaired. This can be called the ecological carrying capacity of an area for the given level of management (Dasmann et al., 1973, pp. 114, 155) - "the maximum number of individuals ... which can be supported by a given habitat under conditions of maximum stress",

(Fisher and Krutilla, 1972, p. 420). Set against this concept of the number of recreationists which may be supported on a given area is the concept of economic carrying capacity. This recognises that, beyond a given total level of use, the benefit derived by the individual recreationers may decline because of the effects of congestion imposed by other users (Dasmann, et al., 1973, p. 116). This decline may be greater than the extra benefit gained by the additional users. The economic carrying capacity may be defined, then, as that level of use at which the net benefit to recreationers is maximised - this level may be less than, equal to, or greater than the ecological carrying capacity of the area.

These concepts need to be used in planning for recreational use in parks and may be reflected in the type of park and park management resulting. On one hand, several, or all, types of outdoor recreation may be pursued in a given park; on the other, a park may provide facilities for only one type of outdoor recreation (e.g. Forster, 1973; Piesse, 1969). To reiterate, the optimal situation in any given park will depend on the natural attributes of the park, the man-made aspects like size, its location with respect to a user population if any, its location with respect to alternative recreation sites, if any,[1] and the characteristics of potential users.

1.3.2 Conservation

The conservation of an area in its natural state by means of a national park may provide significant (though perhaps long term) and increasing benefits of different kinds to society (e.g. Day, 1971, pp. 194-5).[2] Firstly, the areas may act as scientific reference zones (Ovington, 1969, p. 41; Downes, 1975, p. 61) with which to compare developing areas or laboratories in which to conduct experiments on natural processes in natural areas. Research on such processes may be

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1 Both the latter factors will be important in determining visitor numbers and frequency.

2 Note that in this report benefits to the natural community itself are not considered; only those which accrue or may accrue to society are mentioned.

directed at aims like better management of the natural areas themselves, better management of external areas and increased knowledge of the processes as they occur under natural conditions. Acting in such a capacity, a natural area may be a unique or irreplaceable asset when compared to man-made laboratories. Thus the benefits to scientific research stemming from the conservation of natural habitats may be large.

The recreation of a reasonably diverse natural community in a conservation area may serve as a gene reservoir to (1) assist in repopulating other areas depleted in certain species (e.g. Phillips, 1976) and (2) provide a source of genetic diversity for domestic species if required (UNESCO, 1973). The loss of a gene pool which would probably accompany the loss of a natural habitat (Slatyer, 1975, pp. 23-24) is an irreplaceable one. Hence the conservation function of national parks may be very important and the benefits of conservation may be large. These benefits may also appear in "commercial" form is the species conserved yield, for example, useful drugs (Tracey, et al., 1968; Webb, 1969), or can be used for timber production (UNESCO, 1973), or in agriculture (Mason, 1963, p. 108).

If the attainment of conservation benefits is an aim in establishing national parks, then the parks should sample diverse natural ecosystems and, ideally, each ecosystem should be replicated in the park system (cf Slatyer, 1975, p. 22).

1.3.3 Education

Accompanying the above two classes of benefits are the benefits derived from the use of parks for educative purposes. Field trips are made by students at all levels of study, commonly to observe natural communities and processes, or areas illustrating the operation of natural processes in the past, for example, in regions of geological significance.

Education on aspects of the ecology of an area can extend to education on man's role in that environment. This may yield benefits (again perhaps in the long term) of more responsible (recreational) use of that particular environment and, as a secondary benefit, more responsible use of other areas (Downes, 1975, p. 62). These benefits are over and above those of the pure acquisition of knowledge of the natural

environments.

1.3.4 Aesthetic benefits

As well as user benefits such as recreation and education, a national park may provide significant non-user benefits to society. These benefits include "knowledge of existence" - simply knowing that, for example, a certain species exists and is protected from harm, even though the beneficiary knows he has little or no chance of ever seeing a member of that species (Promkutkeo, et al., 1977). Included in this category also might be the benefit derived from viewing fills about natural areas and native wildlife. In so far as national parks increasingly represent or contain the remaining natural habitat in Australia (Day, 1971, p. 193), this benefit may be large and growing.

In considering the aesthetic benefits supplied by parks, the importance of the scenery itself should not be overlooked. In a recent survey conducted among residents of Armidale, NSW (Promkutkeo, et al., 1977), improved (more natural) scenic quality of potential and current recreation and non-recreation areas was the single most highly weighted benefit of environmental protection among the survey respondents. While replication of such a study in other areas is necessary to substantiate the result, it appears that (natural) scenery provides significant pleasure to viewers.

However, work conducted by Sinden and Smith (1975), again in the Armidale region of NSW, showed that the recreationers sampled tended not to distingush between natural forest and exotic (pine) forest as preferred sites for recreation. How are these differing results to be explained? One possible reason might be that the respondents to the two surveys were members of different subgroups in society and were in fact representing the views of these subgroups. If this is the case, it appears that not all people gain pleasure from the same visual environments. In much the same way, then, as a diversity of protected areas is required to provide for the conservation of habitats and species, a diversity of scenery needs to be protected to cater for the needs of society.

1.3.5 Health benefits

Benefits in this category may be largely grouped with the recreation benefits derived from parks and cover aspects of both physical and mental health (Ovington, 1969, p. 37; Boyden and Harris, 1977). The physical-health benefits would include those derived from exercise undertaken in parks and benefits attributable to oxygenation and removal of carbon dioxide (Woodwell, 1978) provided by the park vegetation. Mental health may be beneficially affected by the release from urban over-crowding which would accompany dispersed recreation in parks (Downes, 1975, p. 62).

1.3.6 Watershed management

The retention of vegetation in a part of reserve can be very important in managing an area to provide water or for flood mitigation. Connaughton (1943, p. 641) indicates the five factors influencing stream-flow in watersheds - climate, geology, soil, topography and vegetation. On one hand vegetation consumes water in transpiration and causes some evaporation loss through water interception on the leaves, but on the other it binds the soil and increases the permeability and serves to reduce erosion and evaporation from the soil by intercepting rainfall and by covering the ground with litter and shade. Colman (1953) and Connaughton (1943) give several examples where destructive and costly flash flooding is partly attributable to the clearing of land in forestry and agricultural activities and Connaughton (p. 644) specifically credits national park use of land for its "highly important and satisfactory contribution to natural steamflow". He goes on to call for a rational inclusion of watershed management objectives in any land use decisions and if flood mitigation is a major concern, the benefits of such vegetation as may be found in national parks could be large.

1.3.7 Historic benefits

The dedication of an area as a national park may assist in the retention of sites of historic significance which otherwise might have been threatened by alternative land uses. This is especially the case where areas are specifically set aside because of their historic value,

as with Historic Sites in NSW. The importance of this facet of park benefits may be gauged from several sources. Firstly there is the recent establishment of the Australian Heritage Commission and the drawing up of the National Estate Register in Australia which represent an attempt to record and preserve important features of the Australian landscape (both natural and man-made) for posterity. Secondly, although the benefits to be derived from historic sites may be hard to visualise in concrete terms, they are evidently important as was found in a Canadian survey reported in 1974 (Galt, 1974), where approximately 29 per cent ($157m) of tourist spending by Canadian residents in 1971 was "attributable to tourists whose main activity (was) visiting historical and cultural sites", (Galt, 1974, p. 4). Thirdly, the importance of history to the Australian public can be gauged by attendances at such areas as Old Sydney Town and Timbertown, both representing aspects of Australia's past.

1.3.8 Cultural benefits

As a category of benefits to be derived from national parks and equivalent areas, these may not be readily distinguishable from the historic benefits mentioned above, except perhaps in the case of Aboriginal sites. Such sites could be very important for anthropological and archaeological studies let alone the significance they hold for present-day Aborigines, while the existence of areas of value to current aboriginal populations could have profound implications for park management. The attraction some Aboriginal sites have for tourist purposes may also be significant (see for example Ovington, et al., 1972).

1.3.9 Option value

Option value is not a separate benefit provided by national parks, but has to do with the evaluation of future benefits from them. There are a number of aspects to option value.

The central concept is that of the <u>irreversibility</u> of an investment decision. In the case of national parks, the decision to develop an area may destroy for ever some of the benefits from preservation, whereas the benefits from development are not irretrievably lost by deciding on preservation. The situation where this matters is

where one predicts that preservation benefits, are likely to increase, may fall (or at least not rise as fast as for preservation) (Krutilla and Cicchetti, 1972). In this case, if the decision to develop or preserve is taken by considering benefits and costs over the life of the development project only, this is likely to bias the decision in favour of development. This would not matter if the decision were reversible, so that after the development project was finished one could still obtain the rising preservation benefits. However, in this case those benefits have been foregone, so the option of enjoying them is lost forever.

The problem in this case is that the analysis has been done incorrectly; with an irreversible investment decision the streams of benefits and costs would better be considered over a much longer time period (theoretically, infinite), or else some allowance made for the capital value of the asset at the end of the development project life. In the latter case the higher terminal value of the land under the preservation option will counteract the higher short-term profitability of the land under the development option.

Now clearly the future benefits (and costs) of either the development or preservation option are likely to be uncertain, perhaps more so in the case of preservation. It is sometimes thought that uncertainty gives an additional aspect to option value in the sense that people who do not now wish to use a park, but think they may wish to do so in the future, may be willing to pay now to preserve the option of future use. However, the amount they are willing to pay will just be equal to the expected present value of their future benefits, and this should already be included in the valuation of the preservation benefits.

However uncertainty does create an additional reason for favouring the preservation option. The point is that we are not faced with the decision to develop or preserve in perpetuity; the preserve option can be reserved at some future time, and in the meantime we may have gained additional information which allows us to better assess the uncertainties attached to the preservation or development choice. However, by choosing to develop now even if additional information became available, it would be useless, for we could not reverse the decision anyway. Thus, even if over an infinite lifetime the development option appears better than the preservation option, (being forced to decide on one or the other now) the fact that using the preservation choice postpones that

decision, and hence enables the gathering of more information, is a counter-vailing argument in favour of preservation (Henry, 1974).

1.4 The costs of national parks

The taking of any rational decision on a project must include a consideration of the costs as well as the benefits of that project. This should be the case for any decision on national parks as well. Accordingly, the costs of national parks are described below in order that they may be evaluated subsequently in the case study.

Acquiring the land for the park may involve a significant dollar cost depending on the nature and location of the land, the size of the acquisition and the nature of the land tenure held by the previous owner. If the land is close to residential areas the cost will be higher, ceteris paribus, than if it were remote from any such areas. Equally, the larger the acquisition, ceteris paribus, the larger will be the dollar cost of acquisition.

The influence of form of land tenure on the cost of acquisition can be very important. If the land desired for acquisition is freehold, the cost of acquisition will be roughly equal to the market value of the land plus improvements and this may, depending on other factors, be quite high. If on the other hand, the land is held on lease from the Crown, the cost of acquisition may be low, amounting to perhaps a "market value" payment for any improvements on the land and no payment for the land at all. In the latter case, compensation to the occupier may have to be considered over and above other payments made whereas with the freehold case (and assuming the market is operating satisfactorily, a point which will be elaborated at a later stage) no compensation ought to be paid over the market value. However, in an economic valuation of any project, the relevant costs to be considered are opportunity costs. The opportunity cost of a park project is the income foregone by not proceeding with the alternative land use (e.g. Sinden and Musgrave, 1969, p. 21). Depending on circumstances, this may or may not be measured by acquisition costs. For example, if the park is to be established on leasehold land, the dollar cost of acquisition may be low (for example, a payment for improvements only) but the opportunity cost may be high depending on the use to which the land was put (e.g.

the income from leased, high quality grazing land may be high and the incorporation of the land into a park may thus involve a high opportunity cost). On the other hand, for freehold land (and assuming the land market is operating satisfactorily) the market value will equal the opportunity cost of acquisition. The relationship between opportunity costs and market value is expanded later in the report in the context of the case study of Warrumbungle National Park.

An economic evaluation of a project must also take into account the maintenance or running costs of the park including the cost of facilities and staff. The capital cost of facilities as well as recurrent costs such as repair and replacement need to be assessed. In doing so notice might be taken of the level of management in the park and whether this is optimal. For example Smith and Krutilla (1976) point out that by altering management strategies in a park (and thus altering running costs), the level of benefits derived from the park can be altered. For a given management strategy there will be a particular optimal level of use but when all strategies are compared there may be a single management strategy which will yield the overall optimum in terms of the maximum net benefit to society from park use. The maintenance costs of this *optimum optimorum* may be higher than for other strategies but the benefits will also be higher than those corresponding to the other strategies. Hence, maintenance costs cannot be divorced from the management strategy and to maximise the benefits gained from the park a maintenance cost, higher than the minimum, may have to be incurred.

The final category of park costs are external costs. These costs are costs imposed by the park on, for example, land adjacent to the park. If the park provided conditions suitable for the maintenance of populations of animal pests or weeds and these pests or weeds subsequently invaded adjacent land, thus causing its value to decline, then this decline is a cost of the park. A similar conclusion would apply in the case of fires generated within the park (Sinden, 1971, Tisdell, 1972). *In toto* of course, the external effects of the park may be positive if for example improved management practices by the personnel lead to a decrease in pest weed and fire levels from those previously existing.

The precise measurement of any external costs would need to be based on a thorough knowledge of the biological and physical relationships involved in the interaction between the park and adjacent areas.

Since the debate surrounding national parks often centres on issues other than the direct benefits and costs listed above, (for example, on issues such as jobs generated or lost by park establishment), we now turn to discuss the effects of national parks on their local region and on the nation. Before doing so, it should be noted that evaluation of a national park on any regional economic, ecological or other intention is too narrow. The park should be considered on a much wider scale for appropriate decisions to be made on its ecological and recreational importance and economic value.

1.5 National and regional effects of parks

The establishment of national parks in a particular area may have a number of indirect or spillover effects, which it is sometimes argued should be taken into account in considering a proposal. We can classify these into two broad groups - incidental effects and multiplier effects.

Incidental effects arise because in addition to the direct expenditure on parks to cover the direct costs noted in Section 1.4 whether financed by government or entrance fees or both, there will be expenditure by tourists on petrol, accommodation, food, souvenirs, sporting equipment etc. Multiplier effects arise because part of the income generated by both the direct and incidental expenditure will in turn be spent, generating further income, some of which will be spent, and so on in an infinite chain. Both the incidental and multiplier effects can be considered either at a national or a regional level, and indeed the multiplier effects are almost always considered at a regional level, in which case the relevant question is how much the income generated in a region is spent on commodities produced in that region.

The question which arises is how much weight should be attached to these spillover effects. In many cases the answer will be none. Consider first the incidental expenditure. Assuming that the markets for such goods are competitive and that the incidental expenditures are small relative to the overall market size for each item, then each unit of expenditure is exactly balanced by the costs of the resources required to produce the item. Thus the money that a tourist pays for

petrol to travel to a park just covers the cost to the whole of society of producing that petrol - it cannot be regarded as a benefit due to the establishment of the park.

For multiplier effects, unless there are unemployed (or under-employed) resources in an area, there can be no multiplier effects. This may seem paradoxical since the establishment of a national park often leads to a large tourist sector in the local economy, with consequent impacts on other sectors depending on how the income of the tourist sector is spent. However, if we assume full employment, the resources for that sector's growth must have come either from other sectors of the regional economy (e.g. agriculture), or have been attracted into the local economy. In neither case is there any overall benefit to the region or to society as a whole. In the first case, under the assumption of full employment, the resources have just switched sectors, with no change in the income being earned, while in the second case resources have just switched location, again without any change in income earned. Even on distribution, or equity grounds, there is no reason to consider multiplier effects, unless one is concerned with purely locational aspects of resources (as opposed to how much they earn), for example, if one is concerned with policies for decentralisation. If this is the case the question that needs to be asked is whether the establishment of a national park is the most effective policy instrument for encouraging decentralisation. Clearly, in many cases, it will not be.

However, if there are unemployed resources in a region then both incidental and multiplier effects can be important for now the cost to society of employing previously unemployed (or under-employed) resources is no longer measured by the prices paid for these resources.

How one measures and takes account of these effects will be discussed in more detail in a subsequent section discussing the place of Warrumbungle National Park in its regional economy.

1.6 Conclusion

In this chapter it was pointed out that national parks are not stereotyped entities with the same uses undertaken in each. Rather there is a whole range of parks depending on whether they are single or multi-purpose areas and, if the latter, what mix of uses is allowed.

Consequently an economic analysis of one park cannot be generalised to all parks and a separate analysis must be performed for each park if the results are to be valid. The park considered in this study is a multiple use park with the main emphasis on its recreation value. Accordingly the study concentrates on this aspect in the economic analysis.

To place the economic analysis of the park in context, the benefits and costs likely to flow from parks were discussed as were the national and regional effects of parks. It was concluded that, in many cases, the regional effects of parks (such as increased expenditure by visitors in local towns) are not benefits or costs that can be attributed to the park on a national scale as they merely represent a switching of these effects from other regions in the country. Indeed they are not always benefits and costs on the regional scale either as this will depend on whether there are previously unemployed or under-employed resources in the region.

The next chapter examines the decision making process regarding national parks and the place of an economic evaluation in that process.

CHAPTER 2

DECISIONS ON NATIONAL PARKS

2.1 Introduction

In this report we argue that economics can play a useful role in decisions about national parks, although many other disciplines must also be involved in deciding the best use for an area of land. To some people the association of economics with national parks seems strange, for they believe that economics is necessarily opposed to national parks. However, establishing a national park is just one of several possible uses of a particular set of resources, and determining the best use of resources is a central concern of economics. In this respect, then, decisions on national parks fall within the ambit of economics. Further, there is no *a priori* bias in economic analysis in favour of one use of a set of resources rather than another. This is not to deny that, for reasons we shall see later, the practical application of economic analysis may often be wanting, and this deficiency may well be to the detriment of national parks, but this is a case for doing economic analysis more carefully, not for abandoning it altogether.

The framework of economic analysis to which we refer is cost-benefit analysis and accordingly, in this chapter we shall analyse the advantages and disadvantages of using cost-benefit analysis to evaluate proposals to establish national parks. Of course, other criteria may influence the park decision made (for example international obligations and so on) but it is not clear that these should involve the government in a waste of resources. Hence economic analysis should still be an important (but not necessarily the only) part of decisions regarding national parks.

To place this discussion in a broader perspective, it is useful to begin by asking why decisions on parks are not left to the market place but are usually made by governments; this does not imply any bias in favour of market decisions, but rather allows us to pinpoint more precisely the nature of the difficulties involved in making such decisions.

2.2 Market failure and national parks

It is often alleged that the reason markets cannot be used to allocate resources to national parks is that the benefits derived from parks (such as those listed in the previous chapter), are "intangible" or "unquantifiable". It is crucial to realise at the outset that this view is misconceived. Economists assume that the ultimate aim of economic activity is to satisfy the preferences of consumers, this is part of what is meant by the doctrine of consumer sovereignty. For many questions, in particular for the determination of prices, the processes which shape people's preferences are irrelevant - all that matters is that people can make rational choices between different possible collections of goods and services.

Thus, the benefits of any decision by consumers are always "intangible" since they are just the satisfaction of a consumer preference. The benefits an individual derives from eating a meal in a restaurant, listening to a record, reading a book, or wearing a pair of shoes are no more tangible than the benefits he derives from visiting a park, or knowing that a particular species has been saved from the threat of extinction. Yet the former goods can be traded in markets and command prices, while the latter benefits usually do not. Clearly, therefore, whether or not goods are traded in markets has nothing to do with whether or not their benefits are intangible. As a corollary of this statement, if we accept that for marketed goods and services we can use prices as some measure of the relative value people attach to those goods, then it follows that there is no reason, in principle, why we cannot apply the same kind of valuation to non-marketed goods. That is, although there are no actual prices to reflect what people are willing to pay for non-marketed goods, there is no reason why we cannot ask them what they would be willing to pay under some hypothetical equivalent of market trading. We shall discuss these points more fully later, but we turn now to the proper reasons why decisions regarding national parks are not generally left to the market place.

There are four reasons why a market allocation of resources to national parks may be imperfect - monopoly, joint supply, the public good nature of some benefits, and the absence of future and risk markets. We discuss these in turn. For the first two problems it will be

convenient to suppose that the only benefits derived from a park are recreational, i.e. people have to visit the park in order to derive any benefit. Then it is possible to conceive, in principle, parks being run privately, as indeed some parks have been, with the costs of the park being financed by sale of entrance tickets. In this respect national parks would be no different from other recreational experiences such as visits to theatres, cinemas, sporting fixtures, zoos etc.

One respect in which parks may differ from some of the other leisure activities just listed is that it is more likely that a park may enjoy monopoly advantages. To the extent that a park is established around a particular geological or geographical feature (such as the Warrumbungle Range) or to protect a particular species, it is distinct from other parks, and may be able to capitalise on the uniqueness of its assets to earn monopoly profits, charging entrance fees higher than those of a competitive market. This possibility is discussed by Tisdell (1972).

The second reason why markets may not operate well in decisions on parks is the problem of joint supply, a problem common to many recreational experiences such as cinemas, concerts, etc. The difficulty is that once a park is established, additional visits by tourists may impose no extra cost on the running of the park, at least up to the point at which either the carrying capacity of the environment is exceeded or the number of tourists begins to detract from the enjoyment derived from the park. A private park will have to charge some entrance fees to cover its average costs, but these will exceed the marginal cost of supplying the benefits of the park. The optimal pricing of a jointly supplied resource is a complex issue, but the point to note here is that it is unlikely to be the price established in a competitive market.

Both the monopoly and joint supply problems arise in many sectors of the economy - transport and energy being two common ones, and lead either to government provision of the services, through public utilities, or to regulation of privately owned enterprises.

The third characteristic of parks presents perhaps the most serious difficulties - the public good nature of many of the benefits. The public good problem arises when, in addition to the joint supply nature of the resource, there is the impossibility of excluding people who do not pay

for enjoying the benefits of a park. This could arise even with recreational benefits if the area involved was too large to police or too easy to enter, so it becomes uneconomic to try to charge everyone who enters the park. The problem is even more acute with non-recreational benefits. For example, the aesthetic benefits of preserving the skyline of the Warrumbungle Range can be enjoyed by people who do not enter the park; again, the benefits derived from knowledge that a particular species has been preserved are available to everyone. Clearly any private organisation which tries to provide such public goods without any powers to enforce charges is likely to face a situation in which the revenues it raises substantially understate the benefits derived by society, so that private markets may well undersupply public goods. One possible response is for the government to supply such goods.

The final aspect of market failure of relevance to national parks is the absence of future and risk markets. Many of the benefits of parks, perhaps especially the non-recreational benefits, either extend very far into the future, or have significant uncertainties attached to them. Thus, the decision to preserve an area of outstanding beauty will convey benefits to all subsequent generations, unlike most other capital assets which depreciate rapidly over a couple of decades. Similarly, the decision to preserve a particular species may not be taken because extinction of that species is <u>known</u> to have harmful effects, but because it <u>might</u> have such effects.

The absence of future markets means it is very difficult to know what value future generations will attach to benefits and hence decisions have to be made on the basis of the current generation's expectations. Only if we had perfect foresight could we rely entirely on the decisions made by those in the market.

There is an additional problem, that of distribution of income between generations. As private individuals we may be relatively unconcerned about the future, except in so far as it affects our immediate heirs. However, we may collectively believe that it is desirable to add to the wealth of future generations beyond our private bequest motives, and it is then suggested that the government should act on behalf of such unborn generations. The way in which concern for the future is reflected in an economy is through the rates of interest that prevail, since these reflect, in part, what is called the private rate of

time preference - that is the rate at which individuals trade-off present against future benefits. A high rate of interest implies a low weight on future relative to the present benefits, and the argument that society should give more weight to the future than private individuals do is often expressed by saying that the social rate of discount (interest) should be lower than the private rate of discount. If it is believed that this is the case then governments should seek to bring down interest rates generally, thus encouraging more investment and hence a transfer of resources from present to future generations. In other words, believing that society gives too little weight to the future means that all forms of investment are inadequate, not just investment in the public sector or more particularly in national parks. However, while the argument applies to all forms of investment, it may be argued that it is more important for parks because of their very long lifetime.

A somewhat different set of arguments concerns the question whether the rate of discount used in public sector investment should be lower than that in the private sector, and one of the main points is that of risk. Investment in parks is risky because future benefits are unknown (due to the absence of future markets), and because the complexity of natural systems makes it difficult to predict the effect of not conserving particular areas or species. Because individuals are generally averse to taking risks, a number of institutions have arisen which allow risk to be spread - insurance contracts, shareholding in companies, guarantees, long term contracts, cost-plus contracts etc. The aim of such arrangements is to separate the decision to undertake a risky activity from the decision to bear risks - so that, for example, managers decide on investment projects but the financial risks are borne by shareholders. This separation allows society to invest in a wider range of potentially profitable but risky activities than it would do if all the risks were borne by individual decision takers. However, these institutions for spreading risks are by no means complete in society, so there are many areas where private markets may be unwilling to make investment but where society would benefit by having such investments made. It is argued that the government has a role to play here for through its powers of taxation it can spread risk widely through society. The government can encourage risky investment by arrangements such as cost-plus contracts with aviation companies, by providing medical or other

forms of insurance which the market may inadequately supply, or by undertaking investment directly, such as investment in basic research. To the extent that conservation is seen as an activity with very uncertain benefits, this may be an additional argument for government involvement. Even if this is not seen as the major rationale for government investment in national parks (the other reasons listed above being primary), there is still the question of the appropriate rate of discount to be used. It has been argued that private sector investment is not able to fully spread risks. Hence it uses fairly high rates of discount to compensate for risk-taking (although the extent to which large public companies use high discount rates may exaggerate the real risk being borne by their shareholders, and may reflect rather the desire by managers to protect their employment). The government, as we have seen, is able to spread risk throughout society, and so should use lower (risk-free) rates of discount in appraising its projects. We shall return to such arguments later.

To summarise then, the potential for monopoly, the joint supply and public good nature of the projects, and the absence of future and risk markets may all mean that the private market will not provide sufficient investment in national parks so that some role for government may be required.

2.3 The context of the political decision on park establishment

The arguments we advanced to suggest that private markets may be inadequate in their allocation of resources to parks clearly have a wider application, and would be part of a standard justification by economists for the role of government activity in many sectors of the economy, although this does not imply that every activity actually undertaken by governments would meet with general approval by economists. Direct public provision is only one of many ways in which the government impinges on the economy, and even within that area there is a wide range of services provided - defence, justice, education, waste disposal, social services, art galleries, water resource projects, etc. National parks are therefore just one of a broad range of services whose characteristics are such as to require public provision.

However, we believe it is important to emphasise that while provision through markets may suffer from many of the difficulties discussed in Section 2.2, most of these difficulties also attend provision through the political process. Thus the fact that many benefits may occur in the distant future makes it just as difficult for politicians or bureaucrats to assess as for firms in a market place. Perhaps most importantly, while the non-excludability of public good benefits leads to under-revelation of demand in markets, it is just as difficult for government to assess the benefit enjoyed by society.

While the political process, through voting, lobbying etc., is a mechanism through which information about people's preferences is conveyed to decision-makers, it is clearly a fairly imperfect mechanism, particularly when we consider the detailed nature of the decisions involved. We shall examine in a later chapter various mechanisms by which public authorities may try to obtain a correct revelation of people's preferences. The point we wish to establish is simply that it is not enough just to say that markets are imperfect providers of particular services and therefore that government must supply the services; one needs also to examine the process of public provision and ask whether it can be improved on.

Since the mid-sixties there seems to have been a growing public demand for such a reappraisal of public investment decisions. This is no doubt due partly to the fact that the rapid post-war growth in the size of the public sector in most developed economies led to a demand by the public that this increasing share of their incomes should be spent wisely. Another reason, however, was probably that given above - the realisation that many of these investment decisions are extremely complex, and that many of the claims made by protagonists for various areas of government involvement had not been realised.

Whatever the cause, there seems to be a greater demand now for public accountability. Economists responded to this need for a more precise scrutiny of public investment by the development of cost-benefit analysis. So far its use in developed countries has been confined to a few areas, such as transport or water resource projects, but it is now gaining acceptance in other areas such as defence, education, health and some environmental problems. In developing countries, where the problems are somewhat different, it is gaining acceptance for the appraisal of

publicly supported industrial investment projects.

Before discussing the possible application of cost-benefit analysis to the appraisal of parks we will outline the procedures currently used, and examine a number of other criteria that have been proposed to guide decisions on parks. This is necessary as the usefulness of cost-benefit analysis in this context can only be assessed in comparison with the other evaluation criteria currently used in making decisions on national parks. If these criteria are performing adequately in terms of allocating land among competing uses, then there may be no need for cost-benefit analysis, especially as the technique may be expensive to implement, as we shall see later.

2.4 The current procedure used for decisions on national parks

The various State and Federal Acts and Territorial Ordinances covering national parks in Australia by and large give no specific and objective criteria by which areas are to be judged as to their suitability for reservation. Where guidelines are given (e.g., the National Parks and Wildlife Act, 1972-1974, South Australia) latitude is allowed for the discretion of the operating service to be used in considering areas for reservation, the standards set being of the form "national significance" (28(1)(a) of the above Act).

An alternative approach is exemplified by the New South Wales National Parks and Wildlife Act, 1974, which specifies objectives to be satisfied by the National Parks and Wildlife Service and the reservation of land to accomplish these aims is permitted. Objectives in this Act include statements such as the "care, preservation and conservation of natural environments and natural phenomena" (49(3)(b) and to "promote appreciation and enjoyment of wildlife, natural environments and natural phenomena" (49(3)(d)).

Clearly, such guidelines and objectives can be widely interpreted, allowing the reservation of diverse areas - this is desirable. However, the very breadth of the guidelines and objectives allows much room for political pressure to be exerted in the reservation decisions and by no means ensures that available funds and expertise are directed at the acquisition of areas which might be most valuable in terms of conservation or recreation. In view of this, the specification of more concrete

criteria could aid the decision-makers in selecting those areas most deserving of, or requiring, protection. The following section details some criteria which have been or are being developed to assist in the decision-making by removing elements of arbitrariness from it.

2.5 Other criteria proposed to guide the selection of areas for national parks

In an attempt to ensure that national parks occupy land most suited to their purposes, the following selection criteria have been developed. By and large, the most developed of the criteria deal with the conservation function of parks. Criteria to guide the selection of land for recreation purposes have not been as well specified (*cf.* Forster, 1973, p. 10). This may be a serious shortcoming when it is recognised that a major use of many national parks is recreation, although as recreational usage is more flexible than conservation usage, criteria need not be as tightly specified. The criteria surveyed here vary from broad national criteria to criteria to guide the selection of areas for specific parks and their shortcomings are outlined, where relevant. The subsequent section (2.6) discusses some more general difficulties with these criteria.

2.5.1 A national criterion

Slatyer (1975, p. 25) reports a recommendation of the International Union for the Conservation of Nature and Natural Resources (IUCN), "that a minimum of 5 per cent of the national area should be set aside for reserves". Such a criterion can be nothing more than a rough guideline in making decisions on national parks. For example, it takes no account of the diversity of ecosystems in a country. If we assume one aim of a system of reserves is to conserve a representative sample of all ecosystems in a country (see below), a country with little diversity may require only a small proportion of its land area in reserves to provide an adequate sample whereas a very diverse country may require a larger proportion. For both countries, the 5 per cent criterion may not be valid. More importantly than this, however, in the absence of any other guidelines, it gives no assistance in the location of specific reserves and this is the crucial issue to be faced. If the 5 per cent were the

only criterion, the land could be reserved anywhere and this may not serve the purposes of conservation at all if the integrity of other ecosystems in the country is threatened. In contrast to this criterion, the following guidelines attempt to direct the placement of specific parks.

2.5.2 "Ecological" criteria

Under this heading the following criteria by which to select areas for reserves can be included (UNESCO 1974):

- the degree to which an area represents its surrounding region;
- the diversity of ecosystem types contained in the area;
- the naturalness of the area;
- its effectiveness as a conservation unit
  (included in this last criterion are considerations of size, shape, location with respect to other land use activities, and degree of protection).

The representativeness of an area is important if the aim of reserving the area is the protection of a sample of the habitat surrounding that area. Taking this as a criterion for reserve selection will mean "the incorporation of contiguous sections of whole land systems, and land system complexes, into reserves" (Slatyer, 1975, p. 29). In other words, the satisfaction of this criterion may lead to considerable conflict with other land uses, perhaps placing the decision back into a political context (from which this criterion sought to remove it).

Related to this criterion is that of diversity of ecosystems in the area to be reserved. This criterion attempts to ensure that the reserves contain a range of habitats to cater for many different populations and population stages of different species (UNESCO 1973, p. 23). The present state of ecological knowledge may preclude the proper application of this criterion, however, as details of, for example, habitat preference over the life cycle may not be known for many species of interest.

Considering this criterion with respect to the range of animal and plant species, the delineation of any reserve may artificially limit the extent of the species, causing the loss of much information on ecological

adaptations etc. The point here is that an adequate range of habitats to be reserved in any one area may not be known or agreed upon.

The problem of agreement will be more pronounced with the criterion that areas should be natural to act as conservation areas. Two difficulties seem likely to occur, the first being what is "natural"? This argument is most prominent in the issue of fire in Australian habitats. Some habitats such as rainforest are clearly dependent on fire exclusion while other habitats require fire for their perpetuation as a disclimax community. Both appear "natural". Yet, are the latter communities a result of natural fire regimes or an imposed fire management by the Australian Aborigine and if the latter is the case, are they really "natural" or should fire be now excluded and the development of a fire-free climax community be allowed? Such issues are not likely to be easily resolved and are related to the second difficulty with this criterion - how "natural" should the area be? Much of the Australian landscape has been so altered by agricultural and other activities that only pockets of pre-existing "natural" communities remain. Under this criterion alone, only such pockets would be selected for reserves yet such a selection may violate the other criteria mentioned in this section. For example, to be representative of a region and to contain a habitat diversity, a reserve area may need to include land ranging from flat agricultural land to forested slopes yet the former will not be "natural".

The final "ecological" criterion is that of effectiveness as a conservation unit. As noted previously this criterion will be a function of the size of the reserve, its shape, location with respect to other land uses and degree of protection. The location of the reserve with respect to other land uses cannot be changed so the conservation effectiveness will be a matter of reserve management as is the degree of protection afforded the reserve. The size and shape of the reserve, however, are criteria to be considered in reserve selection. The shape should allow ease of management and as little interface with hostile habitats as possible. The appropriate size of a reserve is a more contentious issue. Ideally it should result from considerations of the carrying capacity, range and desired number of the species to be protected (Slatyer, 1975). In practice some or all of these are likely to be unknown for a species of interest and a "guestimate" must be made as to the optimal size - a process which can be subjective (Day

1971, p. 197).

Such "ecological" criteria are attempts to systematise the selection of areas for protection, yet with the present state of knowledge in the field of ecology, their major worth appears to be in delineating the principles which ought to be taken into account when the reservation of areas is being considered and indicating in which direction ecological research might proceed.

2.5.3 Uniqueness

Uniqueness of an area is often proposed as a criterion for reservation of both conservation (e.g., UNESCO 1974, p. 21) and recreation (e.g. McMichael, 1971, p. 26) areas. This is appealing but the measurement of uniqueness remains a problem. Unique on what scale? A species of habitat or recreational resource (e.g. the Warrumbungle Range) may be unique in a given locality but commonly represented elsewhere. Should it then be reserved? Further, is it ecologically defensible (or an economically sound use of resources) to conserve a naturally unique habitat or species which in the normal course of events (and without man's presence), is headed for extinction? In such a case (assuming the knowledge existed to identify these cases) a criterion of uniqueness may not be adequate for reserve selection.

2.5.4 Per capita open space requirements

The reservation of open space for the health and spiritual well-being of people is mentioned as a justification for parks (e.g. Downes, 1975, pp. 61-2). This has moved little beyond the "justification" stage towards the criterion stage as per capita requirements for these purposes are unknown. Fox (1970) has touched upon this area with a related statistic - "visitors per <u>developed</u> acre per year" - to give an idea of people's perceived carrying capacity of park recreation areas. Coupled with knowledge of the park's catchment population and the proportion of the park to be used for developed recreation, the appropriate size of the park could be estimated. Given that the user population can be identified, the statistic is likely to vary with location as the populations differ. It is also likely that, on this basis, the

appropriate size of the park could only be arrived at after park establishment. The criterion appears limited on these grounds, as well as taking no account of the conservation value of parks.

The following section deals with more general difficulties associated with all these criteria.

2.6 General difficulties with these proposed criteria

Apart from the problems specific to each criterion which were raised above, there are several which are common to all the criteria. These are now briefly considered.

2.6.1 Establishing a consensus on the criteria

The first difficulty to be faced is to select the personnel to decide on the criteria. Why should some be selected and not others and who should select the panels? It is conceivable that with different groups of people involved in setting "ecological" criteria, different criteria will emerge and in this case which should be used and why?

It seems reasonable that in the establishment of "ecological" criteria, expert opinion should be used; also it seems desirable that in the case of the development of any recreational criteria, recreationer, as well as expert opinion should be involved in standard setting because of the different nature of the criteria. The resulting criteria from the two perhaps diverse groups could be in conflict and in this case should either set of criteria be used in preference to the other or should a combination be used, and if the latter, which weighting should be used in combining the criteria and who should decide the weighting? It is clear that such selection criteria, proposed or envisaged, may not remove decisions on national parks from the political process at all.

2.6.2 Criteria flexibility

The criteria will either be fixed or flexible. If they are fixed (i.e. if a given area is designated for reservation regardless of its current use), then the cost of the decision is irrelevant. Yet in the decision-making process, cost is not irrelevant and the costs of land acquisition may be large. One result of using fixed criteria may be the reservation of a relatively unimportant area from the conservation

viewpoint, but one which has very important alternative uses. If, on the other hand, criteria are flexible over different areas, how are they to be varied? Such variation would involve a subjective trade-off of costs and benefits (not necessarily monetary but in terms of conservation value, recreational value and so on). On what basis should such a trade-off be carried out and by whom? This is in fact the crucial shortcoming of such criteria. They are not comparable between different land uses. Given that appropriate panels can be chosen and the resulting criteria are well developed in each field of interest, how are the criteria to be compared? For example, how is agricultural productivity to be compared to the scenic value of an alternative "natural" landscape? What values should be used in deciding which use should prevail? Once again, the decision seems subject to the political process, something the criteria-setting sought to diminish.

2.6.3 The criteria-fixing process

A final general criticism which could be raised does not concern the criteria themselves but the process of their establishment. If such criteria as those mentioned are to be used, it is important that there is as much input into their construction as possible. The input might come from expert opinion in the various fields of concern and lay input from those who will use the parks - the recreationers. Input should also be sought from those who may be adversely affected by decisions to establish parks in order that the criteria not be drawn up, divorced from reality. Such varied input would also be necessary if the criteria were to be changed from place to place. This will go some way towards ensuring that the establishment and possible subsequent modification of criteria is made explicitly and in an unbiassed manner. However, it appears that even explicit criteria setting will be subject to the political process.

It will be recalled that the purpose of examining the criteria set to guide decisions on national parks was to see if they performed adequately in allocating land among competing uses since, if they did, recourse to techniques such as cost-benefit analysis might not be needed. The analysis above has suggested that these criteria are not efficient guidelines for the decision-making process in the sense that arbitrary

political decisions may still prevail, even influencing the criteria established. In view of this, other criteria are needed to guide decision-making in this area. One such criterion might be that used in economics - maximise the net benefits of the land to society (when by net benefits we mean the difference between social benefits and social costs). The means of establishing this measure is the technique called cost-benefit analysis and we now turn to discussing this technique in general and in particular, as it applies to the assessment of national park projects.

2.7 Cost-benefit approaches to problems

To understand how cost-benefit analysts approach project appraisal, it is perhaps simplest to begin by considering how a private company would evaluate an investment project. The first stage is to work out all the relevant changes in physical resource flows that would result from undertaking the project. These would consist of resource flows into the project (inputs) and resource flows out (outputs). In a national park project the inputs would be factors like land, service of rangers, fencing equipment etc., while output would include visits by tourists, effect on ecology of the region (both beneficial and detrimental), effects on conserving historical values or aesthetic attractiveness, etc. All these kinds of data clearly require the expertise of park managers, agriculturalists, ecologists, botanists, geologists etc., and constitute the detailed technical description of the project. Any method of project evaluation must start from this basis.

In the second stage of the evaluation, one attaches prices to all the resource flows to obtain cash flows, generally positive for outputs and negative for inputs although detrimental outputs will also be negative. The crucial point here is to compute the flow of cash at the moment it occurs; thus acquisition of land will be charged at the moment the land is paid for, not when the project starts or depreciated over the life of the project. Now in a private commercial project the prices used will be market prices. Since many of the resource flows will occur in the future, this will require forecasting, so we will need the expertise of economic or marketing experts to ensure that the prices being used are plausible given the flow of inputs and outputs.

The final stage is to calculate the net cash flow at each time period, this is the difference between flows of cash into the project and flows of cash out. However, these net cash flows all occur at different time periods, (typically with negative net cash flows at the beginning and positive cash flows later), and we have to take account of the fact that cash flows at different periods of time have different values.

The reason why money has different values at different times is because money can be invested at positive rates of interest. Thus, if the rate of interest is 10 per cent per annum, $100 invested today becomes $110 a year hence. If offered the choice between $100 today and $100 tomorrow one would clearly prefer the $100 today; this would be true even if one had plenty of money now but forecast a cash shortage next year, for one would be better to take the $100 now and lend it. On the other hand, if offered the choice between $100 today and $120 next year, one would clearly prefer the $120 next year, for even if one was desperately short of cash just now, it would be better to borrow the $100 today, repay it with 10 per cent interest next year, and still have a surplus of $10 next year. Only if offered the choice between $100 today and $110 next year would one be indifferent, for by appropriate borrowing or lending at 10 per cent one can convert one cash stream into the other. Thus we say that $100 now is equivalent to $110 a year hence, with interest rate 10 per cent, or more technically, that $100 now is the present value of $110 a year hence. Thus the reason why money has different values at different times arises from the existence of positive rates of interest. These, in turn, arise primarily because individuals prefer present to future benefits.

To generalise from the above example, the procedure for evaluating cash flows at different time periods is first of all to decide upon the appropriate rate of discount for the project (this will be the rate at which a company can borrow or lend funds, and these rates will be the same in the absence of capital rationing problems).[1] With a rate of discount of 100 x r per cent, a cash flow of $1 in year t is worth $\frac{1}{(1+r)^t}$ now; we say that the future cash flow has been discounted to obtain the corresponding present value cash flow - the amount of cash now which would be equivalent to $1 in year t given that the cash now could be invested to earn 100 x r per cent every year till year t.

1 Appendix 4 outlines the issues involved in the choice of appropriate discount rates.

The number $\frac{1}{(1+r)^t}$ is called a discount factor, and by applying the appropriate discount factor to each period's net cash flow one obtains a series of discounted (present value cash flows. Since all the cash flows are now on equivalent basis, we can simply add them all up to obtain the net present value (NPV) of the project.

The criterion a firm should use then is to undertake a project if the NPV is positive, and to reject it if it is negative. The rationale is that if the NPV is positive then the revenue the firm can earn exceeds the costs, where the costs include the costs of borrowing money. Now, this form of calculation reflects only the benefits to the private firm, whereas we are concerned with benefits to society as a whole. That is, the question we are concerned with is the following: any project involves the use of resources and those resources are capable of alternative uses. Which use gives society the greater benefit; or more precisely, will benefits yielded by this project exceed those of any other use to which the resources could be put?

An important result in economic theory assures us that under certain assumptions, the private profitability calculation will be equivalent to a calculation of social benefits, so that projects earning a positive NPV will be desirable from society's viewpoint, and those with negative NPVs undesirable. The conditions required for this coincidence of private and social evaluation are, roughly, that all markets are in equilibrium (so there is no involuntary unemployment for example), that there are no external effects or public goods, that there is no taxation, that the project be small relative to all the markets involved, and that the project has negligible effects on income distribution (so that one can ignore who gets the benefits or pays the costs).

However, it is clear that the assumptions required for the coincidence of private and social project evaluations are unlikely to hold, although we have stated them in a form that is stronger than required. For many sections of the economy, it is usually believed that the assumptions are close enough to being fulfilled to allow private investments decisions to prevail. In other areas, the assumptions are so demonstrably false that some alternative method of evaluation is required and this is cost-benefit analysis. In particular, we have already seen

that there are a number of reasons why we could not expect market decisions to perform well in the evaluation of national parks. Indeed if this were not so, there would be no need for cost-benefit analysis, for one could simply leave investment decisions to private firms, or, if the investment is done by the public sector, employed accountants trained in conventional investment appraisal. Thus the whole rationale for the development of cost-benefit analysis is the realisation that the conventional investment appraisal techniques are inadequate. For our purposes, it will be useful to analyse the differences between commercial investment appraisal criteria and cost benefit analysis under three categories.

First, the market prices that are used to evaluate the project may not reflect the social costs or benefits of the project. An important example of this is the problem already alluded to in Section 2.2 of whether the rate of discount used in private evaluations is appropriate; another example is where significant involuntary unemployment exists, in which case market wage rates may not reflect the social cost of employing labour. Thus the first problem is that market prices may not properly reflect social benefits and costs. The second problem is really just a more extreme case, namely that for many benefits (and costs), market prices just do not exist, in the case of parks largely because the benefits are public goods. Finally one may want to take account of the fact that the flows of benefits and costs may accrue to different people in society, and weight the benefit to poorer people more highly than the same benefit to richer people.

These three aspects suggest, then, the way in which a cost-benefit analysis would differ from a private profitability calculation. One follows exactly the same stages, but instead of using market prices to evaluate resource flows one has to calculate what are called "shadow prices" or "accounting prices", that is prices which do measure the benefits obtained or foregone by society from particular resource flows. Thus stages one and three remain the same - we obtain a detailed technical description of the project, and in stage three we discount the calculated net cash flows, although we now use the social rather than private rate of discount,[1] and then compute the NPV of the project. It is in stage

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1 These issues are also discussed in Appendix 4.

two, the evaluation of resource flows, that the methodology of cost-benefit analysis diverges from private profitability calculations.

We have now outlined the broad approach of cost-benefit analysis. Clearly the substance of the methodology depends on the calculation of the "accounting prices", and we shall discuss this in detail in the appropriate chapters. For now, we shall deal with some of the broad criticisms that have been raised against cost-benefit analysis.

2.8 Objections to cost-benefit analysis

In this section we are concerned only with the broad objections to the methodology of cost-benefit analysis; difficulties with methods of evaluating specific benefits and costs will be covered in the appropriate sections of later chapters.

One objection often encountered is against the use of money as a numeraire. At one level, this complaint is superficial. What we are concerned with is relative values, that is the value of a visit to a park relative to a visit to a cinema, say. One simple way of expressing such relative values is to relate them all to a common commodity, and even in very primitive societies the convenience of doing this leads to the establishment of one commodity as a unit of exchange, or money. The nature of the commodity is totally irrelevant as far as cost-benefit analysis is concerned, and the only reason for selecting money as a numeraire is that it is the unit to which people are accustomed. One could equally express the NPV of a project as so many bottles of beer, but it would convey far less information to the public. Money represents generalised purchasing power, so people can imagine for themselves the kind of benefits they could exchange it for. Bottles of beer are thought of in a very specific use, while it is the more general sense of the benefits for which they could exchange bottles of beer that one wishes to convey.

A somewhat deeper complaint against the use of money is the problem of inflation. If all prices are rising at the same rate so that relative prices were unaffected, then allowing for inflation is straightforward. However, when inflation proceeds at different rates in different sectors, this distorts relative prices, so that prices may cease to reflect social costs. This is just an argument for doing cost-benefit

analysis carefully, not against the analysis itself.

A more general complaint is that money market prices are distorted by all kinds of market imperfections so that prices do not measure relative values accurately. As we have already said, it is precisely these distortions that give rise to the need for cost-benefit analysis; in other words, the complaint is usually made by people who confuse cost-benefit analysis with ordinary profitability analysis. However, even with distortions, market prices will often provide a useful starting point for calculating shadow prices; just because they are distorted does not mean that market prices contain no information whatsoever.

A more serious problem arises with resource flows which have no market prices, particularly those associated with public goods. While we concede that this area poses great difficulty for cost-benefit analysis, and in some ways forms the core of the topic, we would deny the claim sometimes advanced that there is a fundamental impossibility in evaluating benefits from national parks in terms of money. Such a claim is close to that discussed in Section 2.2 that the reason why markets do not handle parks well is the intangible nature of their benefits. As we pointed out then, this claim is false; we gave a number of other reasons why markets may perform inadequately in decisions on parks and noted that all goods yield intangible benefits - namely the satisfaction of consumer preferences. Thus we can see no difference in kind between the aesthetic pleasure derived from a beautiful view and that derived from listening to a record, yet the latter is priced while the former is not.

All goods and services, therefore, yield intangible benefits, and it is perhaps worthwhile spelling out simply the justification given by economists for using relative prices as a measure of relative values of commodities. Consider a consumer who has allocated $100 of his income to leisure, which in his case consists either of meals out or visits to a cinema. A visit to the cinema will cost him $5, a meal out $15. Suppose he decides on four meals and eight visits to the cinema. Why do we say that, <u>at the margin</u>, a meal out must be three times as valuable to him as a visit to the cinema? In making his decision in allocating his marginal expenditures (in this case hypothetically $15), he could have given up one meal and bought three visits to the cinema, (as a result of such a marginal decision he would then have chosen in total

three meals and eleven cinema visits), but he did not do so, so the benefit from three more visits to the cinema cannot be more than one meal. Conversely he could have given up at the margin three visits to the cinema and had another meal (i.e., had in total five meals and five visits to the cinema), but he chose not to do so, so the benefit at the margin of one more meal cannot be more than three visits to the cinema. Combining these statements we see that, at the margin, the benefit from one meal must equal the benefit from three visits to the cinema, for if this was not so, the consumer would have chosen a different combination of meals out and visits to the cinema.

Now the important point to note is that all consumers faced with the same choice, i.e., the same relative prices, must have the same relative valuation at the margin. Different consumers, with different tastes or different incomes, will buy different initial amounts of meals out and visits to the cinema; but their marginal valuations of meals out to visits to the cinema will all be three to one. There is thus an equivalence between the rate of exchange of commodities in the market (i.e., the ratio of prices), and the ratio of marginal benefits derived by every consumer in the market. In other words, the price ratios reflect the rate at which people, at the margin, will be prepared to give up one commodity in order to get more of another.

It is this trade-off which we are trying to measure in cost-benefit analysis - we are not concerned with benefits in any absolute sense but the relative benefits gained from giving up something of some commodities in order to get more of others. It is vitally important to realise that these trade-offs exist even in the absence of markets, prices or money. To take a simplified example, Robinson Crusoe on his island had to decide how to allocate his limited time between fishing and leisure, and we could take the number of fish he catches in his last hour's fishing as his marginal calculation of the benefit of food relative to the benefit of leisure. Wherever people are in a position of making a choice subject to constraint, then they are comparing the marginal trade-offs in benefits against the marginal trade-offs imposed by the constraints of the situation.

There is no reason, in principle, therefore, why one cannot establish how much of some commodities (in particular, money) people are willing to give up in order to have parks. The difficulty arises from

the fact that without prices there are no directly observable data one can appeal to. Broadly speaking there are four approaches economists take to the evaluation of unpriced goods or services.

Input valuation: Where the goods are used largely as an input to some other sector of the economy, one can establish, through studying the production process, the marginal yield of outputs from the input, and if the output is sold on competitive markets, one values the input at the value of the marginal output. This would be done in valuing the benefits of an irrigation scheme, for example, and is often used for valuing time.

Cost-savings: One values the output by assuming that it replaces some alternative privately produced service so that the value of the public service is the savings made in the private service. This may be applied in transport where it may be assumed that public transport is a direct substitute for private transport. In effect this amounts to using the private transport price to value public transport. Another version of this method is to assume that the output must be provided, so that the problem reduces to providing the output at least cost. In this case we have cost-effectiveness analysis, rather than cost-benefit analysis, and this just ducks the problem of valuing unmarketed outputs.

Cost of access: While the public good may be provided free of charge, there may be costs involved in the public's gaining access to the public good - essentially costs of travel and time. Willingness to bear such costs can provide information about willingness to pay for the good. This "travel-cost" method is the principle one used for evaluating recreational benefits of parks and we shall discuss it more fully in Chapter 7.

Direct survey: When all else fails one has to go out and survey people and ask them to express their willingness to pay. The major difficulties involved here are to ensure that people fully understand the nature of the public good in question, and also to design the questions to avoid biased estimation. If we ask the questions in a way that implies that people can enjoy the benefits of the good without

costs (e.g. taxes), then people are likely to overstate the benefits they perceive, while if they believe they may have to pay, they may understate their preferences (try to free-ride). However, there is some evidence that economists may have exaggerated people's ability or willingness to incorrectly reveal their preferences (Bohm, 1972) and in any case recent research has devised methods that avoid such biases, but they are complex and further development will be required to make them workable.

A third objection to the use of money as a numeraire is the problem of inadequate information. In order to be able to express a meaningful opinion on his willingness-to-pay for a particular benefit, the respondent must know what he is obtaining in return for giving up that amount. He may know this for such benefits as visits to a national park but not for, say, the benefits provided by conserving a given species. Increasing education on the benefits of conserving natural areas would help to alleviate this problem, thus making more meaningful expressions of value possible. However, this problem not only affects the establishment of values for specific benefits. It affects all criteria since they all require information on the nature of areas concerned and the benefits or qualities likely to be gained by conserving the areas. The problem of lack of information is then one which is not peculiar to cost-benefit analysis.

To summarise, then, we believe that there is no reason in principle why people cannot be asked to express their willingness to pay for the benefits of national parks. The problem is that in the absence of price information, methods have to be either indirect, and hence liable to error, or rely on very expensive survey methods, also with problems of error. It is the difficulty of obtaining reliable information cheaply that constitutes the major obstacle to valuing public goods.

A number of further points follow from this. One objection would be that cost-benefit analysis is a very time-consuming and hence expensive process, and that in many cases the costs of the analysis will not really be justified, since the decision will be relatively straight-forward. We would agree with this, and an important part of our suggested analysis is the proposal that it be done in stages, with the easier benefits being assessed first. If this is sufficient to take the decision with respect to present and future costs and benefits no further analysis will be required.

In addition, given the inevitable uncertainties involved, the use of fairly rough and ready estimates will often suffice, with a check to see how sensitive the decision is to such imprecision. We believe it is better to use a methodology which, we would argue, has a substantial rationale to it, but economise by using shortcuts, than to adopt a methodology in the interests of economy which has no rationale to it. Moreover it seems silly to select a methodology which is only good for simple decisions where it is scarcely needed anyway; it seems more sensible to adopt a methodology designed specifically to deal with the difficult decisions and to simplify it when that seems appropriate.

This approach often leads to the opposite complaint that because many of the benefits of national parks are difficult to quantify, analysts will concentrate on the easy ones, and either ignore the hard ones or treat them cursorily. As a result, decisions taken on the basis of cost-benefit analysis will have an inherent bias against projects whose benefits are substantial but hard to assess.

We accept that such dangers may exist, but believe them to be seriously exaggerated. In the first place, the argument is really for doing cost-benefit analysis better, not for abandoning the approach altogether. Most of the abuses that occur, do so because the agency commissioning the study either does not understand cost-benefit analysis (and its limitations) or else does not exercise sufficient control of the study. The commissioning agency can go a long way to minimising the potential for abuse by ensuring that someone within the agency familiarises himself with the basic issues in cost-benefit analysis, by issuing checklists of the benefits and costs it can identify and wishes to be analysed, and by requiring that benefits or costs only be omitted if either it is obvious that evaluating them would be unlikely to change the decision, or that the costs of carrying out the evaluation would be prohibitive. It should not be beyond the scope of any agency to write a brief which, without imposing a rigid strait-jacket on the analysis, severely curtails the scope for abuse.

Our second argument is that cost-benefit analysis has to be compared against alternative procedures, including that of doing no analysis and leaving the decision entirely to the judgement of the decision-maker. Any method of decision-making will implicitly require some assessment of benefits against costs. With cost-benefit analysis one attempts to make

all of these assessments explicit so that at least if one rejects the analysis one is required to say precisely at what point one disagrees with it.

It may be argued that this usurps the powers of the decision-maker, who was selected, either by the electorate or the public service, because people were prepared to back his judgement. But this is not so; any cost-benefit analysis will make a number of assumptions it is possible to disagree with, or leave some difficult areas unassessed, so that the ultimate judgement of the decision-maker is required. What it does is to provide him with a lot of information analysed within a consistent framework. Additional information always entails some diminution of the decision-maker's role, partly because it helps to throw light on a situation and hence make decisions easier, and partly because those providing information have some scope to influence decisions by the kind of information presented and the method of presentation. However, as we have already argued, the scope for the latter form of diminution can be substantially curtailed by tight control of the studies. In any case it may be significantly less with cost-benefit analysis, which operates with a well specified methodology and places emphasis on obtaining information from society at large, than with other appraisal methods.

In short, we believe that with proper control by the agency, the scope for bias in cost-benefit analysis can be reduced to acceptable levels; more importantly, it is certainly much less than with alternative methods of evaluation. By presenting detailed information on benefits and costs, it clearly eliminates the need for some but by no means all, of the judgement exercised by the decision-maker, and we believe that the diminution of authority that does take place is consistent with that which is required by the public demand for greater accountability in the spending of public funds.

Thus, while there are a number of objections that have been raised against the methodology of cost-benefit analysis, we believe that they have little substance. The real arguments concern the details of the methodologies applied in particular circumstances and whether they are valid or could be improved upon. As an example, one particular area which it might be worth mentioning is that of equity. It is true that many cost-benefit analyses ignore distribution issues; however, this is not inherent in the methodology and many analysts urge consideration of

such issues, and propose methods for doing so. The real issue is the difficulty of allowing for equity in a convincing way, and this in turn derives from the deep conceptual complexity of the equity problem. This is one area where one would expect cost-benefit analysis to be fairly primitive, but again even a fairly rudimentary approach may be better than that used in alternative methodologies. What emerges then is the need for constructive suggestions for improved methods of analysing equity problems, rather than a need for a completely different methodology to cost-benefit analysis.

2.9 Cost-benefit analysis and multiple uses

In the establishment of a park, the decision is not simply whether to have a reserve or not but which type of reserve (ranging from strict exclusion of man through to areas developed for picnics and so on) to establish. Usually, as we noted previously, a national park will not be a single use area but within the boundaries, various activities will be catered for - habitat preservation by exclusion of human interference, scientific study, dispersed and intensive recreation. The uses within the park should be selected so that the best use is made of the park land. This may mean that areas within the park are designated for a single use (UNESCO 1974), or several uses may be allowed on the one zone.

A decision on the mix of uses will rest on a consideration of the advantages and disadvantages of multiple use management. (Factors to be considered include the compatibility of different uses, fragility of ecosystems and difficulties of managing or policing coincident uses). As with the park establishment decision itself, a comparison of the various uses on different criteria (for example number of recreational visits versus number of rare species) may not lead to an optimal use situation - the uses should be compared using the one criterion and this should form part of the establishment decision. Some uses (e.g., intensive recreation) may be excluded from some areas (e.g., a breeding ground), and, taking these exclusions into account, plans can be constructed for all remaining feasible combinations of uses. The optimal mix of uses in the park (the optimal park management plan) could be determined by analysing the joint productivity of uses (*cf.* Gregory 1955) - this optimal mix will be that which maximises the net benefits

of the use of the land as a national park. Using cost-benefit analysis, this land use plan can then be compared to alternate uses such as agriculture and the best use chosen.

2.10 Summary - the general framework proposed

In this chapter we have proposed the use of cost-benefit analysis as a useful tool for guiding decisions on national parks. It was pointed out that, while the general methodology of cost-benefit analysis is well established, the determination of values for some benefits (particularly those associated with national parks) might be difficult and perhaps costly. The expense arises since the methodology attempts to accurately account for the complex preferences of the individuals in society. Alternative methods, which make no attempt to consult preferences, will obviously be cheaper, but also, we would argue, seriously flawed. However, in many cases it will not always be necessary to conduct a full cost-benefit analysis, since the decision will be fairly obvious - either the development benefits will be non-existent and the preservation benefit large, or vice versa, and no more than an elementary check will be required to reach a decision. It is where the benefits are likely to be large both from development and preservation that a fairly careful evaluation will be required. Even here, one would proceed systematically and thus minimise costs of evaluation. Usually the benefits and costs of development are relatively easily quantified; one would then evaluate the benefits and costs of preservation, starting with those that are most easily quantified. As soon as one has established that the net benefits from a national park exceed those of the next best alternative, one can stop so that in many cases the most difficult benefits may not require evaluation.

This sounds like the charge often levelled against cost-benefit analysis, that it tackles the easy problems and leaves the difficult ones, thus creating a bias in favour of development. But this is not what we have said - we have only argued that difficult benefits should not be evaluated when the decision has already been taken to establish the national park.

Finally, we must emphasise that cost-benefit analysis is not being proposed as a precise tool; the nature of the techniques and the data inputs is such that a considerable degree of uncertainty will

attach to the figures produced. The analyst ought to explore this, to see how sensitive the final decision is to the underlying uncertainty. But even if cost-benefit analysis did no more than establish plausible orders of magnitude for various costs and benefits, this would allow the debate on establishing a national park to be conducted against a more informed background.

CHAPTER 3

ASSESSING BROAD ATTITUDES TO CONSERVATION

We have discussed previously the failure of normal market processes in allocating land for national parks and the inadequacy of alternative criteria for decisions relating to parks. In the absence of well-defined processes for making these decisions, it is very difficult for the community as a whole to express any preferences regarding the appropriate number and location of parks or indeed its attitude towards the provision of resources for more general conservation purposes. An alternative way of establishing community desires needs to be found and in Chapter 2 we pointed out the possibility of using population surveys for doing just that. Clearly, however, to conduct a national survey on each park proposal or conservation decision would be prohibitively expensive. The survey for a particular proposal might instead concentrate on current and potential users (recreationers, researchers and so on) and those likely to be detrimentally affected by the decision. Thus, it would be a smaller scale, less expensive survey than any national one addressing the same issue.

A national survey seems more suited to establishing general attitudes to conservation, such as its priority among different governmental aims and so on. A survey is likely to perform better in this respect than the present voting system, as the latter will only establish a priority ranking (essentially 1,2) on groups of projects, giving no real guide on priorities within these groupings.

Mueller (1963, pp. 211, 212) notes four uses for sample surveys. "(First), one can make valid comparisons between answers to parallel questions relating to different expenditures or taxes. Second, one can compare the answers by different subgroups of the population to the same question. Third, one can make comparisons over time of answers to identifical questions. Fourth, one may measure an attitude by asking not one but a series of questions on the same topic". Reasons for holding the opinions expressed can also be examined to provide an input into policy formulation.

Taking the first of these points, an appropriate survey could attempt to gauge the relative importance of different government programmes

by ranking the various programmes or allocating proportions of government expenditure to the various programmes. Erskine (1972), gives examples of such an approach in an American context. In one case (a 1969 survey), governmental programmes were listed with the percentage of the budget currently allocated to each programme and those interviewed were asked to consider whether that budget proportion should be increased or decreased. Among the programmes listed (e.g. education, housing, health and so on), increased commitments to expenditure on natural resources were approved by 68% of respondents and only increased commitments to education ranked more highly; by contrast, increases for defence and the space programme were approved by well under 20% of respondents. Similarly, Erskine reports another U.S. survey (in 1970) in which pollution control was again accorded second priority behind education in terms of programme importance in times of spending cuts. More than half the respondents considered pollution control should be one of the last programmes cut if a decrease in government spending was necessary.

By suitable analysis, the responses from different population subgroups can also be assessed. For example, Erskine reports results subdivided by community size, geographic location, city, suburb, town and rural location. Equally, the results could be subdivided according to any other desired criteria such as income levels, membership of various groups and so on. An examination of time trends towards governmental programmes is also reported by Erskine. For example, (again considering pollution control), 38% of respondents to a survey in 1969 placed it among the four top-priority programmes, while 55% of respondents to the same question in 1970 accorded it that priority. Although these results are suggestive of a trend towards placing increased value on environmental issues, they should be interpreted with care. The higher result in 1970 could have arisen from the great emphasis on environmental issues at that time and, conceivably, a similar survey conducted now (when issues such as unemployment and inflation are more prominent) could reverse the result. The point is that to really establish a useful time trend, surveys need to be conducted over much longer time periods to avoid basing decisions on what may only be random shocks to the system.

As far as measuring attitudes is concerned, Erksine reports questions which were framed in terms of extra personal taxes and charges respondents would pay to cover increases in expenditure on various

environmental programmes and she presents evidence to suggest that the willingness to pay these costs has increased with time. The difficulty here is that there is no way of knowing whether the respondents were free-riding (overstating their willingness to pay the charges since they might consider that they would not have to pay anyway). The elimination of this tendency can require complex questioning techniques (e.g. Clarke, 1971) which probably would not be possible in the context of a general population survey. Thus, the results of a simple questioning process may not indicate real opinions on environmental matters. On the other hand, there is some evidence (Bohm 1972) to suggest that free-riding may not be a practical problem in which case simple surveying may be sufficient to indicate real preferences for environmental issues.

Erskine's paper, reporting the results of six groups of American polls treating environmental issues, thus demonstrates that a population survey may be a feasible means of determining, at least approximately, community priorities among governmental programmes. As such, the technique might be useful in the Australian context to assess attitudes towards Governmental spending on environmental programmes *viz a viz* its other commitments. To date no such survey has been conducted to our knowledge. There are, however, some localised examples of the use of survey techniques to establish opinions on certain specific environmental issues. One such example is a survey of public attitudes to various uses of Victoria's alpine region conducted by the Victorian National Parks Association (Jenkin (1976)). A combination of mail and personal interviewing was used, the mail survey being carried out for specific user groups such as skiers, conservation and bushwalking groups. A personal interview technique was used for other visitors to a recreation site in the region and for a sample of the general public of Melbourne. Considering the general public sample, most of the questions strictly concerned the Victorian alpine area and its potential uses. One question, however, approached the issue at hand here - were there enough National Parks in Victoria. The response indicated that 2/3rds of the sample of 250 considered there were not enough, while only 1/5th considered there were. While caution should be exercised in interpreting such a result (since for example the responses may have been biassed by the interviewing procedure and manner in which questions were asked),

the result again demonstrates that opinions could be assessed by means of such surveys. It is then another step to determine the strength of this opinion - what priority more national parks hold in opinions on various governmental programmes and how much the respondents would be willing to pay in some form to obtain more national parks.

Another local-scale survey in Australia is that reported by Promkutkeo *et al.* (1977) in Armidale N.S.W. Subgroups of the population were surveyed regarding attitudes to the dedication of a nearby area as a national park. The area was then being used for mining and grazing purposes. A survey of the general population of the town revealed that they considered increased scenic quality by a return to more natural vegetation was more than 1½ times as important as lost employment to the mining industry and more than twice as important as lost cattle production from the area, since both uses would cease if a park was established in the area. In contrast, a survey of civic leaders (businessmen and city council members) conducted at the same time showed that this second subgroup reversed these importance levels. In noting this subgroup difference, the survey highlighted a very important issue in formulating policies of any sort (and, perhaps, especially environmental policies) on behalf of the public. The opinions of society's leaders may be completely at odds with those of the community. If this is so, the role of population surveys becomes more important in indicating the needs and desires of the community to policy-makers.

Finally, a decision must be made on the operational significance of these population surveys. The influence the opinions expressed exert on decision-makers must be carefully assessed. For example, what should the decision-makers do if the survey reveals that the general public places no value at all on environmental issues? Does this mean that these issues should be disregarded when formulating policies? The answer to this is probably no. Rather, the context of the survey should be examined, in particular to asses whether the respondents had enough information about the issue to express a meaningful opinion. The same comment applies to the opposite result where all other issues are disregarded and environmental issues are accorded an extremely high importance. Resurveying the population may be useful as, with a random sample, both of these outcomes could arise (with very small probabilities)

from the same population - one in which some members accord a high priority to the environment, some low, but most a middle-order priority.

In this brief chapter, we have outlined the use of population surveys as means of establishing community preferences regarding various environmental issues. While several problems are associated with their use, they could provide useful information on broad issues to decision-makers. Owing to insufficient funds, such a survey was not carried out as part of this project, but it clearly could be a useful tool in the decision-making process surrounding national parks, especially if conducted over time in which case any trends in community opinion on parks could be assessed at a moderate cost.

CHAPTER 4

RECREATION IN WARRUMBUNGLE NATIONAL PARK - A GENERAL DESCRIPTION

Before proceeding to evaluate Warrumbungle National Park it will be useful to briefly review the user and recreation types evident in the park to place the subsequent analysis in context.

4.1 Total visitation

The total amount of recreation (measured in visitor-days) undertaken in the Warrumbungle National Park has increased substantially over the period for which records are available. This is demonstrated in Table 4.1 and Figure 4.1, which are based on the visitation records[1] kept by Ranger R. Duggan and the staff of Warrumbungle National Park. Clearly the continuation of such a trend could pose severe difficulties both for the park managers in policing the visitor areas and for the park itself in terms of its visitor carrying capacity (the extent to which the natural environment can continue to support such numbers without a decline in its quality).

A more detailed analysis of the figures indicates that the problems presented by visitor numbers may be more serious than is obvious at first sight. The final year's visitation of 85,686 visitor-days represents an average of approximately 235 visitors each day of the year and this is not a large number considering the trail and facility areas available. However, the distribution of visitation over the year is not smooth as reference to Table 4.2 and Figure 4.2 will show.

There are clear peaks in visitation in the April-May period and in the August-October period. These peaks are obviously a result of

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1 The records are derived from ticket sales at the Information Office within the park. Hence the records contain only "legal visitors". The policing conducted by the park staff ensures that the number of "illegal visitors" is small relative to overall visitation.

Table 4.1

Total Visitation, Warrumbungle National Park,

July 1969 to June 1978

Year	Visitation (Visitor Days)	Annual Change (Visitor Days)	Annual Percentage Change
1969-70	34,048		
		+ 5576	+ 16.38 %
1970-71	39,624		
		+ 8862	+ 22.37 %
1971-72	48,486		
		+ 8152	+ 16.81 %
1972-73	56,638		
		+ 1393	+ 2.46 %
1973-74	58,031		
		+ 8041	+ 13.86 %
1974-75	66,072		
		+ 11784	+ 17.84 %
1975-76	77,856		
		+ 3176	+ 4.08 %
1976-77	81,032		
		+ 4654	+ 5.74 %
1977-78	85,686		

Total Increase = 51,638 visitor days
= 151.66 %

Source: Park Visitation Figures 1969-1970 to 1977-1978.

Figure 4.1

Total Visitation, Warrumbungle National Park, July 1969 to June 1978.

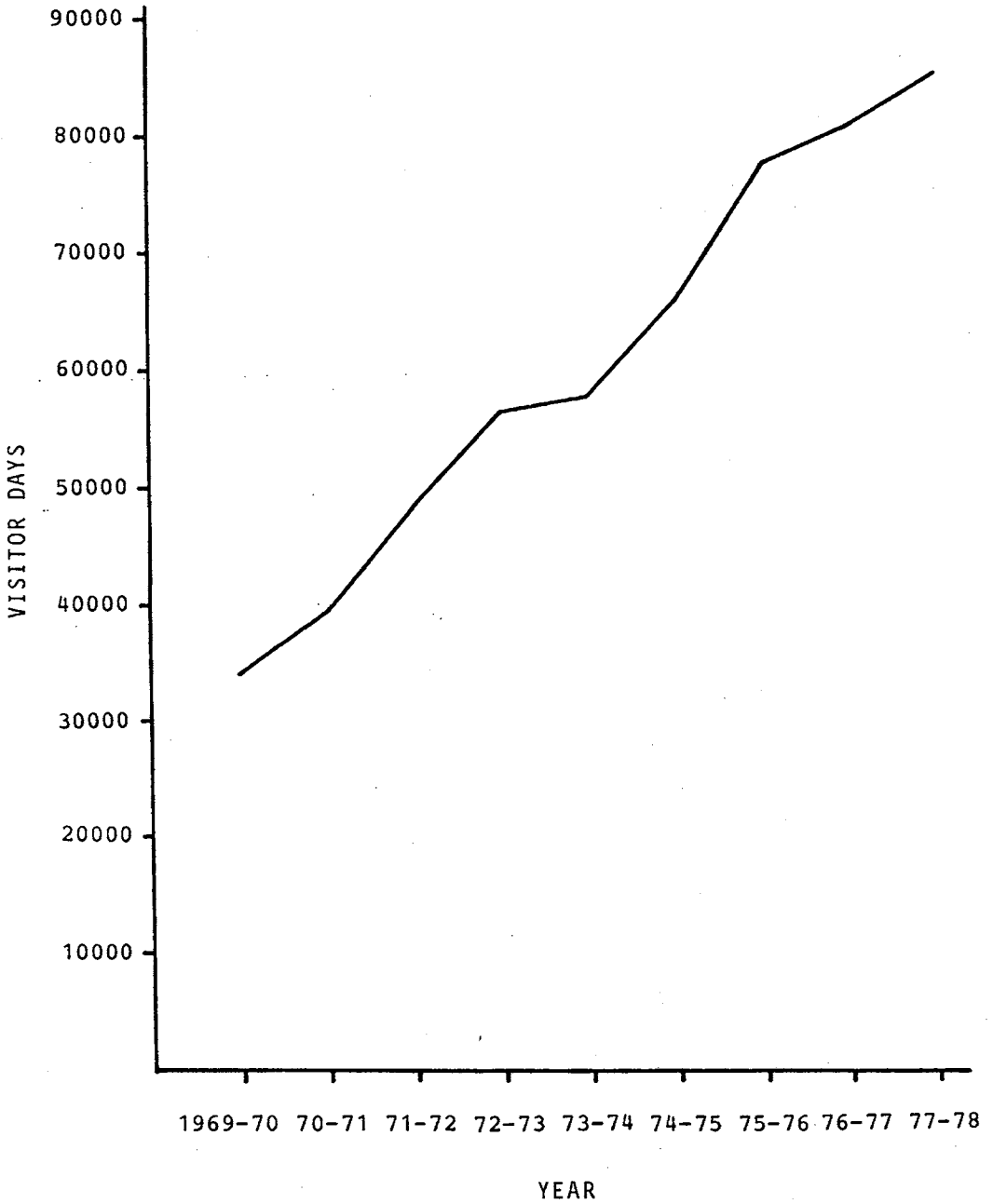


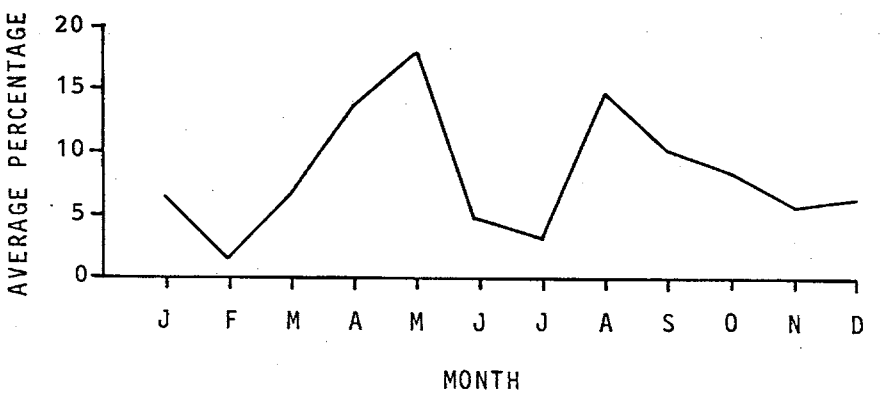
Table 4.2

Average Percentage of Yearly Visitation Per Month, Warrumbungle National Park, July 1969 to June 1978

Month	Average Percentage
January	6.52
February	1.57
March	6.65
April	13.72
May	17.86
June	4.80
July	3.08
August	14.65
September	10.99
October	8.30
November	5.60
December	6.27

Figure 4.2

Average Percentage of Yearly Visitation Per Month Warrumbungle National Park, July 1969 to June 1978



the school-holiday timing along with the Easter[1] and October long weekend holidays. The low proportion of visitation in the December-January holiday period may be explained by the weather and consequent attractions to coastal recreation areas rather than inland ones such as the Warrumbungles. With a yearly visitation of 85,000 days, the May average of 17.86% represents about 489 visitors per day; the corresponding figure for August is 401, that for February is about 48 and for July about 84. The facilities (e.g. water supply, picnic facilities, trails) required to cater for 400-500 visitors per day may be quite different from those required to cater for 50-100 per day. An investment to meet the highest level of usage will, other things being equal, lead to much excess capacity for most of the year while only planning to cater for the average level would clearly be inadequate. If, as seems likely from Table 4.1 and Figure 4.1, the total visitation continues to increase markedly then sheer numbers will place pressures on the facilities at certain times of the year.

While it is outside the scope of this report, some consideration of policies to smooth the visitation over the year could be useful such as differential pricing (with higher prices at peak times) limited advanced bookings and so on. A detailed investigation of all costs and benefits of visitor use would be helpful to determine the appropriate policy or policies to be adopted to achieve this aim.

However, visitor numbers by themselves are an inadequate guide to the likely pressures on park facilities, for one needs to distinguish the facility needs of different visitor types. An important distinction in this respect is between day visitors and camping visitors. Table 4.3 and Figure 4.3 show visitation divided into these two categories. The day visitor category has been derived by summing the numbers of day visitors and the number of bus visitors to the park; the number of camping visitors is made up of those who stayed in tram-cabins and caravans and the Boy Scout, camper and bushwalker classes of visitor.

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1 At times, April visitation is quite low. These years correspond to the early occurrence of Easter in March. In general low March figures are accompanied by high April figures and vice versa. The correlation coefficient between March and April visitation figures is -0.83.

Insofar as all the bus visitors are not day visitors, the day visit figures are overstated but, as the percentage of visitation by bus is small (around 2-3% of yearly visitation) any bias is likely to be small.

As can be seen from Figure 4.3, the proportion of visitation from camping visitors has risen over time. Clearly, day visitors place less pressure on facilities than camping ones as the former would usually require only picnic and toilet facilities while the latter might require washing facilities and accommodation space as well. Thus, pressure on park facilities has increased due both to the increase in the total amount of visitation and the rising proportion of camping visitation. However, the pressure resulting from this latter factor shows some sign of levelling off.

To obtain a more detailed analysis of the type of visitation to Warrumbungle National Park we turn now to the results of the visitor survey conducted in the park as part of this study. Details of the sampling procedure and questionnaire are given in Appendix 1 of this report.

4.2 The visitor sample

Usable replies were received from 538 groups in the park in the May and August-September school holidays. The groups totalled 2098 people representing about 8% of the total yearly visitation (using the mean length of stay and group size).

We begin by analysing the length of stay in the park. The average length of stay per group was 3.429 days. The distribution of lengths of stay is shown in Table 4.4 and Figure 4.4. More than half the groups stayed for 4 days or less; very few groups extended their visit beyond one week. Thus a fairly rapid turnaround of visitors is indicated with most groups completing desired activities in a short time. No survey of the actual walks undertaken by the visitors was made but from the length of stay data it seems possible that the longer walks (e.g. Grand High Tops) would be less patronised than the shorter ones (e.g. Split Rock Circuit).

We now examine the distribution of group sizes among the sample respondents, and results on this are presented in Table 4.5 and Figure 4.5. Large groups are very rare. Couples and small family groups camping in the park dominate the sample with the average group size being

Table 4.3

Percentage of Camping and Day-Visitors, Warrumbungle National Park, July 1969 to June 1978

Year	% Long Stay	% Day Visitor	Total
1969-70	55.71	44.29	100.00
1970-71	57.97	42.03	100.00
1971-72	60.12	39.88	100.00
1972-73	62.04	37.96	100.00
1973-74	64.69	35.31	100.00
1974-75	64.76	35.24	100.00
1975-76	71.46	28.54	100.00
1976-77	78.01	21.99	100.00
1977-78	78.72	21.29	100.01*

* Discrepancy due to rounding error

Figure 4.3

Percentage of Camping and Day-Visitors
Warrumbungle National Park, July 1969 to June 1978

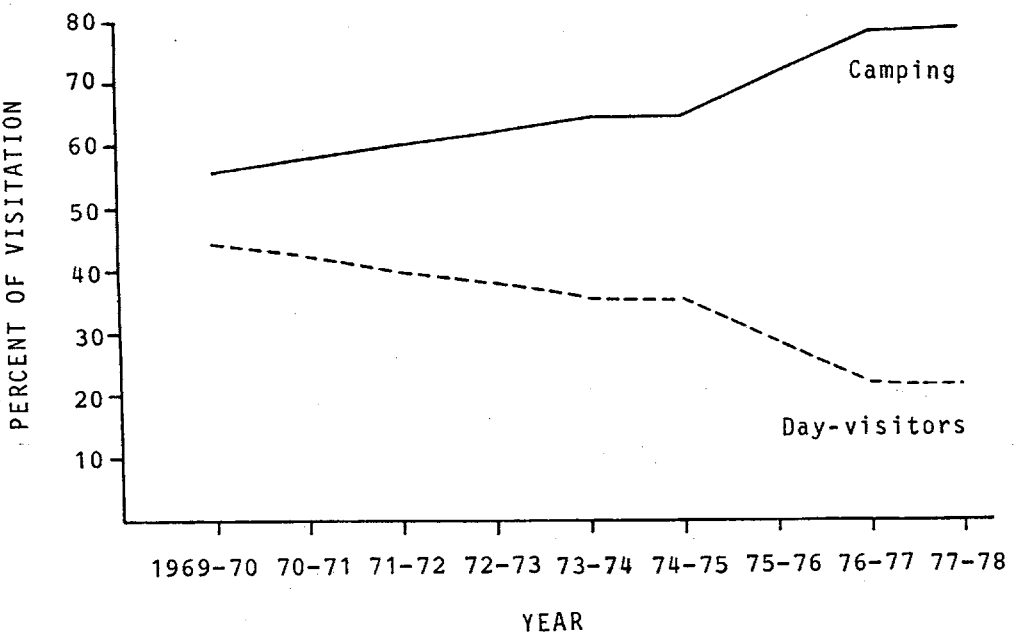

Table 4.4

Total Time Spent in Warrumbungle National Park by Groups in Sample

Time (Days)	No of Groups	% of Total
< 1	52	9.67
1- 2	77	14.31
2- 3	74	13.75
3- 4	113	21.00
4- 5	88	16.36
5- 6	49	9.11
6- 7	22	4.09
7- 8	31	5.76
8- 9	14	2.60
9-10	1	0.19
10-11	7	1.30
11-12	2	0.37
12-13	3	0.56
13-14	2	0.37
14-15	2	0.37
15-16	0	0
16-17	1	0.19
	538	100.00

Figure 4.4

Total Time Spent in Warrumbungle National Park By Groups in Sample

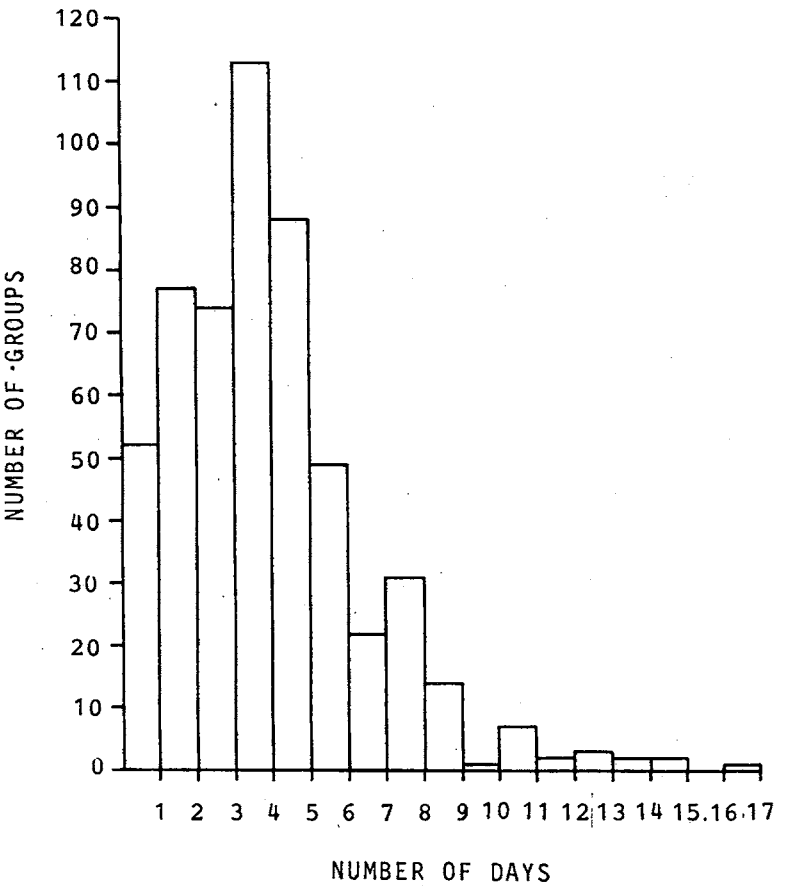

Table 4.5

Sizes of Respondent Groups in Sample

Size of Group	No. of Groups	% of Groups
1	10	1.86
2	127	23.61
3	64	11.90
4	168	31.23
5	104	19.33
6	40	7.43
7	13	2.42
8	4	0.74
9	2	0.37
10	3	0.56
12	2	0.37
15	1	0.19
	538	100.01*

* Discrepancy due to rounding error

Figure 4.5: Sizes of Respondent Groups in Sample

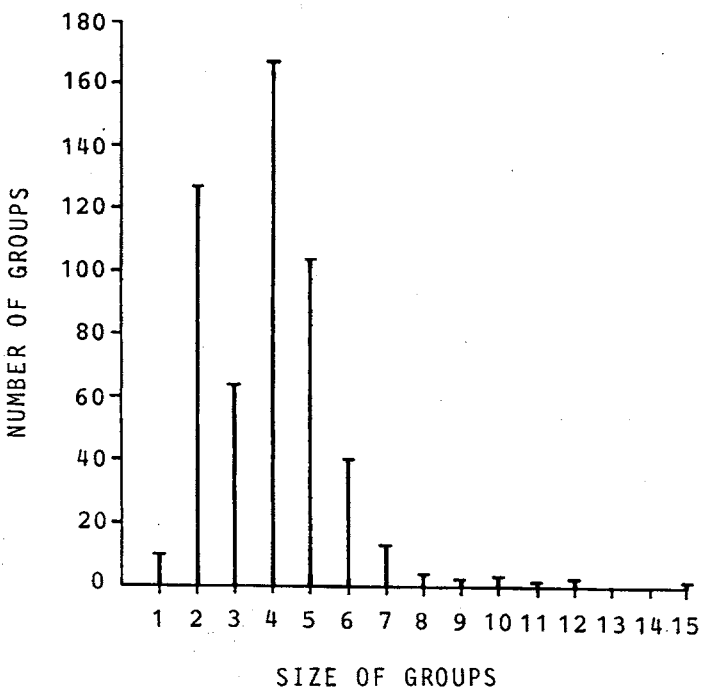

Table 4.6

Activities Undertaken in Warrumbungle National Park by Respondent Groups

Activity	No of Groups	% of Groups
Bushwalking	77	14.31
Picnicking	9	1.67
Driving through	27	5.02
Rockclimbing, abseiling	3	0.56
Camping only	52	9.67
Camping and bushwalking	355	65.99
Camping and Picnicking	1	0.19
Camping with drive through	2	0.37
Camping with rockclimbing and abseiling	12	2.23
	538	100.00

3.9 people.

Next we examine activities undertaken in the Park, and a detailed breakdown for the respondent groups is given in Table 4.6.

Clearly, utilisation of the trail network provided in the park is high with over 80% of groups listing bushwalking as an activity undertaken in the park. Just under 3% of the respondent groups took advantage of the geological formations in the park for rockclimbing and abseiling - this would also involve the use of the walking trail network.

The split between camping and day visiting groups in the sample (as revealed by Table 4.6) is almost identical with that indicated by the visitation records (Table 4.3) with 21.56% of the groups being day visitors and 78.45% being camping visitors. (These percentages do not appear to accord with those in Table 4.4 listing total time spent in the park. The reason for this is that some groups made several

day trips into the park while staying in Coonabarabran. Thus they are recorded as day visitors but their total length of stay in the park exceeded one day.)

The various activities tend to be undertaken by groups of differing sizes and the proportions of day and camping groups also varies with activity. These results are illustrated in Table 4.7. Day visiting groups tended to be larger than camping groups; the largest average group size was for rockclimbing while the smallest was for those just driving through the park. Most bushwalking groups camped in the park as did rockclimbers. On the other hand, picnickers and those driving through the park made little use of the camping facilities available.

Table 4.7

Average Size of Groups Undertaking Different Activities in Warrumbungle National Park

Activity	No.of Groups Undertaking	Average size of Group	No.of Day Visiting Groups	No. of Camping Groups
Bushwalking	432	3.87	77	355
Picknicking	29	4.17	27	2
Driving through	10	2.90	9	1
Rockclimbing	15	4.47	3	12
Camping	422	3.87	-	422
Day Visit		3.99	116	-
All	538	3.90	116	422

In view of the high visitation numbers at the times of survey, the respondents were asked to specify the effect on their visit to the park of the numbers of people they encountered in the park. The results are shown in Table 4.8. Eleven groups failed to respond to this question leaving a total of 527 groups. Approximately half the respondent groups considered that their visit was unaffected by the level of crowding evident at the time of their stay; roughly one quarter had the enjoyment of their experience impaired while slightly more groups found their enjoyment increased by the other people encountered. On the surface, then, it appears as though the level of visitation in the survey periods does not constitute a "crowding problem" where the experience of all or most visitors is detracted from. In other words, the costs imposed by the extra visitors in terms of decreasing the enjoyment of all visitors as yet do not seem to outweigh the benefits gained by the extra visitors. Once again however, a more detailed analysis of the figures reveals that the situation is more complicated than this (see Table 4.9).

Table 4.8

Effect on Visit by Number of People Encountered in Park

Effect	No. of Groups	% of Groups
Made it much more enjoyable	28	5.31
Made it more enjoyable	127	24.10
No effect	235	44.59
Made it less enjoyable	122	23.15
Made it much less enjoyable	15	2.85
	527	100.00

Day visiting bushwalkers and through travellers essentially had their experience enhanced by the number of people encountered as did "camping only" visitors indicating that, by and large, these are gregarious activities. The "camping and bushwalking" group is more evenly divided. Roughly 40% considered their experience was unaffected by numbers encountered, one third had their experience detrimentally affected

Table 4.9

A Crosstabulation of the Effect of Visitation Numbers on Experience Gained by Activity Undertaken in the Park

(No. of Groups)

	Effect of Numbers on Visit (Number of Groups)				
Activity	Much more enjoyable	More enjoyable	No effect	Less enjoyable	Much Less enjoyable
Bushwalking	3	22	44	5	0
Picnicking	0	1	7	1	0
Driving through	3	6	18	0	0
Rockclimbing & Abseiling	0	0	1	1	1
Camping	4	15	21	10	1
Camping and Bushwalking	18	80	138	102	11
Camping and Picnicking	0	1	0	0	0
Camping with drive through	0	0	2	0	0
Camping with Rockclimbing & Abseiling	0	2	4	3	2

by others while slightly less than this had an improved experience as a result of the presence of other visitors. On the whole, picnickers and campers who picnicked or just drove through appear unaffected by crowding levels in the park. A different picture emerges for the "rockclimbing visitors" who might be expected to be least gregarious or most self reliant of all the visitor groups in the park. Only 14 of these groups recorded a response to this question and 11 of these camped in the

park. One half of these groups had their visit to the park adversely affected by the numbers of visitors, one fifth to a high degree. Only two groups considered that their visit had been made more enjoyable by the presence of the other visitors in the park. So it appears that at least for one section of park users, crowding is an important factor in influencing the enjoyment of a visit - to a lesser extent this is true of the "camping and bushwalking" sector of visitors. This may have important management implications regarding the construction and maintenance of facilities depending upon the users the park is intended to accommodate.

A related consideration is the attitude of visitors to the park facilities themselves (such as roads, trails and showers). One hundred and eleven groups offered unsolicited comments on these factors. The state of the roads to and within the park was the subject of much comment. Two groups considered the road to be suitable for the park. The poor condition was seen to be, at least partially, an effective management tool to deter many visitors of a type detrimental to the conservation and recreation values of the park. However, 63 groups considered the road was substandard to dangerous. Comments centred on the roughness of the road, its narrowness in places and the poor standard of river crossings between Coonabarabran and the park which caused substantial additions in distance travelled leaving the park for some groups after rain in the area. From the comments made, it appears likely that Coonabarabran loses substantial visitor trade through the closing of the park-to-town route during and after rain. Forty six of the 111 groups made no comment on the roads.

Regarding the facilities within the park, 13 groups commented favourably while 58 groups commented adversely and 40 made no comment. The favourable comments centred on the trail system within the park and the relationship between park staff and visitors. Almost all the unfavourable comments surrounded the crowded nature of the washing facilities at Camp Blackman - a function of the visitor-peaking noted previously. A few comments were made on the need for more *in situ* interpretive aids for walkers and for more comprehensive maps covering the whole park area, not just the area immediately surrounding the walking trails. On the whole, however, it appears that based on all 538 sample respondents, the visitors to the park gain an experience which is

not marred by crowding and by and large the park facilities are found to be adequate although at peak times some groups desire more extensive ablution blocks. As mentioned previously decisions on the building of more extensive facilities might be examined alongside considerations of the use of different park fee structures, or advance booking systems to smooth visitation over the year, thus relieving pressure on facilities and alleviating any affects of crowding on the enjoyment of park visits.

We now turn to a brief categorisation of the visitors in order to try to establish what sort of people visit Warrumbungle National Park. It has already been seen (Table 4.5 and Figure 4.5) that group size is generally small with couples and small family groups predominating. The composition of the groups is shown in Table 4.10. Groups with two adults comprise 80% of the respondents while approximately one quarter of the groups contained no children. 70% of the groups contained one to four children indicating the importance of family groupings in visitation to the park. The average age of the group-heads was 40.5 while the average age of all adults was about 38. The average age of the children in the respondent groups was 10.67 years.

Further data were gathered on the income and education levels of the adults in the groups. Tables 4.11 and 4.12 and Figures 4.6 and 4.7 present the distribution of incomes for the respondent groups. The annual incomes of the group heads shows a considerable spread over the range. If we allocate an income at the midpoint of each section of the range (and selecting an income of $50,000 for the highest section) the average income of group heads is, to the nearest $1,000, $16,000 (about $310 per week). This can be compared to the Australian average of around $210 per week.[1] Clearly the group heads constitute an above-average-income sample. The average income per adult among the respondents is about $10,800 per year or $208 per week. While this is close to the Australian average given above, it must be remembered that this includes a large proportion of non-working women. Per working adult the average is thus likely to be higher than the national average income. Hence it appears that the

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1 Australian Bureau of Statistics Monthly Review of Business Statistics, October 1978. Average weekly earnings Oct. 1977 to Sept. 1978 per employed male Unit (wages and salaries).

Table 4.10

Composition of Respondent Groups

No. Adults*	No. of Groups	No. Children*	No. of Groups
0	2	0	148
1	51	1	70
2	432	2	156
3	29	3	106
4	19	4	44
5	2	5	8
6	2	6	3
		10	2
	537**		537**

* Adult defined as 18 years of age or over, Child as under 18.

** One group failed to specify composition.

Table 4.11

Annual Income Level* of Heads of Respondent Groups

Income Level	No.of Heads of Groups	% of Heads
$ 0- 3000	23	4.47
3001- 6000	9	1.75
6001- 8000	10	1.94
8001- 9000	15	2.91
9001-10000	17	3.30
10001-11000	46	8.93
11001-12000	45	8.74
12001-13000	34	6.60
13001-14000	37	7.18
14001-15000	39	7.57
15001-18000	102	19.81
18001-20000	49	9.51
20001-30000	67	13.01
over 30000	22	4.27
	515 **	100.00

* Before tax

** 23 heads failed to specify income level

respondent groups are not a representative sample of Australians.

A similar situation is evident with the education levels of respondents. 528 groups specified educational levels and the results are shown in Tables 4.13 and 4.14.

Of the heads of groups, 322 (60.98%) had at least some tertiary education; of all adults excluding group heads, 237 (43.89%) had some tertiary education. (The lower proportion for all other adults probably reflects the influence of the higher number of women in this category as opposed to the group-head category. The higher proportion of all other adults who only achieved high school standard education and none beyond this, tends to bear this out). Clearly, such a proportion of tertiary education would not be typical of the Australian population as a whole so, if the respondents are a random sample of park visitors, it seems that, for the Warrumbungle National Park at least, persons of higher educational levels are more likely to visit than those with lower levels.

Table 4.12

Annual Income Level* of Adults in Respondent Groups

Income Level	No.of Adults	% of Adults
$ 0- 3000	292	28.54
3001- 6000	61	5.96
6001- 8000	38	3.71
8001- 9000	32	3.13
9001-10000	34	3.32
10001-11000	83	8.11
11001-12000	71	6.94
12001-13000	55	5.38
13001-14000	45	4.40
14001-15000	51	4.99
15001-18000	120	11.73
18001-20000	50	4.89
20001-30000	69	6.74
over 30000	22	2.15
	1023 **	100.00

* Before tax

** Not all adults specified their income level

Figure 4.6

Annual Income Level of Heads of Respondent Groups

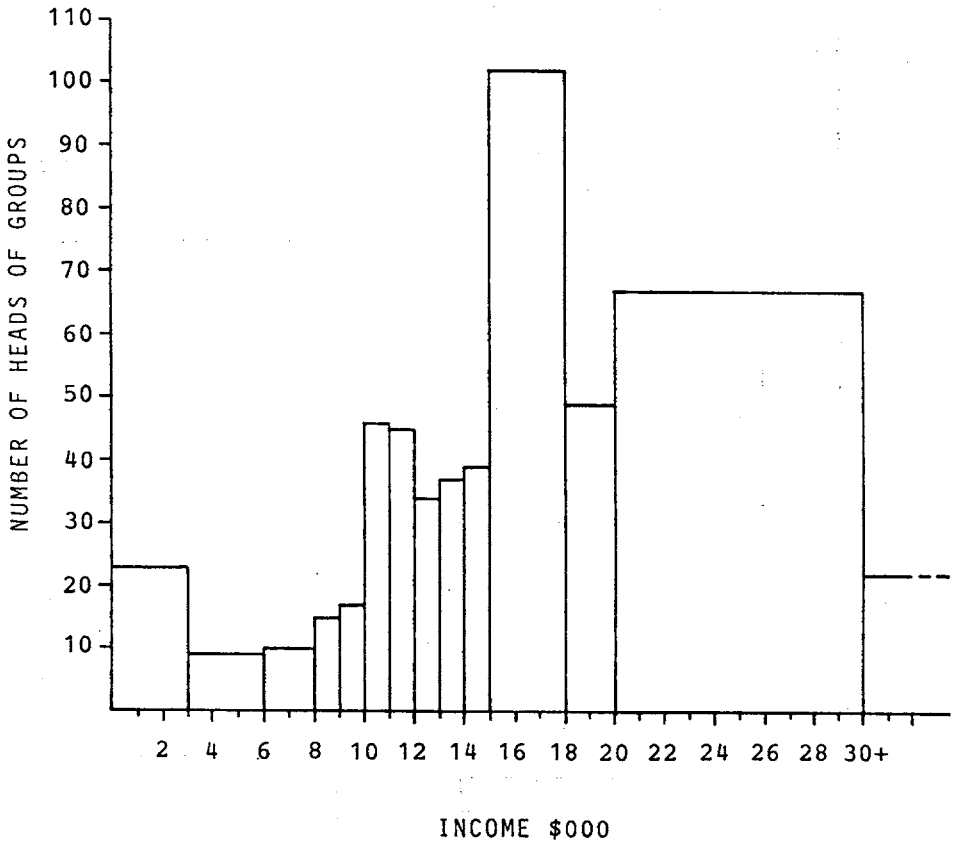

Figure 4.7

Annual Income Level of Adults in Respondent Groups

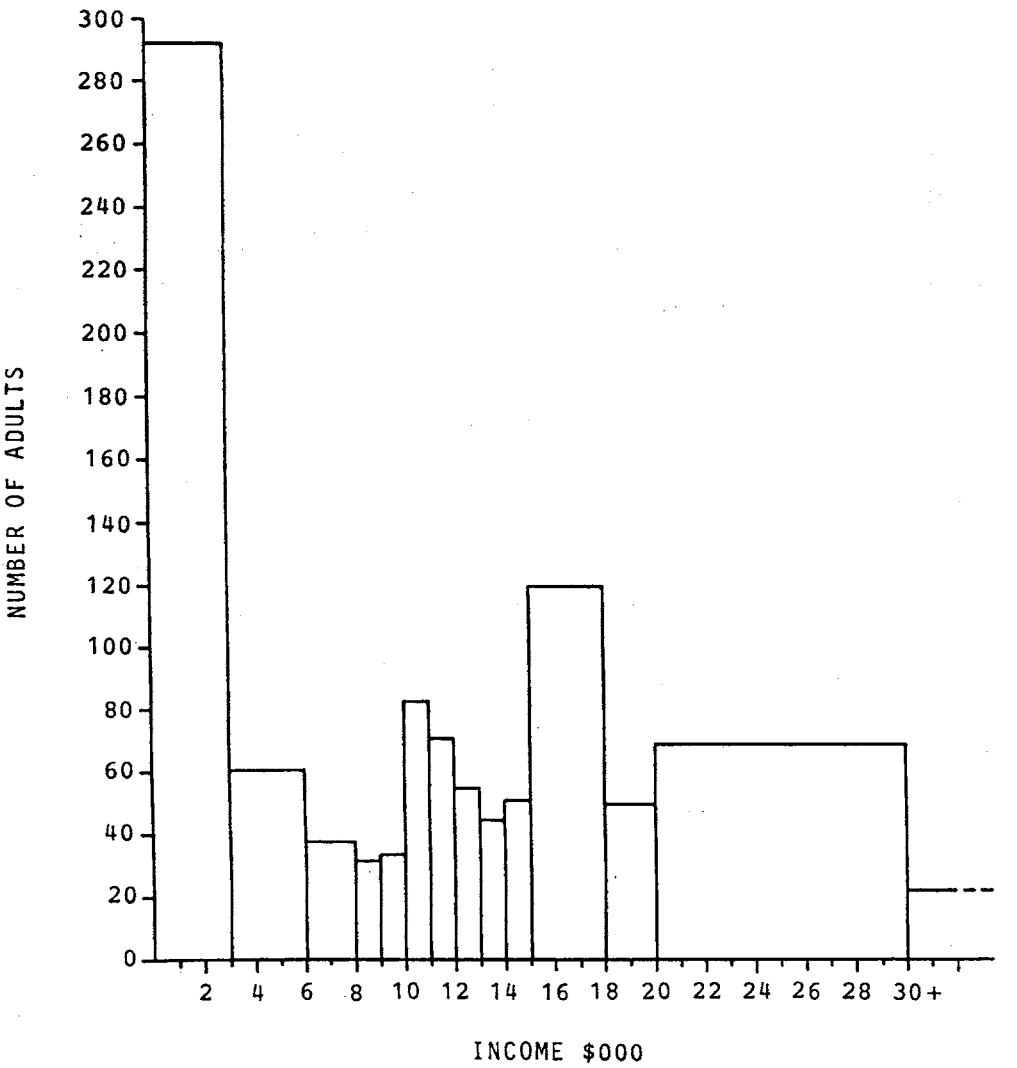

Table 4.13

Educational Attainment of Heads of Respondent Groups

Highest Level Achieved	No. of Heads of Groups	% of Heads
Finished Primary	20	3.79
Completed Intermediate or School Certificate	116	21.97
Finished High School	70	13.26
Tertiary Undergraduate	50	9.47
Tertiary Graduate	175	33.14
Tertiary Postgraduate	97	18.37
	528	100.00

Table 4.14

Educational Attainment of Adults Excluding Group Heads in Respondent Groups

Highest Level Achieved	No. of Adults excluding Group Heads	% of Adults excluding Group Heads
Finished Primary	20	3.70
Completed Intermediate of School Certificate	159	29.44
Finished High School	124	22.96
Tertiary Undergraduate	61	11.30
Tertiary Graduate	138	25.56
Tertiary Postgraduate	38	7.04
	540 *	100.00

* Not all adults responded.

4.3 Summary

This chapter has described the patterns of visitation in, and the types of users of, Warrumbungle National Park, to set the subsequent analysis in context. The amount of visitation was shown to have risen rapidly over the last decade and is very peaked during the school holiday periods of the year. The proportion of camping visitation had increased at the expense of day visitation. All these factors contribute to increased pressure on facilities at varying times of the year. However, at present, the crowding does not appear to be detrimentally affecting the experience of most users. A large majority of visiting groups used the extensive walking trail system while a small number engaged in rockclimbing and related activities. Comments regarding the roads in and to the park were largely unfavourable as were comments on the adequacy of washing facilities at Camp Blackman. Favourable reactions to the park staff and trail system were noted.

On average, a typical visitor group, as indicated by the sample respondents, would be a young family with two or three children. The income of the group-head would be well above the Australian average as would the income of all working adults in the party. The heads are also most likely to have undertaken some tertiary education and it is quite likely that the other adults in the party will also have done so. In these latter two respects the survey respondents were not typical of the general Australian population.

Several conclusions for park management may be drawn from these results, depending upon the types of visitor desired in the park. In many respects, the plan of management for the park[1] anticipates the results in specifying the need for interpretive aids spread throughout the park and the need for development of the road and camping facilities in the park. The results suggest that, in terms of visitor management, campers should be given a higher priority than day users as the proportion of the former is increasing while the latter is falling.

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1 N.S.W. N.P.W.S. Warrumbungle National Park - Draft Plan of Management, no date.

In particular, the provision of different standards of camping areas for different user types should improve the experience of all park users by reducing the impact on a given visitor category of other visitor groups who are seeking different types of enjoyment from their stay in the park. The bad effects of crowding noted for some groups can then be expected to diminish. In developing the camp sites, the usually small size and short length of stay per group shown by this sample should be recognised as this might mean that space requirements are not extensive and some existing space might be used for screening vegetation.

The upgrading of the road within the park is given a high priority in the management plan and this is likewise seen as an urgent need by many park visitors. However, the implications of such an upgrading for park management should not be overlooked as it may lead to a further increase in visitation placing more pressure on already over-crowded facilities. The management of potential visitors before they enter the park may assist in this direction. The use of higher fees at peak times than at other periods of the year or advanced booking for all users are schemes which might be considered along with the upgrading of internal facilities as means of visitor management.

In view of the high educational levels of the visitors within the sample, it seems probable that interpretation aids within the park will need to be of a high standard, providing detailed information about (rather than just descriptions of) features although the latter would still be necessary to cater for children and visitors who were of lower education levels.

Set against this background of park usage, we now turn to an economic evaluation of Warrumbungle National Park.

CHAPTER 5

A SURVEY OF METHODS THAT HAVE BEEN USED IN EVALUATING ENVIRONMENTAL BENEFITS AND COSTS

In this chapter we examine various methods which have been used in the past to value environmental benefits and costs, in particular those of national parks. Emphasis will be placed on any shortcomings of the various methods. This chapter will form an introduction to the subsequent chapters which consider in detail the evaluation of the benefits and costs of Warrumbungle National Park. We begin by considering measurement of costs.

5.1 Cost measures

The cost of a park would include costs of acquiring land, costs of staff and materials for running the park and external costs. The last category would include the effects on neighbouring land of plant and animal pests or fire moving from the park and causing damage outside the park. These various categories of costs are considered in detail in the next chapter when the costs of Warrumbungle National Park are discussed. In this section we concentrate on measurement methods only.

The appropriate measure of cost in cost-benefit analysis is opportunity cost. The opportunity cost of an input to a project (such as land for a national park) is the income foregone by not using that input in an alternative use. In competitive markets, the opportunity cost of an input is measured by its price, but imperfections in the market may cause these two values to diverge. However, in many cases, the difference may be small enough to be ignored and the market price can thus be used as the opportunity cost. This will be the case especially for the maintenance costs of a park. These are essentially costs of labour and materials (including costs of interpretation and resource evaluation) which have readily determined prices.

The situation is less clear for acquisition and external costs. Often the land acquired for a national park was previously leased and as such may command no price on the land market. In this case, one approach that can be taken to determining opportunity cost is to place the land on a hypothetical market and assess what its price would be there.

This is essentially the process used by the Valuer General's office in New South Wales where a given piece of land is compared to other land which has been sold on the market and a value is inferred from this for the piece of land in question. A further cost of acquisition that is mentioned here is that of compensation for landholders who may be totally displaced by park establishment, thus suffering a change in way of life. It is often argued that the landholder should be paid an amount over and above the price for his land to compensate him for this effect. However, this should only be so if it is believed that the land market is uncompetitive and that the price paid does not account for this effect. If this is so, it is a matter for individual negotiation as to the amount paid in compensation as this would vary in different cases.

The external costs of parks (or any other project for that matter) have rarely been included as costs of the project. However, a correct treatment of costs must include consideration of them. One could measure the external costs by assessing the replacement costs of damaged materials (e.g. fencing) or the control costs incurred in eradicating pests. With these methods, it would be important to establish the optimal level of control and damage replacement. Another method of assessment would be to examine changes in the value of land surrounding the park to attempt to gauge any negative external effects of the park. Of course, land values round the park may rise as people seek to purchase land which will never be "built out", in which case this external effect of the park would be a benefit, not a cost.

5.2 Benefit measures

Measuring methods for valuing environmental benefits have been much more varied than those used for costs. Each method that has been advocated or used will be treated separately below, together with comments on its validity. By and large, the measures have only been applied to recreation benefits.

5.2.1 Opportunity cost

In the absence of any measure of benefits, it has been argued that they should be set equal to their cost of provision, or some multiple of that cost. This is clearly a useless procedure as it has the effect of justifying any project at all, as the benefits would always be at least

equal to the costs. If this is so, cost-benefit analysis (or any other sort of analysis) is irrelevant and the real issue of benefit evaluation has been avoided. The only use an opportunity cost measure has with respect to benefit evaluation is as a threshold value - the value the benefit should at least equal if society is to gain by its provision.

5.2.2 Expenditure by producers

Closely allied to the opportunity cost approach is this method which values the benefits at the actual expenditures required to produce the benefits. This is even more meaningless than the former measure, as the producer's expenditure may not be the opportunity cost of benefit production at all (if the market is imperfect) and so we would not even know what the level of benefits should be if they are to be efficiently provided for society.

5.2.3 Expenditure by consumers

This method assumes that the benefit gained by recreationers is equal to the actual expenditure made by them in partaking of the recreation experience, for example the cost of camping equipment, food and so on. This method has severe limitations as clearly many of these expenditures would be made for purposes other than the recreation trip. Moreover, it takes no account of important factors such as time costs. All this method indicates is the gross expenditure on a particular form of recreation - it allows no assessment of the net value of the recreation experience itself, which is what is required. Indeed, gross expenditure data alone are of little help, for the effect on society of that expenditure will vary according to where the expenditure is made. This subject is examined in more detail when the regional effects of parks are discussed.

5.2.4 Value added

"'Value added' is the difference between gross expenditure, or output, and the costs of raw materials or semi-finished products which are incorporated in the final product. (It) is an improvement over gross expenditure because it excludes that portion of total expenditure which is respent outside the local area to buy in the recreational goods and services" (Sinden, 1967, p.6). However, it still suffers from the same

problem as the expenditure method, as the expenditures are made not to obtain the recreation benefit itself but to obtain goods and services connected with obtaining that benefit. The benefit thus remains unvalued.

5.2.5 Gross national product

Coomber and Biswas (1973) report the use of per capita per day GNP as a measure of the value of a day's recreation. Apart from appearing arbitrary, this method would assign the same value to any benefit and thus would give society no information on which benefits were more highly valued by its members and thus which should be provided.

5.2.6 Imputed values

This is really a group of methods in which the recreational experience or resource is valued at the price an equivalent experience or resource would command in a private market. For example, a public museum for which entry is free could be valued using prices charged in a private museum. One problem here is that environmental benefits usually are not exchanged in markets at all so there is unlikely to be a price which could be used in this manner. Also, for an imputed price to be appropriate it should be derived from, for example, an identical recreation area. Clearly, such a situation is unlikely to be found. This criticism is especially cogent where a unique resource is concerned. Another example of this approach has been used in valuing sport-fishing. The recreation experience is valued at the market price of fish caught. This, of course, implies that catching fish is the aim of the activity; valuation of the activity itself is not accomplished since the method implies that, if no fish are caught in a day, the day's fishing was valueless - that is, the individual gained no enjoyment from the activity itself. Obviously, this would not be a valid conclusion in most, if not all, cases.

5.2.7 Willingness-to-pay measures

All of the above measures have been shown to be inapplicable to valuing environmental benefits. Indeed, one general problem with these approaches is that they only attempt to measure recreation benefits and ignore other environmental benefits such as scientific benefits. One class of measures, those assessing willingness-to-pay to obtain the benefits,

are generally applicable to all types of benefit, although the application will vary according to the benefit being assessed.

Willingness-to-pay measurement may be either direct or indirect. Direct measurement entails questioning a respondent to ascertain how much he or she is willing to give up to obtain the specified benefit. This method will be discussed in more detail in Chapter 8 of this report, so problems associated with it will be only briefly stated. Essentially, there are three. Firstly, surveying is costly; secondly, it may be difficult to be certain the respondents are correctly revealing their preferences; thirdly, in some cases the respondent may not have enough information to express a meaningful opinion on his valuation of the benefit. However, these difficulties are only problems of application - the method has a sound theoretical basis unlike the others mentioned above and thus should be used in preference to them.

Indirect measurement of willingness-to-pay is made by assessing all expenditures (of money and time) required to partake in an activity. Essentially this method is used to value recreation benefits. It is different to the user expenditures method outlined above in that it considers only expenditures made relating specifically to the activity - for example, any expenditures on goods and services on a recreation trip which would otherwise have been made, such as food, should not be included. The travel-cost method of valuing recreation is the main example of indirect measurement of willingness-to-pay. It, too, has several problems in application. These are discussed in detail in Appendix 2 to this report and so will not be treated here. This method is used in this report to value recreation in Warrumbungle National Park.

5.2.8 Non-monetary measurement of benefits

The final group of methods proposed for benefit measurement are characterised by their emphasis on a non-monetary score. A fairly typical example of this approach would be subjective ranking of the scenic value of different landscapes. Clearly, the ranking of landscapes might be different for different people so the results of any particular ranking may be meaningless in a general sense. Averaging ranking scores might overcome this difficulty. However, the most serious problem still remains - the rank scores cannot be compared to any other indices and, in particular, cannot be included in cost-benefit analysis. The rankings

may be of use in psychological and related research but appear to have no place in cost-benefit analysis unless they can be translated into monetary terms (money being the numeraire commonly used in cost-benefit analysis). Reynolds (1978a, b) has evaluated scenery rankings in terms of opportunity cost but, as pointed out above, this is unsuitable as a benefit measure. Helliwell (1969, 1973) has translated conservation rankings into monetary values by the use of arbitrary money values. Clearly this is an invalid procedure as, while the rankings might be meaningful, the money figures are not. The difficulties associated with translating rankings into a monetary benefit measure indicate that it is probably a better procedure to assess willingness-to-pay in the first instance rather than derive it indirectly via a non-monetary measure.

5.3 Summary

This chapter has considered various methods that have been used to evaluate environmental costs and benefits. Cost measurement techniques are well established but many of the methods used for the measurement of benefits have been shown to be inappropriate for that purpose. Given the need for cost-benefit analysis, the only appropriate techniques are those assessing willingness-to-pay for the benefits. Both direct and indirect measurement methods are available to accomplish this. However, these methods are the most recently developed and require refinement of technique to be more generally applicable than at present.

CHAPTER 6

THE COST OF WARRUMBUNGLE NATIONAL PARK

6.1 Introduction

Various sorts of costs are involved in the establishment and maintenance of a national park. These costs can be described under several headings - establishment costs, maintenance costs and external costs. In establishing the park, the land must be acquired at some cost. This may entail the removal or relocation of several families who previously lived in the area and these removal costs may be chargeable to the park. Further, in establishing a park, especially where visitor use is likely to be important, the costs of developing the area to a required standard for visitation may be significant. For instance, internal fencing would need to be removed, trails and roads constructed and general camping facilities provided if overnight usage was to be allowed.

A continuing cost over the life of the park is its maintenance requirements. This would include the costs of employing staff for the park and of purchasing materials for the upkeep of park facilities such as trails, buildings and water supplies.

The final category of costs, external costs, is less easy to evaluate as the costs tend to be less conspicuous. Nevertheless they may be important and include such costs as the damage which might be caused if fire or animal and plant pests move from the park onto neighbouring agricultural areas causing crop losses and increased maintenance costs for fences and other property improvements. Each of these categories of cost is discussed below in relation to the present case study on Warrumbungle National Park.

Before proceeding on this discussion, however, it needs to be stressed again that the costs to be assessed are opportunity costs (essentially foregone income) and not necessarily the actual costs paid. This is especially relevant where leased land is acquired for the park - the acquisition cost may be low but the opportunity cost high.

6.2 Establishment costs

The acquisition history of the park is given in Table 6.1. Data on the costs of transactions prior to 1969 were not available. Consequently, some estimate of the value of the land involved must be made for these and other changes. In lieu of alternative data, the values used here are derived from the unimproved capital value of land[1] in Coonamble and where appropriate Coonabarabran Shires for the relevant years. This may overestimate the opportunity cost of the land in as much as the land is less than the average quality of agricultural land in the shire. For the remaining transactions (i.e. where cost data are available) the values stated have been taken to be the correct opportunity costs of the land as a park. In other words, we assume that the officers of the Valuer General's department (who determine the values the Service offers) have simulated a competitive land market well enough such that the values placed on the land are correct estimates of the income foregone by the incorporation of the land into the park. Table 6.2 lists the raw cost data as supplied by the N.S.W. N.P.W.S.[2]

Unimproved capital valuations are made intermittently. Thus the values determined remain relatively constant for several years then, characteristically, show a marked increase at the next valuation. To estimate land values here, this value increase has been averaged over the period between valuations for each Shire such that unimproved capital values rise steadily rather than in infrequent large steps (see Appendix 3). This smooth rise is more likely to represent the real situation than are the series of steep jumps in value. The adjusted U.C.V. for each shire was then divided by the appropriate shire area to derive an average U.C.V. per hectare. This value was then multiplied by the area involved in the park transaction. The transaction in 1974 involves an estimation ofa value for 8.5 ha in Coonamble Shire. However, as the

1 Unimproved value appears relevant here as the land forms the core of the present park and has very little in the way of agricultural improvements. Unimproved capital values for Coonabarabran and Coonamble Shires are given in Appendix 3.

2 The prices per hectare are variable. Such variations could have arisen from the effects of different access conditions, water availability, slope, tree cover and soil on the different areas of land, as well as the presence or absence of any improvements.

Table 6.1

Warrumbungle National Park - History of Acquisition

Date	Area(ha)	Price	Price/ha	Nature of Transaction	Reason for Acquisition	Previous Use	Shire
30/10/53	3360	NA	NA	Withdrawn from leases	Reserved for public recreation	Grazing	Coonamble
1959	25	NA	NA	Gift	Provide recreation facilities	Grazing	Coonamble
8/12/61	3385	-	-	Revoked	Reassessment of park area	-	Coonamble
8/12/61	3240	-	-	Re-notified	Rationalised area; for public recreation	-	Coonamble
1967	2995	NA	NA	Not known	Not stated (Pursuant to NPW Act, 1967)	Grazing	Coonamble
6/6/69	1897	$59500	$31.37	Purchase-owner wished to sell	Protection of Wambelong Creek Valley; Boundary Rationalisation	Grazing	Coonamble
6/6/69	5124	$29000	$19.03	Purchase	Preserve extended area of Range	Grazing	Coonamble
5/12/69	1.821	0	0	Transfer	Boundary Rationalisation	Vacant Crown Land	Coonamble
1969	1.978	-	-	Revoked	Siding Springs Observatory(Act of Parliament)	-	Coonabarabran
24/12/70	858.857	$ 8000	$ 9.31	Purchase	Protect Scenic Values & geological features	Grazing	Coonabarabran
28/1/72	520.426	$42220	$81.13	Purchase-owner wished to sell	Protect Brush-tailed Rock Wallaby; Boundary Rationalisation	Rough Grazing	Coonamble
28/1/72	461.746	$ 8557.50	$18.53	Purchase	Boundary rationalisation scenic and water shed protection	Grazing	Coonabarabran
28/1/72	1429.147	$38877	$27.20	Purchase	Protect scenic value & geological features of southern area of park	Grazing	Coonamble
28/1/72	2567.66	$16500	$ 6.43	Resumption	Park extension to preserve features	Grazing	Coonabarabran
20/7/73	1604.98	$79736.60	$49.68	Resumption	Boundary Rationalisation watershed protection, visitor access & facilities	Grazing	Coonamble
18/1/74	1076.06	$15954	$14.83	Purchase	Extension of park area	Grazing	Coonamble
10/8/74	8.50	0	0	Not known	Boundary Rationalisation	Not Known	Coonamble

Source: Official records of N.S.W. N.P.W.S.

Table 6.2

Costs of Transactions Involved

In Establishing Warrumbungle National Park

Date	Area (ha)[a]	Cost[b]	Shire
1953	+3360	+28190[c]	Coonamble
1959	+ 25	+ 290[c]	Coonamble
1961	- 145(net)	- 1810[c]	Coonamble
1967	+2995	+47710[c]	Coonamble
1969	+3422.82	+60000[c]	Coonamble
1969	- 1.978	- 20[c]	Coonabarabran
1970	+ 858.857	+ 8000	Coonabarabran
1972	+1949.573	+81100	Coonamble
1972	+3029.406	+25060	Coonabarabran
1973	+1604.98	+79340	Coonamble
1974	+1084.56	+16120[c]	Coonamble

Notes a) + Represents an addition to the park, - a deletion from it

b) To the nearest $10

c) Figures are or include estimates from adjusted average unimproved capital values. The process of estimation is as follows:

Table 6.3

Acquisition Costs Inflated to Present Day Prices

Year of Acquisition	Present Day Cost($000)
1953/54	104.06
1959/60	0.764
1961/62	- 4.414
1967/68	91.14
1969/70	104.12
1970/71	13.58
1972/73	169.80
1973/74	126.12
1974/75	25.63

last revaluation for which data are available is 1971 the adjustment process could not be followed and unadjusted U.C.V. is used. The small area of land involved means that the error introduced is negligible.

We need to take account of inflation on land prices over the period and it will be most convenient to bring all figures to present day prices. Consequently the acquisition costs must be inflated to present money values. There is no index of land values available to do this so one must be constructed and again the only data available to allow this are the records of the valuer general previously referred to. However, these data present a further problem as available records only extend to 1974. The approach taken here, which is really less than satisfactory, is to inflate all values to 1974 prices using a U.C.V. index (for the relevant shire) adjusted as before to account for changes in value between revaluations. This value is then adjusted to 1978 prices using the Consumer Price Index for Sydney. Table 6.3 shows the acquisition costs inflated to present day prices.

The other cost of establishment is that of developing the park to desired standards. This would include the cost of trail building and construction of initial camping facilities. The Management Resources Document for the Park gives a brief history of developments in the Park which indicates that the first camping facilities were established in 1957. Tram cabins were acquired in 1959 and 1960 and the establishment of Camp Blackman began in 1974. The ranger's accommodation was built in 1962 while the trail system was essentially completed between September 1958 and January 1962. Huts were also established on the trails during this time using partly volunteer labour. The opportunity cost of these developments has been assumed to be a competitive market wage rate for labour and materials used and where voluntary labour was used, an imputed wage.

The only reliable data on development costs begin in the financial year 1967/68 as previous records are obscure. However, significant developments took place in the park prior to this time (e.g. trail construction and building of the information centre). Accordingly, an estimate of the cost of these developments (in present day prices) has been made for the purposes of this study.[1] No development costs

1 An alternative procedure would have been to omit any consideration of these costs, i.e. estimate them at zero. However, such an assumption is clearly more arguable than that made here. It is better to allocate some costs, even a best guess than to omit them altogether. Moreover, if the costs are set at zero, the final result may be considerably biased in favour of the park alternative and this is undesirable.

have been allocated to the period 1953/54 to 1958/59. With trail and building construction in the period 1959/60 to 1963/64 substantial costs have been allocated; with much lower levels of development from 1963/64 to 1967/68 smaller costs have been allocated. Table 6.4 lists the raw data for the period 1967/68 to 1977/78 supplied by the N.S.W. N.P.W.S. while Table 6.5 lists all development costs inflated to present day values.

6.3 Maintenance costs

Maintaining the park involves expenditure on materials and staff and the opportunity cost of this is here taken to be the market value of the labour and material. Data on maintenance costs were supplied by N.S.W. N.P.W.S. and again are only available from 1967/68 onwards. Consequently estimates of maintenance costs have to be made for the previous years. As we have assumed developments began in 1959/60 so we have assumed maintenance costs to have begun in 1960/61. For each year from 1960/61 to 1966/67 we have allocated a maintenance cost value equal to the average present day value in the years 1967/68 to 1977/78. Table 6.6 shows the raw data on park maintenance costs supplied by N.S.W. N.P.W.S. while Table 6.7 lists all maintenance cost inflated to present day values.

6.4 External costs

This last category of costs is the hardest to estimate. As mentioned previously costs involved here are factors like the damages caused by fires and pests moving from the park onto neighbouring land. In other words, the presence of the park may impose costs on neighbouring landholders. However, it is impossible to estimate, without a detailed examination outside the resources of this project, whether these costs do exist or whether in fact the park confers external benefits on neighbouring landholders. For instance, an increase in natural vegetation that might occur on land incorporated in the park may lead to fire and pest propagation thus causing damage to adjacent areas. Equally, however, the establishment of the park may have improved the pest/fire problem since park staff are employed to (among other things) conduct control programmes to keep fire and pests in check. Such control might not have been possible previously where

Table 6.4

Expenditure on Development Works for

Warrumbungle National Park 1967/68 to 1977/78

Year	Expenditure Materials	Labour[a]	Total
1967/68	925	3707	4632
1968/69	1185	3792	4977
1969/70	540	4444	4984
1970/71	2282	12929	15211
1971/72	20029	28455	48484
1972/73	2322	51562	53884
1973/74	58595	27706	86301
1974/75	22879	30206	53085
1975/76	35061	31886	66947
1976/77	15425	17223	32648
1977/78	38249	15211	53460

Note a - Official records showed labour cost figures combined with maintenance labour costs. As an approximation, labour cost attributable to the development and maintenance categories has been set equal to the proportion of the total expenditure in each category on maintenance and development materials. Subsequent cost aggregation will remove any errors caused by this procedure.

Table 6.5

Development Costs Inflated to Present Day Prices

Year of Development	Present Day Cost($000)
1959/60	50.00
1960/61	100.00
1961/62	100.00
1962/63	100.00
1963/64	50.00
1964/65	20.00
1965/66	10.00
1966/67	10.00
1967/68	10.34
1968/69	11.30
1969/70	10.87
1970/71	31.33
1971/72	92.60
1972/73	96.99
1973/74	137.22
1974/75	72.73
1975/76	81.01
1976/77	35.26
1977/78	53.46

Table 6.6

Expenditure on Maintenance for Warrumbungle National Park 1967/68 to 1977/78

Year	Expenditure		Total
	Materials	Labour[a]	
1967/68	1589	6369	7958
1968/69	2635	8433	11068
1969/70	991	8156	9147
1970/71	274	1552	1826
1971/72	900	1279	2179
1972/73	214	4752	4966
1973/74	2935	1388	4323
1974/75	1247	1646	2893
1975/76	2808	2554	5362
1976/77	18500	20657	39157
1977/78	31455	12509	43964

Note a - see Note "a" to Table 6.4.

the land (which was essentially natural vegetation anyway) was owned or occupied by a number of private landholders with, perhaps, diverse approaches to managing their land.

The situation is more certain where other external effects are concerned. For example, the increase in natural vegetation cover that would follow the reservation of the park would improve water management conditions and decrease soil erosion problems for neighbouring land. (Watershed protection has in fact been one of the aims behind reservation of land for Warrumbungle National Park as is shown in Table 6.1). Here again, only a detailed examination of soil and water conditions before and subsequent to park reservation could value these benefits. A similar situation exists with incursions of native animals onto neighbouring land. These would probably have increased with increasing

Table 6.7

Park Maintenance Costs Inflated to Present Day Prices

Year of Maintenance	Present Day Cost ($000)
1960/61	16.74
1961/62	16.74
1962/63	16.74
1963/64	16.74
1964/65	16.74
1965/66	16.74
1966/67	16.74
1967/68	18.62
1968/69	25.12
1969/70	19.94
1970/71	3.76
1971/72	4.16
1972/73	8.94
1973/74	6.87
1974/75	3.96
1975/76	6.49
1976/77	42.29
1977/78	43.96

natural vegetation in the park but by how much is unknown. It is important to note here that a common method of valuing this cost (area affected times average crop yield) is likely to overstate this cost. The animals will not normally venture far from cover to forage and, in so far as cultivation tends to be less intense near property boundaries than in central areas, the affect of this foraging will be less than if it were conducted in areas of higher productivity.

Ideally, valuation of these external effects would be included in any overall analysis. This has not been done here as it would have required more resources than were available to the project. However, it can be said that the effects are definitely not all detrimental to surrounding land and even those effects which are damaging may be less so than is commonly thought.

6.5 Summary

In this chapter we have assessed the costs of Warrumbungle National Park. Of the costs associated with the park, external costs were not evaluated. Estimates for both development and external costs prior to 1967/68 had to be used. Table 6.8 summarises the costs of the park in present day prices.

Table 6.8

The Cost of Warrumbungle National Park

Year	Present Day Cost ($000)			
	Acquisition	Development	Maintenance	Total Cost
1953/54	104.06	-	-	104.06
1954/55	-	-	-	-
1955/56	-	-	-	-
1956/57	-	-	-	-
1957/58	-	-	-	-
1958/59	-	-	-	-
1959/60	0.76	50.00	-	50.76
1960/61	-	100.00	16.74	116.74
1961/62	- 4.41	100.00	16.74	112.33
1962/63	-	100.00	16.74	116.74
1963/64	-	50.00	16.74	66.74
1964/65	-	20.00	16.74	36.74
1965/66	-	10.00	16.74	26.74
1966/67	-	10.00	16.74	26.74
1967/68	91.14	10.84	18.62	120.60
1968/69	-	11.30	25.12	36.42
1969/70	104.12	10.87	19.94	41.91
1970/71	13.58	31.33	3.76	48.67
1971/72	-	92.60	4.16	96.76
1972/73	169.80	96.99	8.94	275.73
1973/74	126.12	137.22	6.87	270.21
1974/75	25.63	72.73	3.96	102.32
1975/76	-	81.01	6.49	87.50
1976/77	-	35.26	42.29	77.55
1977/78	-	53.46	43.96	97.42

CHAPTER 7

EVALUATING THE RECREATIONAL BENEFITS OF THE PARK

7.1 Introduction

Recreation undertaken in Warrumbungle National Park represents one of the major benefits of the park so any attempt to evaluate the "worth" of the park should include an evaluation of the recreation undertaken there.[1] The standard method used to do this is called the "travel cost method" where the recreation is valued at the cost of all goods and services required to take part in the particular experience. A simple example will suffice to illustrate the method.

The first step is to derive the demand curve for the recreation under investigation. This is the relationship between the cost of recreation and the amount of recreation undertaken. For a park this might be expressed as the relationship between the visitation rate from various origins and the cost of a visit from each origin.

On the basis of this suppose the following data shown in Table 7.1 have been observed in a survey of users at a hypothetical park.

For these data, the relationship between the visitation rate from various origins (V) and the cost of a visit from each origin (C) is given by V = 0.7-0.1C. This is the demand curve for visits to the park and is shown in Figure 7.1.

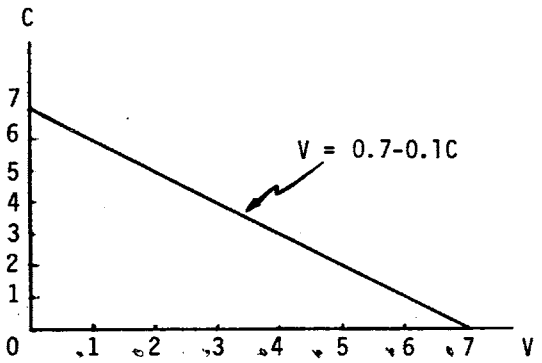
$V = 0.7 - 0.1C$

Table 7.1
Hypothetical Recreation Data

Town of Origin	Town Population	Average Travel Cost/Visit (C)	Visits Made	Visits/Capita (V)
A	1000	$1.00	600	.6
B	2000	$4.00	600	.3
C	4000	$6.00	400	.1

1 Here we are assuming that the recreation would not have been possible if the area had not been dedicated as a park. This assumption appears valid in so far as the majority of the park land was previously used for grazing and extensive public recreation (as at present) would probably not have eventuated on the land if grazing had continued.

Figure 7.1
Demand Curve for Visits to the Hypothetical Park



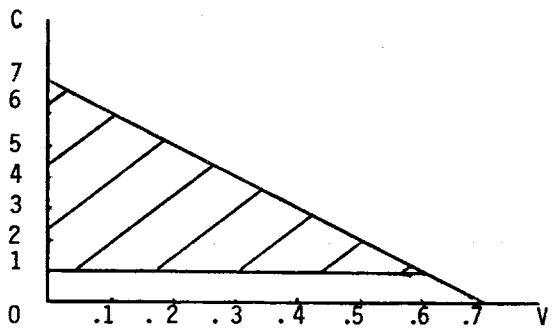
The appropriate measure of recreation benefits for inclusion in cost-benefit analysis is the recreationer's willingness-to-pay to undertake the recreation. This is given by evaluating the area under the demand curve for each town from the observed cost of travel for each town ($1, $4 and $6 for towns A, B and C respectively) to the cost at which visitation to the area is predicted to be zero ($7).[1] This procedure is illustrated in Figure 7.2 for visitation from Town A. Visits from Town A cost an average of $1 each so to find the consumers' surplus for visitation from Town A we evaluate the area under the demand curve from C = $1 to C = $7 (the hatched area in Figure 7.2, equal to $1.80) and multiply this value by the town population. Conducting a similar procedure for all three towns, the total consumers' surplus or total recreation benefit is $2900.

The methodology assumes that the park visitor would respond to a park fee of $1.00 in the same way that he would to an increase in travelling costs of $1.00. Some other difficulties are associated with the method which make actual estimation more complicated than that above. Firstly, the time involved in making a trip to and recreating in the park must be considered, as to omit time from the analysis leads to an undervaluation of the benefits of the recreation. Secondly, if the single recreation trip involves visits to a number of recreation areas,

1 That is evaluating the consumers' surplus for visitation from each town.

Figure 7.2

Calculating the Consumers' Surplus for Visitation from Town A



the costs involved in the whole trip must be apportioned among all the areas otherwise the value of recreation at the site studied could be overstated. These and other problems with the travel cost method are discussed in detail in Appendix 2 to this report.

In this chapter we apply the travel cost model developed in Appendix 2 and as outlined in the simple example above to valuing recreation undertaken in Warrumbungle National Park. We describe the methodology used and give the results of the analysis. In a latter chapter, the costs and benefits of Warrumbungle National Park are compared.

7.2 Methodology

The basic linear demand model developed in Appendix 2 was

$$z_i = \gamma_0 + \gamma_1 C + \gamma_2 t_s + \gamma_3 t_j \qquad (1)$$

where z_i is the level of recreation demanded

C represents the cost of goods and services consumed on site, plus on site time valued at the marginal wage rate plus travel time valued at the marginal wage plus the cost of travel

t_s represents on site time

t_j represents travelling time.

The nature of the data collected placed restrictions on the estimation of this model. In particular, difficulties in estimating the marginal wage rate led to some terms being deleted while problems were encountered in estimating the coefficients of terms incorporating on-site time. Derivation of the appropriate value for travel time also proved difficult. This involved allocating the actual travel time among all sites involved on the trip in proportion to the time spent at each site. Imprecise replies by survey respondents led to poor estimates of the amount of travel time which should be allocated to the visit to Warrumbungle National Park and consequent problems in estimating the coefficient of that travel time. In lieu of this, total travelling time was used.

The basic demand model then reduced to

$$Z_i = \delta_0 + \delta_1 C_1 + \delta_2 t \qquad (2)$$

where C_1 represents the sum of on site costs per head and travel costs per head

t represents travelling time on the trip.

7.3 Estimation of the model and consumers' surplus results

Data from the 538 groups responding to the visitor survey in the park were used to estimate the model. Local government areas as defined for the 1976 Census were used as origin areas and the mean C_1 and t for each calculated. There were 134 areas in the sample. Z_i, the level of recreation demanded, was specified as visits/capita from each origin area, (Z).

The model was estimated in linear and logarithmic forms with the latter giving superior results. Equation 3 shows the estimated equation.

$$\ln(Z) = \underset{}{-5.81276} \underset{(0.09446)}{- 0.29930 \ln(t)} \underset{(0.14247)}{-0.38541 \ln(C_1)} \quad R^2 = 0.20568 \qquad (3)$$

Standard errors of the estimated coefficients are given in brackets. The first coefficient is significantly different from zero at the 0.5% level, the second at the 1% level. The R^2, which indicates the level of explanatory power of the model (1.00 represents a perfect explanation)

is quite low. However, it does not compare unfavourably with the results of other travel cost studies. Some of these studies report R^2 values around 0.9 (e.g. Mansfield 1971, Smith 1971, Common 1973). Other values are lower (for example Gibson and Anderson (1975) report values in the range 0.21 to 0.56) while some authors (e.g. Beardsley 1971, Ferguson and Greig, 1973) do not report estimated equations at all, only results derived from these equations.

As we saw previously, the recreation benefits for a given origin area are measured by the consumer's surplus for that origin which is the area under the demand curve between the observed cost and time for that origin area and that cost and time combination at which recreation demand is zero. By summing over origin areas the total consumers' surplus for the sample can be calculated.

In practice, due to the functional form used, this solution becomes unbounded as zero demand would never be predicted. To overcome this difficulty, instead of using the cost/time combination which would give zero demand, feasible upper bounds to both cost and time were selected. These were $40.00 per head for on site plus travel costs and 80 hours travelling time. Using these values, the consumers' surplus for the sample was calculated to be $718,910.00. This figure needs to be scaled up to an annual amount. The respondents to the survey represented a total of 7194 visitor days (see Chapter 4). With an assumed visitation of 85,000 visitor days in 1978, the total consumers' surplus derived here must be scaled up by a factor of 11.82 to arrive at an annual figure. The annual consumers' surplus is thus $8,497,516 or about $100.00 per visitor day.

In order to assess the magnitude of benefits over the life of the park it is necessary to know the number of visitor days of recreation undertaken in each year. Table 4.2 listed the visitation figures for the park from 1969-70 to 1977-78. If the number of visitor days per year (D) is regressed against a time trend (T) (taking 1969-70 as year 1 and 1977-78 as year 9) the resulting equation is

$$D = 27584.50 + 6649.17\ (T) \qquad (4)$$

$$R^2 = 0.99$$

This equation can then be used to extrapolate backwards to estimate visitation in years prior to the start of official records. However, after 5 years, negative visitation is indicated so it is necessary to

independently estimate visitation prior to 1964-65. (These latter estimates may be too low). The results of estimating visitation rates in this way are shown in Table 7.2.[1] These figures will subsequently be used (in Chapter 10) in the overall assessment of the benefits and costs of Warrumbungle National Park.

Finally, in explaining demand for recreation in Warrumbungle National Park, it is useful to assess the effects of various socio-economic characteristics of the groups and origin areas on visitation rates. As part of the visitor survey, information on the age, sex, education and income levels of visitors was sought. Also, it was hypothesised (see Appendix 2) that the income level in the origin areas may have an influence on visitation rates. Accordingly, income data for the local government areas involved in the sample were obtained from the 1976 Census tables. No Victorian data could be obtained as the information had not been compiled so the Victorian origin areas were excluded from the sample when estimating fuller demand functions. Multicollinearity between variables (for example, between the age and income of the group heads and income of the group and income of origin area) again led to problems in estimating certain coefficients. The best demand equation derived was the following

$$\ln(Z) = -6.59320 - \underset{(0.17839)}{0.38597}\ln(C_1) + \underset{(0.02110)}{0.03467}(V_1) - \underset{(0.10942)}{0.24362}\ln(t) + \underset{(0.03045)}{0.04598}(V_2) \qquad (5)$$

$$R^2 = 0.26043$$

Where V_1 represents the average age of children in the groups from a given origin area.

V_2 represents the average income level of the group heads from a given area

Z, C_1 and t are as defined for equation 3.

The first and third coefficients are significantly different from zero at the 2.5% level and the second at the 20% level and fourth at the 10%

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1 An alternative procedure would have been to set visitation at zero for the years prior to which records were kept. This would clearly not have been the case and it was felt that some estimate of visitation needed to be made to take into account the recreation benefits in the early days of the park.

Table 7.2

Visitation Rates (Visitor Days) for Warrambungle National Park

Year [a]	Visitor Days
1953/54	600
1954/55	600
1955/56	600
1956/57	600
1957/58	600
1958/59	650
1959/60	700
1960/61	750
1961/62	800
1962/63	850
1963/64	900
1964/65	988
1965/66	7637
1966/67	14286
1967/68	20935
1968/69	27585
1969/70	34048
1970/71	39624
1971/72	48486
1972/73	56638
1973/74	58031
1974/75	66072
1975/76	77856
1976/77	81032
1977/78	85686

Note: a Data for years 1969/70 to 1977/78 from Official Records, for years 1964/65 to 1968/69 estimated from equation 4, for years 1953/54 to 1963/64 estimate of likely value.

level.[1] This result indicates that the age of children in the group has a bearing on the number of visits undertaken and that the income level of the group head also influences visitation. As the age of children in a given group increases, visitation is likely to increase and the same situation is evident where the income of the group head is concerned - as his or her income increases, visitation to the park by his or her group is likely to increase.

7.4 Measuring future recreation benefits

The analysis so far in this chapter has centred on estimating the value of present-day recreation in a park, a task to which the travel-cost methodology is well suited. However, in arguing the case for the establishment of a new national park, it is the value of future recreation which will be important and here the travel-cost methodology is less appropriate. Alternative methodologies may need to be developed to enable the evaluation of such future benefits and early attempts at this development are outlined below.

Some work has been done on trying to extend the travel-cost methodology to measuring future recreation benefits and this will be discussed before outlining the new methodologies. Mansfield (1971) has shown how the travel cost methodology can be modified to measure the recreation benefits of new sites. In doing this, it is important to recognise, explicitly, the effect of establishing a new recreation area "as an homogenous extension" (p.63) of the present recreation area. Thus the demand relationships evident for the present area can be applied to the new area, *ceteris paribus*. The recreation benefit for the new area is then equal to the sum of the benefits generated by trips made to the new area which would not otherwise have been made to the old area and the benefits in terms of costs saved for trips made to the new area which otherwise would have been made to the old.

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1 A one-tailed t-test has been used for testing the first, third and fourth coefficients as these were previously hypothesised to be, respectively, negative, negative and positive.

Clearly, this approach is less than satisfactory, however, as two recreation areas would rarely be identical as the methodology requires. What approaches, then, are available? Three basic approaches seem applicable to the problem and each will now be briefly outlined. (Before doing so, it should be pointed out that the cost-benefit analysis framework as such does not change - costs and benefits are still discounted to the present and compared. What does change is the method of accounting for the benefits. Projected costs must, of course, also be used but this presents less of a problem).

7.4.1 Direct questioning

In theory it is possible to survey the population regarding their preferences for a possible future recreation site to determine how much each person would be willing to pay for recreation he expected to undertake on the site, if the site were provided. Suppose, for example, the individual could buy a ticket now guaranteeing him the right to use the site in the future. Does the amount he pays measure the recreation benefit he expects to obtain and therefore can all such values be aggregated to estimate the future recreation benefits of the site?

Cicchetti and Freeman (1971) suggest not. They consider the individual will include a risk premium (option value) in the price paid for the ticket (that premium being the difference between the price the individual pays for the ticket and the expected benefits he would obtain if he does not buy the ticket now but just visits the recreation site in the future if he wants to. He pays the premium to guarantee that the site will be available for his visit). However, it has been argued (e.g. Henry, 1974) that this option value may not necessarily be positive (i.e. it could be negative or zero) since it only guards against supply uncertainty, not demand uncertainty (i.e. whether the potential reactor will in fact visit the area). The consequence of all of this is that we cannot be sure that the values for future benefits expressed in this way are correct.

7.4.2 The "characteristics" approach

This approach to measuring future benefits is very new (see, for example, Greig 1976, 1978; Morey 1978) and consequently has not been greatly developed as yet. It is based on the assumption that recreationers visit a given area rather than some alternative area because they prefer the characteristics of that first area to those provided by the alternatives. While the methodology appears most applicable to valuing the recreation benefits of management changes within a recreation area, it seems suitable for measuring the recreation benefits supplied by a new recreation area, as long as that new area does not markedly affect expenditure by the community on visitation to possible substitute recreation areas.

There are several basic elements to the approach, which are listed here.[1]

(i) The new area must be considered as an extension of the existing park system. A group of areas (parks) is defined, from which recreationers may choose. The group is defined to include all areas for which the new area could act as substitute.

(ii) The characteristics influencing visitors' choices among existing areas in the group must be identified and measured (for example, miles of walking trails of various grades, number of barbeque sites, etc.).

(iii) The expenditure by recreationers on visits to areas within the group must then be estimated. (Note that this would involve a similar procedure to the travel cost one used in this study. Visitors would be surveyed to reveal their expenditure of time and money on trips to areas within the group over a period of time. The main difference is that surveys would need to be conducted at all sites within the group, not just one as is required for applying the travel cost method.)

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1 A more detailed discussion of the method can be found in Greig, 1976.

(iv) The recreationers' preferences for the characteristics of existing areas must be modelled.

(v) The expenditure on various recreation trips is then related to the recreationers' preferences for the various characteristics of the existing areas in the group.

The result of this process is a model predicting the number of trips to each existing area within the group from each visitor origin area. Using the model, the impact of establishing the new recreation area can be determined (assuming community preferences remain the same). The new area will alter the characteristics mix of the group and will change visitation patterns. Once the new characteristics are fed into the model, the predicted change in visitation can be ascertained. The recreation benefits of the new area are then measured as the benefits of all new trips undertaken, plus the benefits of all trips diverted to the new area from the old (valued at cost saved).[1]

7.4.3 The "threshold" method

This third approach is similar to that used in this study (except that benefit and cost streams were known in this case) and is exemplified by Krutilla and Cicchetti's (1972) study of the Hell's Canyon in the United States. Using this approach, the value of future benefits is not explicitly measured. Rather, the likely growth in quantity of recreation benefits consumed over time is modelled (e.g. numbers of park trips per year over the time period of the project), taking into account population growth, income changes and so on.

Using this growth model, the growth over time of $1 worth of recreation benefit in year 1 is ascertained. This gives a certain amount of benefit in each year of the project, corresponding to the $1 benefit in Year 1. For example, if benefits are estimated to grow at 10% per year for the 5 years of a recreation project, the benefit stream (growing from $1 in year 1) will take the following pattern:

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1 Note that this is a similar expression to that used by Mansfield (1971) in using travel cost to measure the recreation benefits of a new site.

est. growth 5%

Year	1	2	3	4	5
Benefit	$1	$1.10	$1.21	$1.33	$1.46

This benefit stream is then discounted to a present value. In this example, if the appropriate discount rate was 5%, the present value of the benefit stream corresponding to a year 1 benefit of $1, would be $5.50.

The next step is to discount the costs of the project. If, for instance, the following cost stream was anticipated:

Year	1	2	3	4	5
Benefit	$2,000	$1,000	$500	$200	$200

the present value of the costs would be (at a 5% discount rate), $3,744.

The final step is to calculate the threshold value for benefits. This is the value that benefits in year 1 would have to be at least equal to if, growing at the projected rate (here 10%), they were to justify the project. The threshold value is calculated by dividing the present value of costs by the present value of the benefit stream growing from the $1 benefit in year one. For this example the threshold value is thus $3,744 ÷ $5.50 or $681.

Having established this value, it must then be determined whether year one benefits will at least be equal to this figure. (This is clearly an easier prospect than determining the value of benefits over the whole life of the project.) If the year one benefits are found to exceed the threshold value, the project is justified on economic grounds.

Which of these three methods should be used? The first approach (direct questioning) would be useful if the option value component could be removed from the valuation expressed by the respondents. This would require careful questioning. The direct questioning technique, however, could be used at the same time to elicit valuations of benefits, other than recreation, supplied by, say, a future park and this would be desirable.

The characteristics approach, on the other hand, only allows the evaluation of short-term future recreation benefits but it appears well suited to this and, with more development, it could give very meaningful results. One specific advantage of the approach is that the decision is viewed in the context of the park system, not just for an isolated park, so the impact of the new park on existing parks is explicitly identified. However, as indicated, visitation is only predictable in the short term

since, in the long run, the parameters underlying the model could change thus changing visitation patterns. The method may be of most use in conjunction with the threshold approach where the characteristics approach could be used to estimate the initial year's benefits for comparison with the required threshold value. Similarly, the direct questioning approach could be used to supply an initial year's value for comparison with a derived threshold value. In this case (i.e. asking respondents only to express a value for one year, not too distant in the future and not for the whole project time stream), it may be easier to eliminate any option value from the valuation since respondents may be more certain about recreating in one year's time than over the next 20 (if that is the length of the project).

Which method, or combination of methods, is used would depend on the decision faced, the time available for decision-making and the funds available for research on the question for clearly none of the procedures is costless.

7.5 Summary

In this chapter we have evaluated the recreation benefits of Warrumbungle National Park using the travel cost method as detailed in Appendix 2. The results of this analysis indicated a consumer surplus value for the recreation benefit of approximately $100.00 per visitor day. In Chapter 10, this value is used in comparing the benefits and costs of Warrumbungle National Park. In order to carry out this comparison the time stream of visitor days from the beginning of the park to the present needed to be established. This is shown in Table 3 of this chapter. A more detailed analysis of demand for recreation in the park indicated that, apart from cost and time considerations, the age of children in the group and the income level of the group head were likely to have a significant impact on the amount of visitation to the park.

The final section of the chapter dealt with the measurement of the benefits of future recreation, a subject which would be of importance in establishing an economic case for creating a new national park. The travel cost method is unsuitable for this purpose and several alternative methodologies were presented for evaluating future recreation benefits. The choice between them might depend on the particular situation being faced.

CHAPTER 8

VALUING OTHER PARK BENEFITS

8.1 Introduction

As we stated in Chapter 1, the main benefit of Warrumbungle National Park to the public appears, at present at least, to be its recreation potential. Consequently, the valuation of park benefits has concentrated on this feature of the park. Valuation of the other benefits of the park has not been attempted here because of lack of time. However, other studies overseas have attempted this and in order to show how these other benefits could be included in the cost-benefit analysis of a park, the approaches used to value the various benefits will be outlined.

The non-recreational benefits of Warrumbungle National Park would include the value of the park as a scientific reference area, as a gene pool, an education area, an area providing purely aesthetic benefits and cultural benefits. The approach to valuation is fundamentally different to that taken in the case of recreation since the latter is valued, in part, by the expenditure made in recreating and these other benefits typically might not generate any expenditure at all, even though they may be very important. By and large, valuation is effected by asking people, in a survey of park users or the population as a whole, to express their willingness to pay to obtain the particular benefit in question.

Three problems arise from this. Firstly, there is the need to survey people to determine their valuations and this could be quite expensive. Secondly, it is difficult to ensure that people will correctly reveal their preferences so that the true value of benefits to them be determined. For instance, if a person considers that he may have to actually pay the amount he states or he feels that the benefits will be provided anyway, he may understate his value. If large numbers of respondents adopt this strategy, the benefits may be undervalued and thus under-provided by society. Conversely, if the respondent is convinced he will not have to pay his stated value but wishes to make sure that the benefits are provided, he may overstate his value. If this strategy is adopted in aggregate, society may commit too many resources to the provision

of the benefits in question and consequently not enough to the provision of others.

However, there is some evidence that economists may have exaggerated people's ability or willingness to incorrectly reveal their preference (Bohm, 1972), so this may not be a problem and in any case if it is believed that the problem might be significant, more sophisticated techniques have been developed to reduce the scope for misrepresentation of preferences (e.g. Clarke Taxes - Clarke (1971)). The present complexity of these methods, however, limits their applicability to large-scale surveys.

The third and perhaps most important problem, is that of information. In order to be able to express a meaningful opinion on his willingness-to-pay, the respondent must know the benefit he is obtaining in return for giving up that amount. The respondent may know this for such benefits as recreation in national parks but not for, say, the benefits provided by conserving a given species. Increasing education on the benefits of conserving natural areas would help to alleviate this problem, thus making more meaningful expressions of value possible.

Each group of benefits that has been valued in the literature thus far will now be discussed commencing with wilderness recreation.

8.2 Wilderness recreation

Warrumbungle National Park offers the potential for "wilderness recreation" in some of the undeveloped areas of the park. This type of recreation is typically a solitary or small group activity. Relative solitude is likely to be an important part of the experience and with more crowding, the value of the experience to the individual may diminish. Hence any valuation process will need to take some account of congestion effects in assessing the value of an area for wilderness recreation. The most convenient way of doing this is by questioning recreationists themselves on these effects and on their valuations of the experiences achieved.

The three problems raised above in discussing the use of surveys to value park benefits are evident here. It is difficult to survey all wilderness users and hence the cost of sampling them may be high due to the dispersed nature of the activity. To obtain a reasonable sample size,

sampling may have to be carried out over long periods with a few samplers, or alternatively intensively over a short period of time. Both could involve large amounts of labour. Respondents may incorrectly reveal their preferences or lack information on the benefits to be gained by recreation in the area. However, in as much as the wilderness recreationer is well prepared for and informed about the area in which he is to travel, it could be expected that he would have a good conception of the experience to be obtained and would be able to express an opinion of its value to him.

An example of the survey approach to valuing wilderness recreation is given by a case study in the Spanish Peaks Primitive Area of the United States (Cicchetti and Smith, 1973). In this study, an analysis of the trail system in the area was made to determine, at given levels of usage, what the expected number of encounters with other parties would be on the trails and in the camps.[1] (Number of encounters was taken as a measure of solitude and thus the value of the experience was assumed to be dependent on the number of encounters). The visitors' willingness-to-pay for their experience under those conditions was sought. The results are summarised in the Table 8.1.

Table 8.1

Willingness-to-Pay for Wilderness Recreation, Spanish Peaks, U.S.A.

Total Daily Use (No. individuals)	Expected Encounters Trail	Camp	Seasonal Aggregate willingness-to-pay
150	3	2.25	$13,657
200	4	3	$14,170
250	5	3.75	$11,970

At a total usage of 150 per day, the total benefit was measured as $13,657, an average of approximately $91.05 per season-user. As usage rises to 200 per day, expected encounters also rise. Aggregate benefit

1 Even though United States wilderness areas may be different to Australian ones, the method of analysing the benefits of wilderness recreation in the differing areas would be essentially the same.

rises to $14,170 reflecting the fact that more users partake of the experience but average benefit has fallen to $70.85 per season-user reflecting the diminished value of the experience to each user. When usage rises to 250 per day, aggregate benefit actually falls (to $11,970) indicating that the benefits derived by each user have fallen so much that the decrease outweighs the increase in benefit achieved by allowing more users.

Such information can be used both to assess the net benefit of the area in wilderness recreation use, and to aid management planning for the area. Of the three usage figures given here, 200 per day yields the maximum benefit to users, indicating that this is the level of usage that should be permitted in the area.[1] Note, however, that this case is simplified by the costs of each level of usage being approximately the same. Hence only the benefits need to be considered in the comparison. Other cases with differing costs must include considerations of these costs.

8.3 Aesthetic benefits

Clearly both developed and wilderness recreationers will gain benefits of an aesthetic nature. However, these are valued in the total recreation experience. This category of benefits refers strictly to aesthetic benefits enjoyed by casual through-travellers, or local residents, who do not need to visit the park specifically in order to enjoy such benefits. Here we would include the benefits gained as one drove past the Warrumbungle Range on the highway. (Note that this particular benefit would only be attributable to the park if the alternative land use were to alter the range to such an extent that travellers could no longer obtain the benefit). What is an experience like this worth? A method used in approaching this problem is again to survey preferences for different views and convert the preferences into a willingness-to-pay measure. The views may be actual or representations as in photographs

1 If ecological constraints are not operative. In establishing optimal levels of usage, as mentioned earlier in the report, attention must be paid to both the ecological carrying capacity and the economic carrying capacity of the area.

or pictures. The use of photos and pictures presents a difficulty in that it must be assumed that the preferences are expressed for the view shown, not the photo or picture itself. The problem of ensuring a correct revelation of willingness-to-pay also remains.

The example given here is not strictly a national park example. However, the principle used is the same and the example is the simplest and most readily explained. The method has been used for national park benefits but is more complicated in such applications. This study deals with air pollution abatement from the Four Corners Power Station in New Mexico, USA (Randall et al.1974). Respondents in a statistically chosen sample were asked how much they would be willing to pay in extra sales tax or extra electricity bills (for residents in the area) or extra user fees (for recreationists) in order to decrease the level of pollution from the plant. The differing situations mentioned below were simulated by photography on days of minimal operation or total shut down. The results were as follows.

Total emission was 96,000 tons/year.

For a reduction of 76,000 tons/year (to 20,000 tons/year) total willingness-to-pay for the population was

$15.54m ± $1.24m

For a total reduction to zero pollution, total willingness-to-pay for the population was

$24.57m ± $1.52m

It is apparent that the value of aesthetic pleasure can be quite high and may be an important component of environmental benefits.

8.4 Watershed protection

Benefits of watershed protection include the stabilisation of runoff, the decrease in soil erosion and decrease in silting of waterways and dams. An evaluation of these benefits could take the form of cost foregone. For example, in the absence of the control afforded by the natural vegetation of a national park, man-made works may need to be constructed to achieve the same level of protection. The natural area will enable this cost to be avoided - an estimate of its value is thus given. Note that the assumption is made here that watershed protection is desirable, so that the only question that remains is one of cost minimisation. In this respect, it is not strictly a benefit

evaluation. However, it would be possible to evaluate the watershed benefits if the water yield were used as a production input in some other area of the economy. The value of the water (and hence the watershed) would be equal to the value of the marginal output produced from the water if the output is sold on competitive markets.

Although these are the benefits for which evaluation examples exist in the literature, the methodology can be extended to other benefits. The big step in such evaluation is to define clearly the nature of the benefit one seeks to evaluate. It is often the obscure way in which benefits are defined that makes subsequent evaluation difficult.

8.5 Option value

The discussion so far has focussed on the evaluation of benefits at any moment of time. But a crucial feature of national parks is the way these change over time. This is important because development projects tend to be *irreversible* (the natural environment may not be recreated) while a preservation alternative leaves the option, in the future, of developing or preserving when more knowledge is available with respect to the decision. This leads to the concept of 'option value'. There are two aspects to this. With development, future preservation benefits may be permanently destroyed whereas with preservation future development benefits are still available. If the net benefits of preservation are rising faster than the net benefits of development (even from a lower initial level) assessing the projects only on the lifetime of the development (say 20 years) will bias the analysis in favour of the development project since the future greater benefits of preservation will have been ignored. Cost-benefit analysis must take into account the different nature of the benefit streams. Two ways of doing this are to extend the time span of the analysis (e.g. to 100 years instead of only 20), or to add to preservation benefits, at the end of the development project's life, a value designed to capture future preservation benefits.

The second aspect concerns the uncertainty attached to benefits and costs both of development and preservation strategies, and more specifically with the possibility of acquiring additional information which will allow benefits and costs to be assessed more precisely. For example, scientific research may make it clear that some particular species is or

is not of importance as a source of medical drugs, say. Again the irreversibility of development projects introduces an asymmetry, for while if we mistakenly preserve too much land we can subsequently develop more, if we mistakenly develop too much now, there is nothing we can do to correct the mistake. This gives additional value to the preservation strategy as a means of exploiting any additional information we should acquire in the future. A more detailed discussion of option value can be found in Ulph (1978).

The first aspect of option value was used in the Hell's Canyon study (Krutilla and Fisher, 1975) where the choice was between hydro-electric development and leaving the canyon for wilderness recreation. It was successfully argued that the likely growth of future recreation benefits relative to the development benefits made preservation the sensible strategy.

8.6 Alternative approaches to considering benefits

If certain benefits are not able to be valued for any particular reason, it may still be desirable to explicitly consider the benefits when making the decision. Various means are available for this and are discussed at length by Sinden and Worrell (1979). The discussion here will necessarily be brief.

If the decision to be made is only a choice between areas to be dedicated as a park with a certainty that one area must be chosen, a ranking or scaling of the park benefits to be gained from each area may be useful. Then each area can be compared on this basis and the best chosen for a park. (Note that, in essence, this procedure ignores park costs as a determinant in the decision.) The ranking could be determined by reference to expert opinion or, especially if recreation is to be a prime activity in the prospective park, by community survey as well. In determining the value of an area for conservation using ranking or scaling, the approach developed by Helliwell (1969, 1973) might be considered. This generates an index value for an area based on the scarcity of its inhabitant species and individuals and this can be compared to the same index derived for other areas examined. The derivation of the index appears objective, but it is in fact subject to the opinions of the analyst and so indices constructed by different

workers will be, in general, non-comparable. Helliwell extends the index into a monetary framework but this step is purely arbitrary and should be disregarded as a measure of the value of conservation relative to other land uses.

An alternative approach to considering the park decision might be to include a detailed description of the unmeasured benefits and costs of the park along with an analysis of the financial aspects of the park. In so far as this forces consideration of those unmeasured benefits and costs, it is a useful approach. However, the decision[1] still remains subject to the attitudes of decision-makers who might, on the one hand, place too much emphasis on the financial analysis and by thus downgrading the other important aspects of the park, reject a park proposal which should have been accepted. On the other hand, it is possible that the decision-makers might place too much emphasis on the benefit descriptions and not enough on the financial aspects of the park and might choose to establish a park which will cost society more than the benefits it obtains from the park. In both situations, society loses from an inefficient allocation of land.

A further alternative is to conduct a strictly financial analysis of the park proposal and then include the unmeasured benefits as constraints in the analysis. Standards for recreation or conservation areas might be established and the effect of these standards on the financial analysis determined. If the standards improved the ratio of financial benefits to costs, they should be included in the proposal. If, however, the standards decrease the benefit-cost ratio, it must then be decided if the standard is worth the cost it imposes on the project. If it is included, it has implicitly been valued at, at least, its cost to the project. Clearly, this value may be more or less than the standard's actual value to society. Thus, this approach does not guarantee an optimal allocation of land between uses but it does have the merit of forcing an explicit decision to be made regarding specific benefits. In this way, subjectivity in decision-making might be diminished as each decision could be challenged by others concerned. Also,

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1 At varying points in the report we have referred to the "decision" to establish a park as though it were a single decision. In reality of course this is a sequence of decisions but this does not affect our analysis.

it may be useful in demonstrating what a benefit should at least be worth if it is to be provided by the project. This will give a threshold value for the benefit which could then be the subject of a community survey to ascertain whether the value of the benefit is greater than its cost. Community opinions can thus be included in the decision, whereas with other approaches they may not have been.

8.7 Summary

This chapter has discussed the valuation of national park benefits which have not been the subject of valuation in the case study of Warrumbungle National Park. The survey technique, with appropriate questions, appears to be widely applicable to valuing these benefits and a good definition of the benefits would enable the framing of questions which would elicit proper valuations. The costs of the survey approach would probably mean that it would be used only in the more contentious issues.

For benefits (and costs) which are not valued in considering a project, other approaches are available which at least ensure that the benefits and costs are explicitly considered in making the decision. However, each of the methods noted is open to elements of subjectivity on the analyst's or decision-maker's parts and may not lead to efficient allocation of land to national parks and other uses. On the other hand, incorporating all benefits and costs into a cost-benefit analysis framework shows promise of achieving this aim - the need is for more research to develop techniques of application to broaden its scope.

CHAPTER 9

REGIONAL AND LOCAL EFFECTS OF NATIONAL PARKS

9.1 Introduction

The first chapter of this report briefly discussed the effects a national park might be expected to have on its local region. It was noted that these effects should not always enter into a decision regarding the park as, on a national or regional scale, they may not be benefits or costs at all. This chapter considers this argument in more detail. In particular, the types of impact a national park would have on its local region are discussed. Qualitative and quantitative means of evaluating the economic effect of a national park on its surrounding region are described and the case of Warrumbungle National Park, as it effects the nearby town of Coonabarabran, is examined.

In the first section of the chapter, the types of regional effects a park might have are discussed. In the following section, the regional effects of national parks on income, employment and recreation are compared and contrasted to the national effects of parks on these factors. Sections 9.3 and 9.4 discuss the assessment of the regional effects on parks. Section 9.3 reviews qualitative methods of regional impact assessment, while Section 9.4 discusses quantitative assessment techniques. Section 9.5 contains the results of the Warrumbungle National Park study and specifies the approximate impact the park is having on incomes and employment in the town of Coonabarabran. Section 9.6 discusses the estimation of the future economic impacts of a national park while Section 9.7 summarises the estimates of Warrumbungle National Parks regional economic impact.

9.2 The nature of the regional effects of parks

The multiple use nature of a national park can give rise to various spillovers into the region surrounding the park.[1] These spillover

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1 In this chapter the benefits and costs of recreation undertaken by regional users of the parks are specifically excluded, having been incorporated in Chapter 7.

effects might include conservation spillovers, recreation spillovers and spillovers caused jointly by conservation and recreation. Each of these categories will be briefly considered and the regional benefits and costs created by the various impacts will be described.

9.2.1 Conservation spillovers

These spillovers have previously been described in the chapter dealing with the costs of a national park under the heading of external costs of the park and so will not be examined in detail here. The spillovers mentioned were such things as the effect on fire and pest incidence on neighbouring land and the effect on water management conditions surrounding the park. It was shown in that discussion that these effects could be either beneficial or detrimental to neighbouring land; the exact case for each park could only be ascertained after a detailed examination of the situation.

9.2.2 Recreation spillovers

In this section we will briefly discuss the spillovers into a region created by recreation in (tourism to) a national park. The most obvious impact of visitation to a national park is the increase in numbers of people passing through neighbouring towns. (This is especially the case for a park such as Warrumbungle National Park where the majority of visitation originates outside the local area and the main access route(s) to the park run through the local towns.) This increase in numbers can have several effects, both positive and negative, on the region.

At least some of the visitors will purchase food, camping supplies, and so on in the local towns. This will result in a direct increase in the regional income, although how beneficial this income increase really is depends greatly on whether the articles purchased are locally made or grown, or are imported into the region. More will be said on this later. Given that some income increase does accrue to local businesses and individuals, regional employment may, in turn, increase in certain sectors of the regional economy. If the income and employment increases are sustained, further boosts to the regional economy can be envisaged such as increased business for the building trade and so on.

The ultimate result may be a more diversified local economy which would be more stable in the long term than one based solely, for example, on agriculture. Thus park tourism may represent a long term benefit to a local economy more able to resist downturns in the activity of another dominant sector.

The increased visitation will clearly have its costs to the region as well. Any economy based to a large extent on tourism is likely to be unstable in the short term as a result of the marked seasonal nature of tourism. This effect would be diminished if the regional economy were diversified. In fact, if the economy were based largely (for example) on agriculture prior to the increase in tourism, it might already be attuned to seasonal variations in economic activity. The addition of a tourist sector may serve to damp or accentuate the seasonal variations, depending on the relative timing of activities in the various sectors.

Other spillovers from the increased tourism might be expected. The way of life of the inhabitants of the region may be changed, subtlely or substantially. This, however, may be a positive or a negative effect depending on the perceptions of the inhabitants - the change in pace of life may be welcomed by some but not others. Visitors from larger cities and towns may expect to be provided with more amenities than are typically found in small rural centres and the provision of these facilities would benefit local people as well. However, it is they, the local people, who most likely would have to bear the costs of these facilities through increased rates and charges. Eyesore developments might proceed in train with increasing tourism and this would be a cost to the local people as well as the visitor.

One complaint often levelled at increasing tourism in a local economy is that it may lead to localised inflation as the demand for goods and services (in the short run at least) exceeds their supply. However, this increased demand could, in the longer run, reduce prices as a bigger market (albeit consisting of largely transient members) could reduce the unit costs of the goods and services.

It appears then that the situation with spillovers caused by recreation in parks is similar to that caused by conservation spillovers. There are both positive and negative effects on the region and detailed study of each community involved is needed before any conclusions as to the relative size of the positive and negative effects can be made.

9.2.3 Other spillovers

Other spillovers into the regional economy are caused purely by the existence of the park, not from effects arising from its conservation or recreation functions.

In this category might be included the loss of employment in various sectors in local towns which depended on the previous land use for support. For example, if the land (prior to dedication as a park) was used for agriculture services sector in the local towns, leading to a decrease in income and employment in that sector. Depending on the degree to which the rest of the towns' economies rely on the agricultural sector for support, the loss of agricultural land could have a wider and more serious impact. However, this impact would only be a cost to the region if the lost income and employment was not replaced by a similar amount of income and employment (at similar wage rates) in other sectors of the regional economy. It is possible that such replacement could occur through increased employment in the tourism or park management sectors; thus there would be no direct dollar cost to the region by the loss of agricultural land. (It is conceivable that the loss of agricultural land might be a benefit to the region if it decreases the towns' dependence on a declining agricultural sector for economic activity). However, there may be psychic costs associated with the change of employment between sectors. Such costs are hard to quantify but nonetheless may represent a significant regional impact due to the establishment of a national park.

Costs to local governments are often raised as key arguments against national parks. It is argued that parks represent a loss in rateable value to the local government area and thus increase the financial burden on the rate payers throughout the area needed to maintain services. However, this argument is by no means clear cut. To the extent that land dedicated for a park was freehold and subject to rating, the statement holds. However, historically much of the land dedicated for national parks was crown land and was not subject to rating and thus its dedication as a park does not represent a loss of revenue to the local government. It has also been the case in many instances that the value of land surrounding a park has increased after the dedication of the park as people seek to purchase land in areas which will never be

"built-out". As these increases in land value are incorporated into the valuation rolls, rate income will *ceteris paribus* increase, thus offsetting any loss in rate income experienced by loss of rateable land to the park.

This chapter examines in further detail only a limited range of the regional spillovers mentioned above. In particular, the effects of park tourism on regional incomes and employment are assessed. Methods of assessing the regional impact of tourist spending on these indicators are examined and the results from the case study are discussed. However, firstly, it is necessary to consider regional effects in relation to the national effects of parks and in doing so indicate the appropriate place of regional impacts in the discussion surrounding national parks.

9.3 Regional effects v. national effects

The applicability of assessing national parks and accepting or rejecting them on a regional (economic or otherwise) basis can be questioned for several reasons. Primarily, national parks provide benefits to the whole nation, not just to the regions in which they are located, so it seems appropriate that the parks should be considered in a national context. Since the governments involved in national park provision have wider responsibilities than purely regional concerns, decisions on national parks ought to be made recognising this and not on the basis of regional pressures either for or against particular parks.

To extend this argument in an economic context, to assess national parks solely on a regional basis would be incorrect as this would preclude probably the majority of benefits of the parks from consideration, thus distorting the information on which the decision is based. Also, as it is likely that proportionately more of the costs than the benefits will be incident in the park region itself, the decision-making would become more biassed against the selection of any area for a park. An extreme example of this would be if an area were to be dedicated purely for species and habitat conservation with no recreation allowed. In such a case the local economic effects could be negative as there would be no offsetting growth in the tourist sector to absorb the loss in other sectors. Thus a decision on local economic grounds could be made to abandon a park proposal, whereas on a national level, the benefits

from conservation might far outweigh all costs incurred and lead to the opposite decision being taken. Equally, the reverse situation can be envisaged where an area may be of considerable local benefit and interest and might thus be dedicated on regional criteria while on a national level the area might be considered commonplace and not worth preserving.

A further point which can be made for a supra-regional assessment of park proposals is relevant to both economic and ecological evaluations. The selection of a given park should only proceed in the context of the existing park system. From an "ecologic-economic" point of view, planning on a regional basis could lead to the reservation of an area of land of which there are already several examples in the park system and this could be a waste of money. Funds might be better spent reserving areas as yet unsampled in the system. Also, considering recreation, for example, any expected increase in demand could be catered for by marginal investments in existing parks rather than large investments in a new region which, in any case, might only divert recreation from existing areas, leaving these areas with excess capacity. Assessment on a scale broader than regional would help to overcome these problems.

Finally, an assessment of a national park on regional economic criteria may give no guidance at all to a national or state body on whether to proceed with the park or not simply because what are costs and benefits at a regional level may not be costs and benefits at a national or state level. For example, with the dedication of a park, some jobs may be permanently and irreplaceably lost from a region and this is a cost to the region. If these people were subsequently employed at equivalent jobs elsewhere in the economy, there would be no cost to the nation. (If the jobs obtained were of a higher standard than the previous ones, there would be a benefit to the nation.) Considering the benefits of park establishment, the new income generated in a region by increased tourism may be a benefit to the region but in a national context it merely represents resources diverted from other sectors in other regions. Thus the regional benefits and costs of national parks may be no more than transfers when viewed from a national standpoint.[1]

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1 Of course, any park tourism undertaken by foreign visitors would represent a benefit to the region and also the nation.

However, an analysis of the regional effects of a park may be useful for two reasons. Firstly, the knowledge gained from such a study would be essential if appropriate adjustment policies were to be formulated, for example to assist in the relocation of people who lose their jobs as a result of the establishment of the park. The effect of the park on its local region (and on other regions), having been quantified, can thus be allowed for in formulating any other policy which might affect the area and the policies could now be formulated on a firmer data base than if no regional impact assessment had been made. Secondly, by establishing the real situation regarding the regional impact of a park, the discussion surrounding the park could centre on the park itself rather than its supposed effects (positive or negative) on its local region.

We will now consider the relationship between regional and national income, employment and recreation demand.

9.3.1 Income

Clearly, an increase in tourism to a given region is likely to lead to extra sales, and thus income, in sectors servicing tourism in that region. *Ceteris paribus* this will be a benefit to the region. However, it may not be a benefit to the nation as a whole. If all resources in the national economy are earning the same income after the tourism boost as before, then what has happened is merely a transfer of resources between regions and/or sectors. The nation, as a whole, gains no benefit from the tourism boost. It is only if the resources earn more in servicing tourism in the region than in other sectors elsewhere is there a national benefit, as this would represent a more efficient allocation of resources.

9.3.2 Employment

A similar situation holds with respect to regional and national employment changes. If all those newly employed in the tourist-serving sectors in the region were employed previously at equivalent jobs elsewhere in the nation (region), then the increase in employment in the given sectors represents only a transfer of employment within the nation (region) and not a benefit to the nation (region). Only if those now employed servicing tourism were previously unemployed or

underemployed in the nation (region) would the boost in tourist-servicing employment be a benefit to the nation (region).

9.3.3 Total recreation demand

The establishment of a new national park is quite likely to lead to an increase in tourism to a region. This, again, may or may not be a national increase, depending on where the increased visitation originates. If tourism to all other areas is unaffected by the new park's attraction to tourism, then the nation will experience an overall rise in tourism and presumably will benefit from increasing recreation undertaken. On the other hand, tourism to the new park may simply represent trips which otherwise would have been made to existing parks - there is no overall increase in the number of recreation trips undertaken to parks. (However, the quality of each trip may alter due to changing crowding characteristics.) It is conceivable that the operations of parks from which visitation has been diverted will be markedly affected by the drop in their visitation numbers. This emphasises the fact that decisions on parks should not be made on a small regional scale; rather, the whole system of parks on a state or national basis ought to be considered when new proposals are discussed.

The remainder of this chapter considers approaches that have been taken in assessing regional effects and which could be applied in the current study examining the regional impact of a park. In particular, the remainder of the chapter considers the regional economic impact of the park. The next section considers in detail qualitative methods of impact assessment, while Section 9.5 considers quantitative assessment methods.

9.4 Qualitative approaches to the assessment of regional economic impacts

Various possible approaches exist for examining regional economic impacts. These may be divided into qualitative and quantitive methods. Qualitative methods include the use of economic and social indicators (either separately or combined), while quantitative methods include input-output and economic base analyses. The qualitative methods will now be discussed with the methods being described and data requirements and problems noted.

9.4.1 "Social indicators"

This approach to regional impact assessment basically collects data on various parameters and assesses them on a qualitative basis. For example, considering economic activity, indicators deemed important in that activity are selected and analysed, perhaps on a comparative basis with other areas, in an attempt to gauge any apparent economic effects. Moore (1962), in an American study examining the impact of reservoir construction and recreation on local economic growth, analysed time series data on the following variables, considered to be important indicators of economic activity in a region: population, per capita income, wage bills, retail trade and bank deposits. A comparison was made between regions containing reservoir recreation areas and regions without them. The conclusions of this study suggested that reservoir based recreation was associated with a slowing in population decline in rural areas and an increased growth of per capita incomes, total wage bills, retail trade value and bank deposits when compared to areas where the recreation sector was absent. The results indicate little more than this. They demonstrate only an association, not a causal link, between recreation and increased economic activity in otherwise depressed rural areas. A mere examination of the gross statistics such as this cannot tell how much the recreation sector has contributed to the change in economic activity of the region, its affect on other sectors in the region and whether the benefits of the increased economic activity accrue to the region itself or are leaked to other regions. (For example bank deposits may be largely used to promote activities in regions distant from the point of deposit and in this case, increases in money deposited could mean an actual decrease in money circulating and available in the region itself.) In short, all an observation of these various factors gives is an overview of the region (perhaps in comparison to other regions if that is desired). It does not (and cannot) indicate the economic impact of any project on a region for reasons which will be outlined.

For illustrative purposes only, a procedure similar to Moore's has been conducted in this present case study of Warrumbungle National Park. The approach is shown to be descriptive of the region only and in no way enables the park's impact on its local region to be examined. It is included here only to emphasise the weaknesses of the approach and is in no way recommended for regional analysis.

The parameters selected for analysis were population, employment classified by industry groups, value of ordinary services provided by local government, retail sector statistics and tourist accommodation data. Data have, where possible, been collected from the 1947 census and each census thereafter to encompass the period prior to the initial dedication of land for the park (1953) until the present. In some cases, this has not been possible as the data record does not extend that far back (e.g. with the value of retail sales). Following Moore's (1962) example, an area for comparison with Coonabarabran was selected. The neighbouring shire Coonamble, in which the majority of Warrumbungle National Park is situated, receives very little of the business generated by park visitation, while Coonabarabran receives the vast majority.[1] Following Moore's reasoning, the effects of visitation might be shown in a comparison of statistics for the two areas. A discussion of each "indicator" follows.

Population

The population figures for Coonabarabran and Coonamble Shires are shown in Tables 9.1 and 9.2 below. An examination of the total shire figures show population increases to 1961 and decreases thereafter for both shires. The decreases are probably the result of the decline of the agricultural sector upon which Coonamble is much more dependent than Coonabarabran (see Tables 9.3 and 9.4). The decline from the peak population for Coonabarabran Shire is 413, a loss of 5.39%, while the decline for Coonamble Shire is 1413, a loss of 19.48%. In both cases where figures are available, the towns (Coonabarabran and Coonamble themselves) have shown population increases, in some instances at the expense of the rural portion of the shire. This is especially marked in Coonabarabran where the loss of 527 in rural population from 1954 to 1966 is almost exactly offset by a gain of 528 in the town population over the same period. Coonamble Shire on the other hand experienced a net loss over the same period of 67, the town failing to offset rural losses.

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1 Pers. comm. A. Morris, District Ranger, NSW NPWS, Coonabarabran.

Table 9.1

Population : Coonabarabran Shire and Town

	Year[a]					
	1947	1954	1961	1966	1971	1976
Town	NA	2210	2547	2738	NA	NA
Intercensal Changes Number		+337	+191			
Intercensal Changes %		+15.25%	+7.50%			
Rural	NA	5199	5116	4672	NA	NA
Intercensal Changes Number		-83	-444			
Intercensal Changes %		-1.60%	-8.68%			
Total Shire	6593	7409	7663	7410	7408	7250
Intercensal Changes Number		+816	+254	-253	-2	-158
Intercensal Changes %		+12.38%	+3.43%	-3.30%	-0.03%	-2.13%

Notes: a - Census population at 30th June in specified year.

NA - not available.

Decline from peak: 413, 5.39% (1961 to 1976)

What can be concluded from this? Firstly, there is a similar pattern of population change in the two regions (overall decrease with an increasing town population); secondly, Coonabarabran Shire seems to be holding its population better than Coonamble Shire. It may be inferred from this that some different factors are at work in the two regions to produce the differing population results. One of these different factors may be the effect of tourism to Warrumbungle National Park on Coonabarabran, an effect absent from Coonamble. However, without a much more extensive analysis of the regions, this conclusion is not warranted and other factors may contribute to slowing Coonabarabran's decline. For example, its situation on main north-south and east-west highways could be more of a boost than any park tourism through the town. An examination of population figures cannot shed any light on the impact of the national park on its local region.

Employment Classified by Industry Group

An examination of employment in the two shires (Tables 9.3 and 9.4) over time provides more insight into the structure of the regions than an examination of the population figures. Both shires are heavily dependent on the agricultural sector, although this dependence has decreased with time in each case. However, Coonabarabran exhibits less dependence than Coonamble on this one sector (an average of 42.64% as against 50.37% of employment in agriculture). To counter-balance this, Coonabarabran Shire has relatively more employment than Coonamble Shire in the following sectors - mining, manufacturing, construction, wholesale and retail, transport and storage, communication and public administration, community services and finance, although the differences are (statistically) not significant[1] for the construction and communication sectors. A full comparison between sectors in the shires is shown in Table 9.5.

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1 This term is explained in footnote b to Table 9.5.

Table 9.2

Population : Coonamble Shire and Town

	Year[a]					
	1947[b]	1954	1961	1966	1971	1976
Town	2567	2910	3235	3396	NA	NA
Intercensal Changes Number		+343	+325	+161		
Intercensal Changes %		+13.36%	+11.17%	+4.98%		
Rural	2967	3964	4017	3411	NA	NA
Intercensal Changes Number		+997	+53	-606		
Intercensal Changes %		+33.60%	+1.34%	-15.09%		
Total Shire	5534	6874	7252	6807	6247	5839
Intercensal Changes Number		+1340	+378	-445	-560	-408
Intercensal Changes %		+24.21%	+5.50%	-6.14%	-8.23%	-6.53%

Notes:

a - Census population at 30th June in specified year.

b - Figures for 1947 relate to Coonamble Municipality (Town) and Wingadee Shire (Rural). These were amalgamated on 1/5/52 to form Coonamble Shire.

NA - not available

Decline from peak: 1413, 19.48% (1961 to 1976).

Table 9.3

Employment by Industry[a] - Coonabarabran Shire

Year[b,c]

Industry	1947		1954		1961		1966		1971		Average %	Standard Deviation
	No.	%	No.	%	No.	%	No.	%	No.	%		
Agriculture	1177	45.76	1309	45.44	1260	44.63	1225	42.13	1005	35.23	42.64	4.38
Mining	5	0.19	5	0.17	12	0.43	2	0.07	9	0.32	0.24	0.14
Manufacturing	172	6.69	264	9.16	162	5.74	159	5.47	137	4.80	6.37	1.70
Electricity, etc.	NA	NA	18	0.62	20	0.71	22	0.76	19	0.67	0.69	0.06
Construction	231	8.98	251	8.71	262	9.28	303	10.42	287	10.06	9.49	0.72
Wholesale & Retail	233	9.06	343	11.91	376	13.32	346	11.90	378	13.25	11.89	1.73
Transport & Storage	166	6.45	150	5.21	154	5.46	156	5.36	153	5.36	5.57	0.50
Communications	41	1.59	58	2.01	66	2.34	83	2.85	79	2.77	2.31	0.53
Public Admin.	155	6.03	211	7.32	49	1.74	50	1.86	78	2.73	10.63	2.81
Comm. Services					230	8.15	247	1.72	246	8.62		
Finance, etc.	41	1.59	44	1.53			54	8.49	96	3.36		
Entertainment	139	5.40	179	6.21	171	6.06	180	6.19	186	6.52	6.08	0.41
Other & not stated	212	8.24	49	1.70	61	2.16	81	2.79	112	3.93	3.76	2.64
Unemployed	NA		NA		NA		NA		68	2.38		
TOTAL	2572	99.98[d]	2881	99.99[d]	2823	100.02[d]	2908	100.01[d]	2853	100.00		
% of population in workforce	39.01		38.89		36.84		39.24		38.51			

Notes: [a]Industries classified according to Australian Standard Industrial Classification (Preliminary), Commonwealth Bureau of Census and Statistics, Canberra, 1973.

[b]Employment at 30th June in specified year. [c]1976 not yet available.

[d]Totals not equal to 100% due to rounding error. NA Not available.

Table 9.4

Employment by Industry[a] - Coonamble Shire

Industry	Year[b,c] 1947[d] No.	%	1954 No.	%	1961 No.	%	1966 No.	%	1971 No.	%	Average %	Standard Deviation
Agriculture	1252	54.67	1509	54.81	1469	52.35	1237	46.02	1025	44.01	50.37	5.04
Mining	1	0.04	0	0.00	2	0.07	0	0.00	3	0.13	0.05	0.05
Manufacturing	124	5.41	120	4.36	90	3.21	125	4.65	86	3.69	4.26	0.85
Electricity, etc.	NA	NA	16	0.58	25	0.89	21	0.78	17	0.73	0.75	0.13
Construction	127	5.55	237	8.61	235	8.37	286	10.64	109	4.68	7.57	2.43
Wholesale/Retail	197	8.60	322	11.70	350	12.47	315	11.72	300	12.88	11.47	1.68
Transport & Storage	104	4.54	81	2.94	81	2.89	97	3.61	70	3.01	3.40	0.70
Communications	34	1.48	61	2.22	64	2.28	60	2.23	57	2.45	2.13	0.38
Public Admin.	113	4.93	157	5.70	29	1.03	33	1.23	64	2.75	9.59	3.29
Comm. Services					221	7.88	209	7.78	190	8.16		
Finance, etc.	37	1.62	37	1.34			48	1.79	87	3.74		
Entertainment	168	7.34	183	6.65	184	6.56	176	6.55	154	6.61	6.74	0.34
Other & Not Stated	133	5.81	30	1.09	56	2.00	81	3.01	56	2.40	2.86	1.79
Unemployed	NA		NA		NA		NA		111	4.77		
TOTAL	2290	99.99[e]	2753	100.00	2806	100.00	2688	100.01[e]	2329	100.01[e]		
% of population in workforce	41.38		40.05		38.69		39.49		37.28			

Notes: [a]Industries classified according to Australian Standard Industrial Classification (Preliminary), Commonwealth Bureau of Census and Statistics, Canberra, 1973.

[b]Employment at 30th June in specified year.

[c] 1976 not yet available

[d]Figures for Coonamble Shire for 1947 include Coonamble Municipality and Wingadee Shire - these were amalgamated on 1/5/72 to form Connamble Shire.

[e]Totals not equal to 100% due to rounding error.

NA not available.

Table 9.5

Comparison between Employment in various Industry Sectors, Coonabarabran and Coonamble Shires, 1947 & 1971.

Sector	Mean % Employment		t statistic[a]	Level of Significance[b]
	Coonabarabran Shire	Coonamble Shire		
Agric.	42.64%	50.37%	-7.7475	.0005
Mining	0.24	0.05	3.9511	.01
Manufg.	6.37	4.26	2.8732	.025
Elect.	0.69	0.75	-1.1839	n/s
Constr.	9.49	7.57	1.7841	n/s
W/sale-Retail	11.84	11.47	3.4350	.025
Trans./Storage	5.57	3.40	14.5249	.0005
Comm.	2.31	2.13	1.2980	n/s
Public Ad.) Comm. Serv.) Finance)	10.63	9.59	3.6577	.025
Entertm't	6.08	6.74	-2.0422	n/s

[a] A positive value indicates percentage in Coonabarabran greater than percentage in Coonamble; a negative value, the opposite.

[b] Significance is a statistical term and can be interpreted here as the probability that the two means are in fact the same, given the data from which they were drawn. Thus there is only one chance in 100 of the result for the mining sector occurring if the two sectors employed equal proportions of the workforce in the two shires. This is only a slight chance, so it can be concluded, with 99% certainty, that the proportion of employment in the mining sector in the two shires is different. N/S represents not significantly different (the cutoff level being a level of significance of 0.05) and means that, on the basis of the data used, it cannot be concluded that the proportion of employment in the respective sectors in the two shires is different.

The results shown in Table 9.5 suggest that the two shires have a different economic structure (in so far as this can be measured by employment) with the economy of Coonabarabran Shire being more broadly based than that of Coonamble Shire. Results which might be of particular

relevance to this project relate to the construction, wholesale and retail, transport and storage, public administration, community services and finance and entertainment sectors as an increase in tourism to an area would be most likely to influence these sectors, if any. Each of these sectors will be taken in turn.

An increase in tourism could influence employment in the construction industry by leading to the building of new shops, accommodation establishments and housing for new tourist-serving employees. While there is a relatively larger construction sector in Coonabarabran Shire than in Coonamble Shire, the difference is not statistically significant (i.e. could quite possibly have happened by chance and not reflect any difference in the actual situation in the shires). The implications of this for the tourist sector are unclear. On the one hand the extra Warrumbungle tourism may have had no effect on the construction industry but on the other it might have boosted construction for the tourist industry but switched the resources for this from construction for other sectors. More detailed analysis of the construction industry is required before any conclusions can be drawn regarding the real impact of tourism on it.

The wholesale and retail sector in Coonabarabran Shire is significantly larger than its counterpart in Coonamble Shire. While this may indicate extra employment generated by tourism to the Warrumbungle National Park, it may also in part or in whole represent business generated by through-traffic as the town of Coonabarabran is situated on main highways while Coonamble is situated away from these routes. A similar situation is evident when considering the transport and storage sectors. The larger one in Coonabarabran most probably reflects its situation on main transport routes rather than any other factor.

Considering the Public Administration, Community Services and Finance Sectors, these again are significantly larger in Coonabarabran Shire than in Coonamble Shire. This would be expected if tourism is an important activity in one area as opposed to another, as the visitors would tend to demand such services as are found in their home areas, mostly large urban centres (e.g. Moore (1962) p. 108). However, once again, this does not really assist in assessing the impact of Warrumbungle visitation on Coonabarabran as the extra services could be demanded by through-traffic, not park visitors. In any case, even if park tourism

has caused a boost in these various sectors, it could not be concluded that this was an employment boost to the region as the increases may merely represent switches from other sectors or even labour imported from other regions.

The final industry to be considered is the entertainment sector. (This includes cafes, restaurants, clubs, accommodation establishments, parks, picture theatres, laundromats, and so on). Following Moore's reasoning, this sector, above all, would be expected to reflect the relative importance of tourism to an area. The data, however, run counter to this proposition. The entertainment sector for Coonabarabran Shire is relatively smaller (though not significantly so) than that in Coonamble Shire and on the basis of this, it could be concluded that the tourism to the Warrumbungles and Coonabarabran was having little effect on the regional economy. However, factors such as the type of tourism to each area would need to be examined in order to clarify this situation as the impacts, if any, may primarily occur in other sectors.

The final comment that could be made regarding the structure of Coonabarabran's economy is to assess changes in it over time. This can be done by calculating the coefficient of correlation between the structure observed at various points in time. A coefficient of +1.00 would indicate that the economies showed exactly the same structure (as measured by percentage of employment in each sector) at each point in time. As the coefficient decreases, the dissimilarities in structure increase. Table 9.6 shows the results of such a comparison for Coonabarabran.

Table 9.6

Correlation Coefficients Comparing the Structure of the Economy of Coonabarabran Shire at Different Points in Time

Year	1947	1954[a]	1961[a]	1966[a]	1971[a,b]
1947	1.00	0.98	0.98	0.97	0.95

Notes: [a] Electricity sector combined with Other and Not Stated to accord with 1947 classification.

[b] Unemployed combined with Other and Not Stated to accord with 1947 classification.

The results show that the economy has been slowly changing structure with time when compared to its structure in 1947. An inspection of the figures in Table 9.3 reveals that much of this change is probably due to the decline in the agriculture sector with increases in the construction and wholesale and retail sectors. The agricultural decline is most probably due to factors other than increasing regional tourism, but the growth in the other sectors may be a result of it. Once again, however, the figures provide no evidence that this is the case, or, if it is, whether park visitation has been the main factor in increasing regional tourism.

Thus, considering the structure of the economy in this way does not indicate the impact of tourism on the region. In particular, such an examination does not identify the impact of park tourism on the regional economy because it says nothing about the source of changes in any sector. The change in employment could merely represent switching of labour between sectors at equivalent wage rates (e.g. from agriculture to construction) or between locations (e.g. from Sydney to Coonabarabran) in which cases it does not represent growth in the regional economy. This descriptive approach to analysing structure thus sheds no light on the impact of Warrumbungle National Park on Coonabarabran.

Value of Ordinary Services provided by Local Government

Moore (1962, p.108, pp. 142-144) stresses the impact a tourist industry can have on towns close to the recreation site. Among these reported impacts is a demand for increased community services. In the present context, this has been measured by the value of ordinary services[1] provided by the local governments in the two shires over time. The total value provided (see Tables 9.7 and 9.8) has been greater in Coonabarabran for roughly the first half of the data recorded but less than Coonamble for the second half. The same pattern is reflected when the values per head are compared. This runs counter to Moore's proposition in that with the marked increase in tourism to Warrumbungle

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1 Maintenance of roads, bridges and sewers, garbage services, parks and reserves, lighting, town planning, libraries, and so on.

Table 9.7

Value of Ordinary Services Provided - Coonabarabran Shire

Year	Population[a]	Value of Ordinary Services Provided[b]	Value of Ordinary Services Provided per capita
1947	6593	$ 95268	$14.45
1948	6690	112606	16.83
1949	6870	134182	19.53
1950	7060	132460	18.76
1951	7250	NA	NA
1952	7300	285600	39.12
1953	7409	257544	34.76
1954	7409	322184	43.49
1955	7500	343440	45.79
1956	NA	NA	NA
1957	7720	483954	62.69
1958	7770	537640	69.19
1959	7890	550906	69.82
1960	NA	NA	NA
1961	7663	679778	88.71
1962	7720	605524	78.44
1963	7750	542584	70.01
1964	7680	758008	98.70
1965	7680	570554	74.29
1966	7410	647243	87.35
1967	7470	634748	84.97
1968	7560	917128	121.31
1969	7510	778073	103.60
1970	7500	842672	112.37
1971	7408	922740	124.56
1972	7320	1031000	140.85
1973	7280	1040000	142.86
1974	7200	1311000	182.08
Increases	No 607	1215732	167.63
1947-74	% 9.21%	1276.12%	1160.07%

Notes a. Population figures for 1947,54,61,66,71 are census measures. Figures for 1948-52 estimated at Dec 31 in relevant year. Figure for 1953 is 1954 Census figures. Figures for all other years estimated at Jun 30 in relevant years.

b. Roads, bridges, sewers, garbage, parks, lighting, town-planning etc

c. Value of ordinary services recorded to nearest 1000 dollars

Table 9.8

Value of Ordinary Services Provided - Coonamble Shire

Year	Population[a]	Value of Ordinary Services Provided[b]	Value of Ordinary Services Provided per capita
1947[d]	5534	74280	$13.42
1948	5570	90776	16.30
1949	5680	105676	18.60
1950	5870	105422	17.96
1951	6480	NA	NA
1952	6620	179322	27.09
1953	6874	203406	29.59
1954	6874	238056	34.63
1955	7000	332032	47.43
1956	NA	NA	NA
1957	7140	370834	51.94
1958	7260	463812	63.89
1959	7420	556284	74.97
1960	NA	NA	NA
1961	7252	477216	65.80
1962	7340	522238	71.15
1963	7420	677284	91.28
1964	7100	766834	108.00
1965	7040	841688	119.56
1966	6807	1047605	153.90
1967	6820	981708	143.95
1968	6740	NA	NA
1969	6710	938876	139.92
1970	6650	970951	146.01
1971	6247	983067	157.37
1972[c]	6100	1423000	233.28
1973	6000	1555000	259.17
1974	5900	1627000	275.76
Increases No	366	1552720	262.34
1947-74 %	6.61%	2090.36%	1954.84%

Notes a-c As for Table 9.7
d Figures for 1947-52 include Wingadee Shire and Coonamble Municipality. They were amalgamated on 1/5/52 to form Coonamble Shire.

Table 9.9

The Retail Sector - Coonabarabran and Coonamble Shires

Year	Coonabarabran			Coonamble		
	Estab'mnts	Empl'mnt	Sales ($)	Estab'mnts	Empl'mnt	Sales ($)
1968-9	107	504	6178000	94	430	5848000
1973-4	118	502	7740000	89	353	6354000
Change)No.	+11	-2	+1562000	-5	-77	+506000
) %	+10.28%	-0.40%	+25.28%	-5.32%	-21.81%	+8.65%

Source: Australian Bureau of Statistics, N.S.W. Office. Handbook of Local Statistics, various issues.

National Park (see Chapter 4), the opposite trend would be expected to be observed. Clearly, other forces are at work which are masking the tourism effect (if indeed it is operative at all) and an analysis such as this cannot reveal the true situation.

The Retail Sector

The retail sector is clearly one which would be greatly affected by tourism to an area so, following Moore, an analysis of retail trade could provide an indicator of the impact of tourism on a region's economy. Data on the retail sector at the local government level is poor, the only data being from the economic censuses of 1968-9 and 1973-4. These data are presented in Table 9.9.

Even though there are little data, what there are suggest that the total retail sector in Coonabarabran is bigger than that in Coonamble. The number of retail establishments in Coonabarabran has risen, but has fallen in Coonamble; employment in Coonabarabran's retail sector has remained roughly constant but has fallen markedly in the sector in Coonamble; sales in both shires have risen but the increase in Coonabarabran is, proportionately, about three times as great as that in Coonamble. It is possible that this pattern is brought about by tourism in Coonabarabran Shire which does not occur

in Coonamble but without an analysis of the origin of sales (i.e. who brought the goods) this could not be stated with certainty. It is yet another step to conclude that it is tourism to Warrumbungle National Park that is causing any or all of the growth in the retail sector. Also, an examination of sales figures like this does not allow an estimation of the impact of those sales on the regional economy. This impact will depend on where the purchased goods came from. If all the goods came from outside the region, there would be little impact; if the goods were all made in the region itself, the impact could be great. This point will be examined at length later in this chapter when multiplier effects are considered.

Tourist Accommodation

The final "indicators" to be examined relate specifically to the tourist sectors in the two economies. Here data (see Tables 9.10 and 9.11) are as poor as for the retail sector but serve to show the relative size of this sector in Coonabarabran and Coonamble.

The number of establishments offering accommodation in Coonabarabran is more than twice that in Coonamble and increased in the period observed, while the number in Coonamble decreased. Employment is 3½ to 4 times greater in Coonabarabran's accommodation sector and wages and salaries (as reported for 1973-4) are correspondingly about 4 times greater. Almost 5 times as much accommodation was purchased in Coonabarabran as in Coonamble in 1976; takings from accommodation were more than 6½ times as great for the same year. Moreover, accommodation takings have increased at a greater rate in Coonabarabran than in Coonamble and gross takings are substantially higher in the former region.

All this indicates that the accommodation sector in Coonabarabran is more important than its counterpart in Coonamble. This is probably a result of larger volumes of tourism to Coonabarabran, but the cause of this is, in the absence of other data, unknown. Moreover, the economic impact of tourism cannot be gauged by simply measuring takings, wages and employment as this takes no account of the switching of incomes between sectors, the origin of employment in the industry and so on. This is further discussed when multiplier analysis is considered below.

Table 9.10

The Tourist Accommodation Sector - Coonabarabran Shire

Year	No. of Estab'mnts[a]	Full-time Emplymnt.[b]	Other Emplymnt.[b]	Wages & Salaries	Room-Nights	Takings from Accommodation	Gross Takings
1973-4	12	44	59	$260,000	NA	$426,000	$1,429,000
1976	14	54	42	NA	41,411	$714,000	NA

Table 9.11

The Tourist Accommodation Sector - Coonamble Shire

Year	No. of Estab'mnts[a]	Full-time Emplymnt.[b]	Other Emplymnt.[b]	Wages & Salaries	Room-Nights	Takings from Accommodation	Gross Takings
1973-4	6	14	14	$64,000	NA	$71,000	$556,000
1976	5	16	8	NA	8,590	$108,000	NA

Source: Australian Bureau of Statistics, N.S.W. Office. Handbook of Local Statistics, various issues.

Notes: [a] at 30/6/74 and 31/12/76.
[b] employment at 30/6/74 and 30/6/76.
NA Not Available

Thus far in this chapter, the "Social Indicator" method of impact assessment has been discussed, with the approach closely following that of Moore (1962). It is clear from the preceding discussion that such an analysis is totally inadequate when trying to assess, as is the aim here, the economic impact of a specific (park) project. It can only, at best, give a general and comparative description of economies considered. The approach completely ignores crucial issues in regional analysis. It does not (and cannot) analyse the origin of any employment and income changes and hence is unable to specify the economic impact of any project on an economy.[1] As such, it should be discarded in any form of regional analysis and other methods must be used.

9.4.2 "Social Scaling"[2]

A similar but somewhat more sophisticated approach to impact assessment attempts to combine indicators (including some of those discussed above) into a scale to give a single measure of impact - these methods are here termed "social scaling" methods. In essence, the procedure runs as follows.

Step 1: Firstly, the indicators which are to make up the scale must be selected. These might include strictly financial variables (e.g. the amount of retail sales, the value of building activity), as well as sociological (e.g. crime statistics), natural (e.g. climate) and institutional (e.g. local government statistics) variables.

Step 2: Each of these indicators must now be measured in its usual units. If it is not normally measured, scaling on, for example, a 0 to 10 scale could be used instead.

Step 3: Following measurement, each indicator must be weighted to reflect its relative importance. The weighted measures must then

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1 Even though it may be useful in other fields of research such as sociology.

2 See Sinden & Worrell (1979) for a more detailed account of these methods.

be standardised so that all measures are on a common scale, then the standardised measures can be aggregated into a single score, the index number.

Obtaining such a score for each of various towns would enable a comparison of the situation in each town to be made with the situation in other towns. Then, for example, the effects of a given Government policy on the various towns could be gauged by changes in the aggregated score as the policy affected the variables included in the scale. Equally, the effect of different government policies on the same town could be gauged. Thus the method (really a group of methods) appears useful if an impact analysis is to be conducted on differing areas.

However, serious difficulties associated with each of the above steps render the approach highly suspect. The result is highly susceptible to manipulation, depending on the input, and the final result could vary with the will of the analyst. The difficulties will now be discussed.

The basic problem underlying all steps in the process is that, at each stage, decisions are essentially arbitrary and are open to manipulation by the analyst. For example, it may be very important who selects the variables to be included in the index as the inclusion or omission of a particular variable may have a crucial bearing on the resulting value of the index. Equally, the subjective measurement of a given variable might be completely different among different people as would an appropriate set of weights expressed by them to reflect the relative importance of different variables. Various methods of standardisation are available and the method used can affect the results achieved (Sinden and Worrell 1979). As there are no criteria by which to select the method of standardisation to be used, another element of arbitrariness is introduced. In the final step, aggregation, the method used can also affect the final indices derived and again the selection of an aggregation procedure seems fairly arbitrary.

The problems outlined above are sufficient to eliminate the "social scaling" methods as means to assess economic impact. The results of an analysis may be more due to the prejudices and impressions of the analyst than any actual impacts occurring in an economy.

The qualitative methods of impact assessment thus far discussed have been shown to be incapable of assessing the economic impact of

a national park on a region. Various quantitative means exist which can assess this impact both more directly and more usefully. These methods are now examined.

9.5 Quantitative methods of assessing regional economic impacts

Five approaches will be discussed in this section. They are:-

- the "Ad Hoc" approach
- the "Keynesian" approach
- "Economic Base" analysis of an economy
- "Input-Output" analysis of an economy
- "From-To" analysis of an economy.

At the outset, it should be noted that these methods have generally been used to assess impacts of policies or projects on variables such as sales revenue, regional income and regional employment. By and large, applications have taken no consideration of the "social" effects of the policies and projects studied.[1]

The ultimate goal of all the quantitative approaches is to derive a Multiplier (for sales, income or employment). The nature of a multiplier will now be briefly stated.

Expenditure by tourists in a given sector of a regional economy will not solely affect that sector. Rather, the effects will spread throughout the economy depending on the links that exist between the various sectors in the economy. A simple example will serve to illustrate this.

Assume that the moteliers in a town purchase all their food supplies in that town and that food costs consume one quarter of income from accommodation let to tourists. Assume also that another quarter of the income is spent on wages and salaries, for staff and the owner, while the remaining half is used to pay off debts owed in a completely different region. So for a $100 accommodation purchase by a group of tourists, $25 would be spent on food for the establishment, $25

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1 Karunaratne and Jensen (1978) show how environmental considerations may be included in an input-output framework, but the majority of work to date has not done this - it is characterised by an emphasis on sales, income and employment.

on wages and salaries and $50 on debt repayments. Let us now examine the food retailing sector which has just received $25 income. Suppose this sector characteristically purchases 60% of its supplies from local growers and 40% from suppliers outside the region and makes a 20% profit on all its sales (which goes to the owners as a salary). Thus, $5 would end as salary, $12 would go to local growers, and $8 would go outside the region and therefore be lost to it. Further examining the local growers, suppose 50% ($6) of the value of purchases from them is respent outside the region on seed and fertiliser, leaving 50% as income for them. Finally, assume all the wages and salaries earnt are spent within the region. The transactions flow can be envisaged in Figure 9.1.

In the terminology of multiplier analysis, the initial $100 is termed the direct effect. Spending in other sectors arising from this direct effect (e.g. here in the food retailing and growing sectors) is termed the indirect effect. The increased income yield is used for consumption within the region and the amount of this consumption is termed the induced effect of the initial spending. (Here it is 100% of income earned - it could be 50% or any other figure).

We are now in a position to calculate the multiplier. The formula for its calculation is:-

$$\frac{\text{Direct effect} + \text{Indirect effects} + \text{Induced effects}}{\text{Direct Effect}}$$

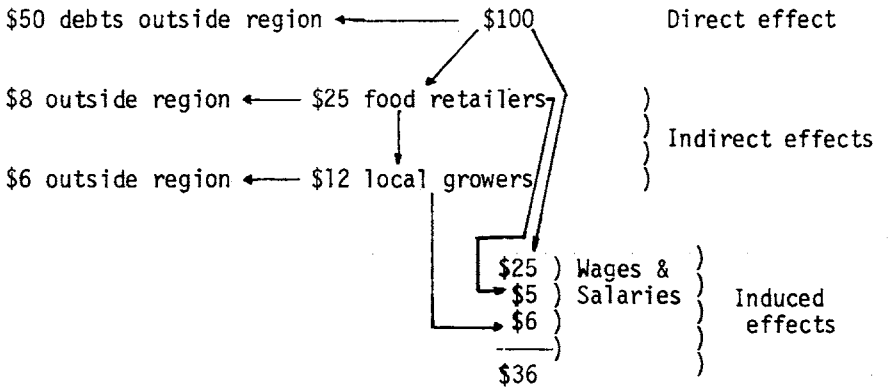
For our example, this would be:-

$$\frac{100 + 37 + 36}{100}$$

or 1.73. In other words, every $100 spent by tourists in the accommodation industry would generate $173 of income for the region. Clearly, the proportion of money spent outside the region ("leakage") is of crucial importance in determining the size of the multiplier. The more money spent outside, the smaller will be the multiplier. Thus, it is usually found that the size of the multiplier varies directly with the size of the region. A small region is most unlikely to be self-sufficient in, for example, food and probably the majority would be imported from other regions, representing a leakage of money to the outside areas. Similarly, building supplies, fuel, transport equipment and so on would most probably be imported into a small region, representing further leakages

Figure 9.1

Hypothetical Flow of Transactions Stemming from $100 Accommodation Purchase by Tourists



from the regional economy and lowering the multiplier impact of any spending in the economy.

A second point to note is that the multiplier would not be the same for expenditure in differing sectors. The simple example will be used again. Recall that $100 of expenditure in the accommodation sector had a multiplier value of 1.73. If an amount of $100 is spent by tourists directly in the food retailing sector, the multiplier would be 1.92 (a direct effect of $100, and indirect effect of $48 and an induced effect of $44). The multiplier is greater as there is less leakage to the outside.

A related principle to these is that the more complex a region's economy (i.e. the more linked sectors in the economy) the higher will be the multiplier. For instance, suppose there is no local food growing sector in our sample economy and that all food must be purchased outside the economy. Now for a direct effect of $100, the indirect effect will only be $25 and the induced effect $30. The multiplier is only 1.55 for the simpler economy.

Using the concept of the multiplier, the financial impact of tourism on an economy can be gauged. Firstly, the multiplier value must be derived, preferably one for each sector in the economy but, if not, then an aggregate multiplier. Secondly, expenditure-by-sector data (or aggregate expenditure data if necessary) must be collected from the tourist group of interest. In the present case,

this is the visitors to Warrumbungle National Park. Then by multiplying these expenditures by the relevant multipliers, the total financial impact on the economy (Coonabarabran) by tourists (Park visitors) can be ascertained. Section 9.6 contains the results of this procedure. Prior to this, however, a brief description will be given of the five methods of deriving a multiplier. Each method provides a "short-cut" way of tracing expenditures through an economy, as this clearly could be a very time consuming task with any real situation.

9.5.1 The "ad hoc" approach[1]

This model takes the form $\frac{A}{1-BC}$ where "A" represents the proportion of tourist's expenditure which remains within the region after leakages from the actual spending itself; "B" represents the proportion of their income that local people spend on locally produced goods and services; "C" represents the proportion of local people's expenditure that becomes income for other local people. This basic model has been extended (notably by Archer and Owen (1971)) to enable a more detailed analysis of tourist impact on an economy - multipliers were derived for expenditure by each different type of accommodation user instead of the one multiplier which would be derived using the basic expression. The formula used by Archer and Owen (1971) was:-

$$\sum_{j=1}^{N} \sum_{i=1}^{n} Q_j \; K_{ij} \; V_i \left(\frac{1}{1 - L \sum_{i=1}^{n} X_i Z_i V_i} \right)$$

where j = types of tourist accommodation, 1 .... N.

i = types of consumer outlet, 1 ..... n.

Q = the proportions spent by each type of accommodation user.

K = the proportions spent on each type of consumer outlet by each category of tourist.

V = the income generation in each category of expenditure.

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1 This terminology and discussion follows Archer (1973).

L = the propensity to consume

X = the pattern of consumer spending

Z = the proportion of income spent within the region by the inhabitants

The term outside the brackets measures "A" in the simple formula, while "BC" is measured in the denonimator.

Archer (1973) cites the main advantage of the ad hoc approach as its limited data requirements. Mitigating against this is its "limited value to policy-makers and planners" (Archer (1973), p.6), as it provides only a restricted view of the one sector. Implications of activity in other sectors for the tourist sector are ignored, although these may be of crucial importance. For example, restrictions in the building industry may make it impossible to expand the motel industry even if the multiplier analysis indicated this would be the most appropriate course of action to take. Indeed, a policy decision to increase the size of the motel industry based on an ad hoc multiplier analysis could create many regional problems rather than boost the regional economy. The ad hoc method also fails to fully take account of the induced effects of increased spending and these may be quite large.

9.5.2 The "Keynesian" approach

This approach attempts to model the leakages that occur in the regional economy by utilising concepts such as the marginal propensity to consume, the marginal propensity to import and the marginal tax rate.[1] For example, take an income of $1 to the regional economy. If the marginal tax rate is 0.3, 30 cents would be unavailable to the regional economy but would be leaked to the national economy as a whole. If the marginal propensity to consume was 0.8, then only 56 cents of

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1 If a region's marginal propensity to consume was 0.8, then for the last dollar of disposable income, 80 cents would be consumed and 20 cents saved. If a region's marginal propensity to import was 0.5, then for the last dollar of disposable income, 50 cents would be spent on imports and 50 cents spent on local goods and services. If the marginal personal income tax rate was 0.3, then for the last dollar of income received tax payable would be 30 cents.

the original $1 would actually be spent in the economy, 14 cents leaking out of the form of savings. If, further, the marginal propensity to import were 0.5, only 28 cents of the original dollar income would be spent in the regional economy, with 28 cents leaked to other regions. Thus on the first round of expenditure, taking direct and indirect effects alone into account, the multiplier would be 1.28. A further consideration of induced effects could raise the multiplier value depending on what portion of the 28 cents became new personal income in the region.

The main weakness of this approach lies in the fact that regional values for the parameters mentioned above, typically are not available and recourse is generally made to national statistics. The point is that the derived multiplier then refers to the nation as a whole rather than to any specific region and it may give no guidance on the situation in any region at all in so far as no region will possess a similar, scaled down version of the national economy. Several authors have attempted to estimate regional multipliers using this approach (e.g. Steele (1969), Brownrigg and Greig (1975)), but have had to estimate the marginal propensities involved. For example, Steele (1969) did so by adjusting known average propensities to consume downwards to reflect differences between them and the respective marginal propensities. If this can be done with reasonable certainty, the resultant multiplier could be useful.

9.5.3 "Economic base" analysis of an economy

In its simplest form, economic base theory suggests that growth in an economy occurs as a result of injections of outside money. Sectors which export goods and services to bring in this money are termed basic industries. The remaining non basic or service industries do not export goods or services and so do not contribute to growth in a regional economy. Under these terms, tourist spending is a basic activity and can thus lead to growth in an economy.

Using this theory, the multiplier can be expressed as the change in basic and service sector activity, divided by the change in the basic sector activity(activity being sales, incomes or employment).

On the surface, this would appear to be a simpler method than the ad hoc and Keynesian approaches for determining a multiplier. However, there are many difficulties associated with the economic base approach among which Isard and Czamanski (1965) note the following (p.21):

(a) the classification of an industry into a basic (exporting) or service category, considering that a given industry may perform both functions

(b) the model fails to account for imports into a region

(c) no consideration of intersectoral differences is possible, the one multiplier acting on expenditure of all types

Archer (1973, p.9) further notes that the assumption that all growth originates outside the economy is quite unrealistic.

9.5.4 Input-output analysis

This method of deriving a multiplier is the most demanding in terms of time and data but also the most productive of information. The basic requirement of the method is a table laying out all transactions between the sectors in the economy of interest together with transactions with households in the economy and transactions made outside the economy (imports and exports). Sales to tourists form part of the export sector.

Table 9.12 shows a simplified input-output table with only three sectors, agriculture, manufacturing and services in the regional economy. The figures in the rows represent sales, while the figures in the columns represent purchases. Thus, considering the Services trades row, $1,000,000 of sales was made to the agricultural sector, $500,000 to the manufacturing sector, $100,000 to itself, $1,000,000 to regional consumers, $200,000 to general exports, and $800,000 to tourists to the region. Considering also the services column, $800,000 worth of goods and services was purchased from the agricultural sector, $600,000 from manufacturing, $100,000 from itself, $500,000 from "local factors of production" (e.g. labour) and $1,600,000 from imports. (Note that the whole economy, and each sector, is in equilibrium with the value of inputs equalling the value of outputs).

Using such a table, the effects of purchases made by tourists can be examined as the money filters through the economy. For example, take the $800,000 spent by tourists in the services sector. The money would be spent on further inputs to the services sector in the following ratios:-

8/36ths (or approx. $178,000) would be spent on agricultural inputs

6/36ths (or approx. $133,000) would be spent on manufacturing inputs

1/36th (or approx. $22,000) would be respent in the services sector

5/36ths (or approx. $111,000) would be spent on local labour, etc.

16/36ths (or approx. $356,000) would be spent on imports

Table 9.12- Input-Output Table for a Simple Economy[a, b]

	(1) Agricul-ture	(2) Manufactur-ing	(3) Services trades	(4) Households	(5) General Exports	(5a) Tourist Spending	(6) Total output
1 Agriculture	200	500	800	200	2000	500	4200
2 Manufacturing	300	200	600	100	4000	100	5300
3 Services trades	1000	500	100	1000	200	800	3600
4 Payments to local factors of production	200	600	500	-	-	-	1300
5 Imports	2500	3500	1600	-	-	-	7600
6 Total inputs	4200	5300	3600	1300	6200	1400 (7600)	22000

a Source Archer, B.H. The Uses and Abuses of Multipliers, Research Paper TURI, Tourist and Recreational Research Division, Univ. of Wales, Bangor, 1973

b Figures in thousand dollars

Subsequent rounds of spending could be traced in a similar fashion until all the money was dissipated. The multiplier could then be calculated in the usual way. Clearly, this task would be unmanageable with any realistic input-output table for a real economy. A short cut method of performing this same task involves the use of matrix algebra and, with any realistic economy, the use of computers (e.g. McCalden (1968)). The procedure is, however, outlined for the simple economy shown in Table 9.12 (see Harmston and Lund (1967) for a more detailed treatment).

The only data really required are those relating to transactions within the regional economy. (In our example, we will take the 9 entries in the top left-hand corner of Table 9.12. This will ease the computation but will yield multipliers which take no account of induced effects of increased consumption by householders). Firstly, an input coefficient table is constructed by dividing each of the 9 entries by the total input figure in the same column as the entry. This will yield Table 9.13, the input-coefficient matrix A.

Table 9.13

Input Coefficient Table for the Simple Economy

	Agriculture	Manufacturing	Services Trades
Agriculture	0.0476	0.0943	0.2222
Manufacturing	0.0714	0.0377	0.1667
Services Trades	0.2381	0.0943	0.0278

This matrix is then subtracted from the identity matrix I (Table 9.14) and the resulting matrix (I-A)

Table 9.14

An Identity Matrix

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

(Table 9.15) is inverted[1] to yield a direct and indirect benefit table (Table 9.16).

1 Inversion means to calculate the "reciprocal" of the matrix (I-A), i.e. $(I-A)^{-1}$

Table 9.15

The Matrix (I-A)

$$\begin{bmatrix} 0.9524 & -0.0943 & -0.2222 \\ -0.0714 & 0.9623 & -0.1667 \\ -0.2381 & -0.0943 & 0.9722 \end{bmatrix}$$

Table 9.16

The Direct and Indirect Benefit Table for the Simple Economy ($(I-A)^{-1}$)

	Agriculture	Manufacturing	Services Trades
Agriculture	1.1309	0.1385	0.2822
Manufacturing	0.1341	1.0734	0.2147
Services Trades	0.2900	0.1380	1.1185
Total Multipliers	1.5550	1.3499	1.6154

Table 9.16 shows the direct plus indirect multipliers for our simple economy. The top 9 entries show the effect on the industry in the relevant row by income received by the industry in the relevant column. Thus, there is a multiplier effect of 1.1309 on the agricultural sector resulting from income directly received by that sector and a multiplier effect of 0.2900 on the services sector resulting from income received by the agricultural sector. If the columns are summed, the totals represent the multipliers which would act if the industry in that column exported one unit of its product. For example, if the agricultural sector exported $10,000 worth of products, the total effect on the economy would be just over $15,500. Thus, depending on the detail available in the data, a multiplier can be derived for as many sectors in an economy as is desired, enabling a detailed examination of, for example, the effects of tourist expenditure on all sectors in the economy.

Archer (1973) outlines the weaknesses of the input-output approach. Firstly, the demand for data is extensive and costly to procure. Secondly, the model is static and represents the situation at the time data were collected and updating the model to account for changes

over time would entail roughly the same costs as the initial compilation. Thirdly, the approach ignores the possibility of economies of scale and alternate sources of supply in given industries as it assumes that, as an industry increases the value of its output, it increases the value of its inputs proportionately and obtains them from the same sources.

9.5.5 "From-to" analysis

This approach is essentially similar to the input-output method but is less demanding in terms of data. The only data required are those on output flows; no input figures are required. Clearly, this represents a time saving but cross checking of row and column totals is not possible and thus errors may be introduced. Once the output matrix is constructed, the analysis proceeds as for the input-output procedure so it will not be described here.

9.6 Results

Owing to the limited resources available for the study, it was decided to devote most attention to obtaining precise estimates of actual tourist expenditures in Coonabarabran and to apply to these expenditures, multipliers derived by other workers. Clearly, this will only provide an approximate impact of tourism on Coonabarabran as there is no way of telling if the multipliers used are correct. Consequently, a range of multiplier values will be used with the range covering the most likely values for Coonabarabran, as indicated by other studies. Various multipliers that have been derived are shown in Table 9.17.

Considering Income Multipliers, there is a considerable consistency in the values derived over the range of studies and methods. Of particular interest here are the multipliers associated with expenditure made by campers, hotel and guest house visitors to an area. The income multipliers for campers' expenditure vary from 1.26 to 1.35, for visitors using hotels from 1.25 to 1.31 and for visitors using guest houses 1.25 to 1.41. (The last and highest value for guest houses is associated with high local labour and goods inputs). Moreover, the various composite income multipliers do not differ much from these ranges, the vast majority falling in the range 1.20 to 1.40. While caution must be exercised in applying these figures derived in other studies to the situation surrounding Warrumbungle National Park and

Coonabarabran (as clearly, the regions would differ in a number of respects) the consistency suggest that the appropriate multipliers could lie within the specified ranges. Accordingly, the range of multipliers shown will be applied to the expenditure figures obtained in the survey of park visitors. The results should not be interpreted as the impact of park visitation on incomes in the region - at the best they can be interpreted as a likely range bracketing the possible impact.

Incomes in Coonabarabran will also be affected by the wages paid to staff employed by the N.P.W.S. McColl and Throsby (1972) state that the minimum income multiplier value for a rural Australian region is likely to be between 1.19 and 1.27; Archibald (1967) independently suggests that the minimum value for a composite income multiplier is 1.2. The figure 1.2 is selected for use here, keeping in mind its possible inapplicability to the Coonabarabran situation.

More variation can be noted with the employment multiplier. There is a cluster around 1.10[1] (Brownrigg and Greig (1975), Archer (1974), and Isard and Czamanski (Kalamazoo) (1965)), another cluster in the range 1.30 to 1.60 (Isard and Czamanski (1965), Kalter and Lord (1968)) and a further cluster from 1.70 onwards to the highest observed value of 3.64 (Weiss and Gooding (1968), Mathur and Rosen (1974), Schaefer et al (1978), Hansen and Tiebout (1963)). Inspecting the various studies, it is apparent that the middle and upper ranges of values (with the exception of Schaefer's study) are associated with large areas such as states or large cities, while the lowest range is associated with small lesser developed areas such as the case in this present study. Thus the lowest employment multipliers would seem more appropriate in this case than the larger values. (The derivation of the Schaefer results is unclear so these multiplier values will not be

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1 Indicates that for each job directly created by tourist expenditure, 0.10 other jobs are indirectly created. The other figures should be similarly interpreted.

Table 9.17

Income and Employment Multipliers

Source	Multiplier Value		Approach Used	Applied To
Archer & Owen (1971) Anglesey Study.	Hotel, guest house visitors	1.25	ad hoc	Income
	Stationary caravan visitors	1.14	ad hoc	"
	Bed, Breakfast, farmhouse visitors	1.58	ad hoc	"
	Camping Visitors	1.35	ad hoc	"
	Composite	1.25	ad hoc	"
Smith & Wilde (1977) Tasmanian Study	Accommodation - Queenstown local	1.33	"	"
	region	1.33	"	"
	Rosebery local	1.47	"	"
	region	1.47	"	"
	Strahan local	1.48	"	"
	region	1.52	"	"
	Zeehan local	1.30	"	"
	region	1.33	"	"
	Composite region	1.37	"	"
	Other establishments Queenstown local	1.38	"	"
	region	1.38	"	"
	Rosebery local	1.35	"	"
	region	1.35	"	"
	Straham local	1.43	"	"
	region	1.47	"	"
	Zeehan local	1.29	"	"
	region	1.32	"	"
	Composite region	1.37	"	"
	All establishments		"	"
	Queenstown local	1.33	"	"
	region	1.33	"	"
	Rosebery local	1.40	"	"
	region	1.40	"	"
	Strahan local	1.45	"	"
	region	1.49	"	"
	Zeehan local	1.30	"	"
	region	1.32	"	"
	Composite region	1.37	"	"
Archibald (1967)	A Composite Income Multiplier Probably lies between 1.2 and 1.7		Keynesian	Income
McColl and Throsby (1972)	Minimum multiplier value for a Rural Australian Region is likely to be of the order of 1.19 to 1.27.			
Steele (1969), UK Regions, Composite Multipliers.	North	1.42	"	"
	Yorkshire, Humberside	1.26	"	"
	East Midland	1.45	"	"
	East Anglia	1.33	"	"
	South East	1.57	"	"
	South West	1.42	"	"
	Wales	1.38	"	"
	West Midland	1.33	"	"
	North-West	1.39	"	"
	Scotland[c]	1.77	"	"
Tiebout (1960) Chicago Suburbs	Low Income Suburb	1.054[b]	"	"
	Higher Income Suburb	1.096[b]		
Weiss & Gooding (1968) Portsmouth, New Hampshire	Private Export employment multiplier	1.8[b]	Economic Base	Employment
Mathur and Rosen (1974) Cleveland Ohio	General total employment multiplier	1.8002[b]	"	"
Schaefer et al. (1978) NSW	Kyogle Shire Employment Multiplier	1.7[b]	"	"
	Tweed Shire Employment Multiplier	2.1[b]	"	"
Garrison (1974) Tennessee	Reservoir Recreation East Tennessee Income Multiplier (1962)	1.53	Economic Base	Income
Browning & Greig (1975) Isle of Skye Study[a]	Accommodation Expenditure		Keynesian	Income
	Licensed Hotels	1.26 - 1.28	"	"
	Unlicensed Hotels	1.42 - 1.46	"	"
	Guest Houses	1.61 - 1.66	"	"
	B & B Premises	1.58 - 1.63	"	"
	Static Caravans	1.71 - 1.77	"	"
	Touring Caravans	1.76 - 1.82	"	"
	Camping	1.76 - 1.82	"	"
	Holiday Cottages	1.69 - 1.75	"	"
	Youth Hostels	1.46 - 1.50	"	"

	All expenditures			
	Licensed Hotels	1.26 - 1.28	Keynesian	Income
	Unlicensed Hotels	1.37 - 1.41	"	"
	Guest Houses	1.37 - 1.41	"	"
	B & B Premises	1.37 - 1.41	"	"
	Static Caravans	1.32 - 1.34	"	"
	Touring Caravans	1.26 - 1.28	"	"
	Camping	1.26 - 1.28	"	"
	Holiday Cottages	1.27 - 1.30	"	"
	Youth Hostels	1.26 - 1.28	"	"
	Staying with relatives	1.25 - 1.27	"	"
	Others	1.25 - 1.27	"	"
	Day Trippers	1.21 - 1.23	"	"
	Employment multipliers [b] from Accommodation Expenditure spent in			
	Licensed Hotels	1.08 - 1.16	"	Employment
	Unlicensed Hotels	1.07 - 1.14	"	"
	Guest Houses	1.04 - 1.08	"	"
	B & B Premises	1.04 - 1.07	"	"
	Holiday Cottages	1.05 - 1.08	"	"
	Employment multioliers [b] from all expenditure by visitors using			
	Licensed Hotels	1.09 - 1.18	"	"
	Unlicensed Hotels	1.08 - 1.16	"	"
	Guest Houses	1.05 - 1.10	"	"
	B & B Premises	1.05 - 1.10	"	"
	Holiday Cottages	1.05 - 1.11	"	"
Archer (1973) Anglesey I-O Study (1970)	Income Multipliers for spending by different categories of tourist - Hotel	1.3063[d]	Input-Output	Income
	Farmhouse, B & B	1.7614	"	"
	Stationary Caravan	1.2171	"	"
	Campers	1.3097	"	"
	Composite effect	1.3260	"	"
Archer (1974) Anglesey (1970) Study	Tourist employment multiplier [b]	1.11	"(?)	Employment
Blake & McDowall (1967) St. Andrews Study	St. Andrews - Tourism	1.3375	"	Income
Isard & Czamanski (1965) quoting various studies	Employment multipliers [b]			
	California	1.52	"	Employment
	Los Angeles	1.37	"	"
	San Francisco	1.33	"	"
	St. Louis	1.34	"	"
	Kalamazoo	1.08	"	"
	Mean of 16 studies	3.64	Economic Base	
Hansen & Tiebout (1963)	California	2.76[d]	From-To	"
	Los Angeles-Long Beach	2.13[d]	"	"
	San Francisco	2.06[d]	"	"
	Rest of California	2.51[d]	"	"
Kalter & Lord (1968) Walworth County, Wisconsin	Recreation Export Multipliers[d]	1.49	"	Income
		1.57	"	Employment

NOTES
a) results reported omitted direct affect. This has been added here for consistency.
b) total jobs per direct job generated.
c) best estimate
d) short run multiplier

considered). Brownrigg and Grieg (1975) derive an employment multiplier of from 1.09 to 1.18 for visitors using licensed hotels and 1.05 to 1.10 for visitors using guest houses; Archer (1974) derived a multiplier of 1.11. In accord with these figures, a multiplier of 1.10 is subsequently used to estimate the possible impact of Warrumbungle tourism on total employment in Coonabarabran. (Similar caveats apply to these results as did to the income results).

As far as general employment is concerned - that created by employment in park operations rather than by tourist business - a low multiplier also seems in order due primarily to the small size of the region. Isard and Czamanski (1965) report various employment multipliers for different areas. The smallest area treated is Kalamazoo Michigan with a multiplier of 1.08. Other authors using different techniques derive higher multipliers than their results - these do not seem applicable here considering the nature of the region (and the less acceptable methodology used). Once again, the figure of 1.08 should not be regarded as a precise one but is only an estimate in the likely range.

We now turn to applying these figures to the Warrumbungle National Park case study to quantify the impact of Park visitation on incomes and employment in Coonabarabran.

The income results reported are derived from the visitor survey undertaken in Warrumbungle National Park for this project in which the park visitors were asked to specify their expenditure on their present trip in various categories in Coonabarabran. The expenditure data collected referred only to park visitors who were not normally residents of Coonabarabran as any expenditure by Coonabarabran residents visiting the park would not be an addition to the regional income. Expenditure by the National Parks and Wildlife Service in Coonabarabran for the year 1977-8 is also detailed. Thus the overall impact of park operations on incomes in Coonabarabran can be assessed. The employment results are based on figures derived by the Australian Bureau of Statistics and a survey of tourist accommodation establishments in Coonabarabran conducted as part of this study. The response rate to this latter survey was low (about 46%) so the employment results should be regarded as tentative only.

9.6.1 Income

The expenditure in Coonabarabran by the 538 groups in the visitor sample is categorised in Table 9.18. Total expenditure by the groups was $19,527.56.

Table 9.18

Expenditure by Survey Respondents in Coonabarabran

Category	Expenditure
Food and drink	$6786.99
Petrol & Car Servicing	4318.19
Photographic supplies	444.52
Clothing	447.72
Sporting Goods & Camping Supplies	527.58
Health Services	322.82
Accommodation	5298.30
Souvenirs	785.85
Other items	595.59
TOTAL:	$19,527.56

As the first stage in estimating the regional impact of park tourism on incomes, it is useful to increase the sample expenditure to an annual figure for sales to tourists. Owing to the sampling procedure which had to be adopted (see Appendix 1), it is not possible to use any of the available statistical procedures (Mendenhall et al 1971) to estimate the total and the error associated with it. Rather the procedure followed is simply to scale the sample expenditure up by a proportion equal to the ratio of the number of visitor days observed in the sample to the yearly total of visitor days. This procedure assumes that,

1) the proportions of day visiting and camping visitors are the same for the sample respondents and the total yearly visitors. In Chapter 4, it was shown that this is in fact the case - the composition of respondent groups with respect to day and camping use was almost exactly the same as that recorded for the most recent yearly figures.

2) expenditure patterns of the sample respondents are the same as those of the whole-of-year group. There are no data to confirm or deny this but it does not seem to be an unreasonable assumption.

The assumed total visitation for the year 1978 is 85,000 visitor days. (This is a slight decrease on 1977 visitation but this seems

reasonable as available figures - to September 1978 - show a decrease over the total visitation to the corresponding time in 1977). This is 11.82 times the number of visitor days observed in the sample. Working from this basis, total expenditure in Coonabarabran by visitors to Warrumbungle National Park in 1978 would be of the order of:-

$(19,527.56 x 11.82)
= $230,815.76
≑ $231,000

In the previous section, a range of possible income multipliers was specified for Coonabarabran. The range was 1.2 to 1.4.[1] Applying these figures to the above expenditure amount yield the following range for the impact of park tourist expenditure on incomes in Coonabarabran for the year 1978:

$277,200 to $323,400

Two further items must be added to this to arrive at the final financial impact of the park (that from its total operation, not just the visitation to it). These are the expenditure in Coonabarabran on materials used in the park and the incomes of the park staff themselves. Data on these items were supplied by the district staff of the N.S.W. N.P.W.S. Total annual expenditure on materials for use in the park is about $40,000, while wages paid to park and district staff amount to about $112,000.[2] No multipliers are available to estimate the total impact of the first figure on incomes in the town but it is probably very close to 1, as much of the expenditure is made on materials which are imported into Coonabarabran (such as fuel and motor vehicles). Thus there would be little flow on of the money into other sectors of the town's economy. Considering the income of staff, the direct increase in

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1 It is most likely that the true multiplier would be at the lower end of the range, considering the small size of the Coonabarabran economy, although locally made souvenirs, etc. would boost it.

2 The district staff component was assessed as their annual wage multiplied by their estimate of time devoted to matters relating to Warrumbungle National Park.

incomes is $112,000. Of this about $89,000 would be spent (assuming an average propensity to consume of about 0.8) and we assume here that all of this is spent in Coonabarabran on such items as food, clothing, and so on. Applying a multiplier of 1.2[1] to this yields an impact on incomes in Coonabarabran of $106,800 and adding the park and district staff income gives $218,800. So the total impact of park operations on incomes in Coonabarabran is an annual addition at present prices of about $536,000.[2]

9.6.2 Employment

Employment impact arises from two sources - visitors staying in Coonabarabran utilising the town's accommodation and retail services and actual employment in and directly connected with the park. Each of these categories will be taken in turn.

Total employment in the 14 tourist accommodation establishments in Coonabarabran Shire at 31/12/76 was 57 full-time and 53 part-time workers[3], a total of 83.5 full-time equivalent jobs. As far as can be ascertained, 12 of the 14 establishments were in Coonabarabran itself, giving a pro rata employment of 71.6 at 31/12/76. There are now 13 accommodation establishments in Coonabarabran and scaling employment up gives a total of 77.6 jobs. Operators of these 13 establishments (caravan parks, hotels, motels, guesthouses, and rented bungalows) were asked to specify how much of their trade was due to tourists visiting Warrumbungle National Park. The proportions are listed in Table 9.19. The weighted average of these proportions (using the number of establishments in each category as weights) is 20%. Assuming a constant relationship between the amount of business generated and employment,[4]

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1 The lowest value in the range specified by Archibald (1967) and approximately the lowest by McColl & Throsby (1972) of 1.19.

2 The lowest estimate of tourist expenditure impact has been used - 277200 + 40000 + 218800.

3 A.B.S. Handbook of Local Statistics, N.S.W., Sydney, 1977.

4 This relationship may of course not be constant but the available information does not allow the derivation of the true relationship. In these circumstances a constant relationship seems the most reasonable estimate.

this represents a total of 15.5 jobs in the tourist accommodation industry which can be attributed to tourism to Warrumbungle National Park.

Turning to the park's impact on retail sector employment, recall that the total estimated sales to tourists in Coonabarabran for 1978 was $231,000. The latest retail sales data available for Coonabarabran Shire are from 1973-74, when the total amount was $7,740,000.

Table 9.19[1]

Proportion of Business due to Park Tourism, Coonabarabran Tourist Accommodation Establishments

Type of Establishment	Estimated % of Business due to Park Tourism	No. of Establishments
Motel	25%	5
Hotel	10%	3
Caravan Park	5%	2
Bungalows	40%	2
Other	15%	1
		13

[1]Proportions reported for each category are derived from the survey results. Responses by representatives of each category are taken to hold for all establishments of that type.

Inflating this figure to 1978 values[1] yields a total sales value of $12,441,300 for the year. The proportion of this sales value due to park tourism is thus 0.02. Total employment in the retail sector was

1 Using the Consumer Price Index 1977-8 for Sydney - ABS Monthly Review of Business Statistics, October 1978, Canberra.

502[1]. Once again, assuming that there is a constant relationship between sales and employment, employment in the retail sector in Coonabarabran, due to park visitation is about 10 jobs.

Thus, in the retail and accommodation sectors in Coonabarabran, a total of 25.5 jobs is generated by park tourism. Using the multiplier value noted previously (1.10), this indicates that park tourism gives rise to approximately 28 full-time equivalent jobs in the town of Coonabarabran.

The next item to estimate is the impact of direct park employment on jobs in Coonabarabran. From data supplied by the N.S.W. N.P.W.S. there are at present 5 full-time workers in the park. As well as this there are 4 seasonal workers who work an average of 13 weeks a year and 5 other workers who work an average of 23 weeks a year. This gives a total of 8.2 full-time equivalent jobs in the park. The district staff number 3.5[2] and they estimate 2/3rds of their time is spent on tasks relating to Warrumbungle National Park giving 2.3 full-time equivalent district jobs. Thus, in total, the park operation creates about 10.5 jobs directly. These workers would, in turn, support other jobs in Coonabarabran. Once again a low employment multiplier (1.08) is used as the region is small and would import many of its services from elsewhere. Applying this multiplier yields 11.3 jobs - the total district employment generated by park operations.

Summing the job figures from the two categories, it appears that Warrumbungle National Park may give rise to 39.3 full-time equivalent jobs in Coonabarabran.

9.7 Estimating the future economic impact of a national park on a local region.

As we have seen, the appropriate approach for estimating the economic (income and employment) impact of a particular project on a region is

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1 The total sales and employment figures for the Shire are allocated to Coonabarabran as there is no information on distribution of the sector within the Shire. This would have no effect on the result of this sector if the Sales : Employment relation is true.

2 One half-time secretary.

firstly to ascertain how much income and employment is directly generated by the project in the region and secondly to apply to that income and employment appropriate multipliers which will translate the direct effects into overall effects. Hence the estimation of the future impact of any project might be made by firstly estimating the direct income and employment effects of the project at the appropriate time and then applying the relevant multipliers to those figures. Both of these steps present problems in practice, however. Estimating the future direct impacts of a new park on a region could be done in conjunction with estimating the future levels of visitation to the park, the latter being required to implement a cost-benefit analysis of the proposal. Estimating the multipliers which would hold in the future is more difficult. The sizes of the multipliers for a region depend on the structure of the regional economy so to estimate the true multipliers relevant to different forms of expenditure, the future structure of the economy must be known. Obviously, this would not be known, the only sure thing being that the structure would change if for no other reason than that a new park was introduced. Hence multipliers which would be applicable in the present would not truly describe the situation after the park was introduced. However, the changes induced by the establishment of the park may only make a small difference in the short term so that the present multipliers may not be greatly affected and thus may be used in attempting to estimate the regional impact of the park.

As an illustration of this point, take the case of the simple regional economy for which multipliers were derived using input-output methodology (see pp.143-147 above). Assume a park is to be established in the area which will cause agricultural activity to decline by 2%. The manufacturing and services sectors make up the shortfall in inputs previously purchased from this regional sector by increasing agricultural imports. After the park is established it is found that park tourism had led to an increase in services-trades sector activity of 2%[1].

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1 These estimated percentage changes are based on the results of the Coonabarabran-Warrumbungles study where park-tourist expenditure formed about 2% of retail sector activity. A 2% decrease in agricultural activity (equivalent to about 26 jobs in the case of Coonabarabran in 1954) seems a reasonable estimate.

The relevant portion of the new input-output table is shown in Table 9.20.

Table 9.20

Part of the Input-Output Table for the Simple Regional Economy after the Establishment of a Park

	Agriculture	Manufacturing	Services Trades
Agriculture	196	490	800
Manufacturing	294	200	612
Services Trades	980	500	102
Payments to Local Factors of Production	196	600	510
Imports	2450	3510	1648
Total Inputs	4116	5300	3672

The input coefficient table is thus Table 9.21.

Table 9.21

Input Coefficients for the Modified Economy

	Agriculture	Manufacturing	Services Trades
Agriculture	0.0476	0.0925	0.2179
Manufacturing	0.0714	0.0377	0.1667
Services Trades	0.2381	0.0943	0.0278

The corresponding direct and indirect benefit table for the modified regional economy is shown in Table 9.22.

Table 9.22

Direct and Indirect Benefit Table for the Modified Regional Economy

	Agriculture	Manufacturing	Services Trades
Agriculture	1.1293	0.1357	0.2764
Manufacturing	0.1339	1.0731	0.2140
Services Trades	0.2896	0.1373	1.1171
Total Multipliers	1.5528	1.3461	1.6075

Comparing Table 9.22 with Table 9.16 it is evident that these estimated changes brought about by the hypothetical establishment of a park in the region have caused little alteration in the overall multipliers for each sector (or indeed in the within-sector multipliers). In each case the total multipliers have changed by less than 0.5%.

Therefore if the direct impact of a park project is or will be small relative to the overall regional economy it may be acceptable to use multipliers derived for the economy as it is presently structured to help estimate the future overall economic impact of the park on the region.

9.8 Summary

This chapter considered the regional and local effects a national park might have. Firstly, the nature of these effects was discussed, then approaches to their quantification were assessed. The "social indicator" and "social-scaling" methods were found to be very inadequate for assessing economic impacts, allowing only qualitative assessment of the situation. Quantitative assessment of economic impact by multiplier estimation is much more helpful and various approaches to this were considered in terms of information provision, data needs and theoretical validity. Of these approaches, the input-output and from-to methods of assessment seem best in overall terms.

As resources were unavailable for a comprehensive regional survey (required to implement the latter two approaches), multiplier data were gathered from various sources in the literature. Likely values were then applied to tourist expenditures and park operation data to estimate the impact of Warrumbungle National Park on Coonabarabran. The results, which should be the subject of critical examination, are shown in Table 9.23.

Table 9.23

Results of the Analysis of the Economic Impact of Warrumbungle National Park on Coonabarabran, 1978.

	From Tourism	From Park Operations	Total
Income:			
Direct	$231,000	$152,000	$383,000
Indirect & Induced	46,200	106,800	153,000
Total	277,200	258,800	536,000
Employment:			
Direct	25.5	10.5	36
Indirect	2.5	0.8	3.3
Total	28.0	11.3	39.3

The final section of the chapter dealt with the estimation of the future income and employment impacts of a park project. As long as the direct impact of the park operation on the regional economy is relatively small (i.e. does not markedly change the structure of the regional economy) it may be acceptable to use present multipliers for the region to estimate future impacts at least in the short term.

CHAPTER 10

OVERALL ASSESSMENT OF WARRUMBUNGLE NATIONAL PARK

In Chapter 6 of this report the costs of establishing and operating Warrumbungle National Park were assessed, followed in Chapter 7 by an evaluation of the benefits of the park in terms of the number of visitor days to the park, and the consumers' surplus per visitor day. In this chapter the cost and benefit information will be combined in an overall economic assessment of Warrumbungle National Park.

There are several procedures which could be followed in comparing the cost and benefit data. Firstly there is the Benefit-Cost Ratio approach in which the stream of benefits is discounted to the present and the resulting value is divided by the stream of costs, discounted to the present at the same rate as the benefits. If the ratio so derived is greater than one the project is justified since project benefits exceed project costs. A second procedure is to derive the Net Present Value (NPV) of the project. The process is similar to deriving a Benefit-Cost ratio except that the discounted costs are subtracted from the discounted benefits (rather than the latter's being divided by the former). A positive result indicates that benefits are greater than costs and the project is therefore justified. The third approach is to derive the Internal Rate of Return (IRR) of the project. The IRR is that interest rate at which discounted benefits equal discounted costs. The interest rate so obtained is then compared with the project agency's accepted interest rate for investments. If the IRR is greater than this standard the project is deemed to be acceptable.

Notwithstanding other problems with these approaches, a major difficulty is that each requires a good estimate for the value of the benefits and costs of the project throughout the project's life and often these values (especially benefit values) are very inaccurately known. An alternative procedure is to derive the break-even level for benefit values - that is to derive the level of benefits that would be required to justify the expenditure on resources represented by the cost figures. Then by comparing the break-even level of benefits with the estimated level, it can be established whether or not the project is justified.

Table 10.1

Assessment of the Costs and Benefits of Warrumbungle National Park

Year	Annual Benefits (000's of Days)	P.V.@ 5%	P.V.@ 10%	Annual Costs ($000)	P.V.@ 5%	P.V.@ 10%
1953/4	0.60	.60	.60	104.04	104.04	104.04
1954/5	0.60	.57	.55	-	-	-
1955/6	0.60	.55	.50	-	-	-
1956/7	0.60	.52	.45	-	-	-
1957/8	0.60	.49	.41	-	-	-
1958/9	0.65	.51	.40	-	-	-
1959/60	0.70	.53	.39	50.76	38.07	28.43
1960/1	0.75	.53	.38	116.74	82.89	59.54
1961/2	0.80	.54	.38	112.33	76.38	52.80
1962/3	0.85	.54	.36	116.74	74.71	49.03
1963/4	0.90	.55	.35	66.74	40.71	26.03
1964/5	0.99	.57	.35	36.74	21.31	12.86
1965/6	7.64	4.28	2.44	26.74	14.97	8.56
1966/7	14.29	7.57	4.14	26.74	14.17	7.75
1967/8	20.94	10.68	5.44	120.60	61.51	31.36
1968/9	27.59	13.24	6.62	36.42	17.48	8.74
1969/70	34.05	15.66	7.49	41.91	19.28	9.22
1970/1	39.62	17.43	7.92	48.67	21.41	9.73
1971/2	48.49	20.36	8.73	96.76	40.64	17.42
1972/3	56.64	22.66	9.06	275.73	110.29	44.12
1973/4	58.03	22.05	8.70	270.21	102.68	40.53
1974/5	66.07	23.79	9.25	102.32	36.84	14.32
1975/6	77.86	26.47	9.34	87.50	29.75	10.50
1976/7	81.03	26.74	8.91	77.55	25.59	8.53
1977/8	85.69	26.56	8.57	97.42	30.20	9.74
TOTAL	626.58	243.99	101.73	1912.66	962.92	553.25

The derivation of the break-even level of benefits in this case proceeds as follows. Firstly, the present value of the cost of establishing and running the park is computed, at various discount rates. Next, based on Table 7.3, the stream of recreation benefits (numbers of visitor days per year) is discounted using the same discount rates as in the cost calculation.[1] By dividing the present value of costs by the discounted quantity of benefits, the break-even level of benefits, in dollars per visitor day, is derived. The consumers' surplus value of one visitor day (derived in Chapter 7 using the travel cost methodology) can then be compared to this break-even level to determine whether or not the establishment of Warrumbungle National Park has been justified in cost-benefit terms.

Table 10.1 summarises the relevant information. Column I shows the annual amount of benefits in thousands of visitor days while Column 4 shows the annual costs of the park in thousands of dollars. Columns 2 and 3 discount the benefit amounts at 5% and 10%[2] respectively while Columns 5 and 6 do likewise for the park costs. The total benefit and cost amounts (both discounted and undiscounted) are given in the last row of Table 10.1 and Table 10.2 shows the computation of the break even level for park recreation benefits.

Table 10.2

Computation of Break-even Recreation Benefits

Discount Rate	(1) Present Value of Amount of Recreation (000's Visitor Days)	(2) Present Value of Costs ($000)	(3) Breakeven Recreation Benefits [(2)÷(1)] $
5%	243.99	962.92	3.95
10%	101.73	553.25	5.44

1 Discounting visitor days may at first appear strange but has exactly the same basis as discounting future money receipts - one days' recreation now is valued more than one day's recreation in the future.

2 These two discount rates span the range of what is usually taken to be the appropriate social rate of discount for cost-benefit analysis. The issues involved in the selection of appropriate interest rates are discussed in Appendix 4.

Thus the level of recreation benefits required to justify establishing Warrumbungle National Park would be between $3.95 and $5.44 per visitor day. Our estimate of the value of the recreation benefits of the park is approximately $100 per visitor day, a value that greatly exceeds the breakeven level. Therefore it is safe to conclude that, on their own and ignoring scientific and other values, the recreation benefits of Warrumbungle National Park more than justify the costs involved in its establishment (even allowing for a considerable range of error in the calculation of the value of a day's recreation in the park).

CHAPTER 11

SUMMARY AND CONCLUSIONS

This study began by assessing the decision making process as it affects national parks. We discussed the nature of park decisions and the benefits and costs involved in making decisions on the establishment of national parks. By discussing problems associated with the private provision of national parks through the market place, we focussed attention on characteristics of national parks, which, in general, make decision making on parks difficult. These characteristics were firstly, the possible monopoly nature of national parks, secondly the problem of joint supply of park benefits, thirdly, the public good nature of the benefits supplied by parks and fourthly, the absence of future and risk markets and thus the absence of adequate information on future park benefits and costs. All these factors lead to the failure of markets to provide parks but they also apply to the decision-making process as it now operates. For example, with a public good, society traditionally has no way of registering its demand for the good so decision-makers will be unaware of the appropriate number and distribution of parks desired by society and in the absence of adequate information regarding future benefits and costs, decisions will necessarily be based on less than perfect information.

We then reviewed several criteria currently used in, or proposed for, guiding decisions on national parks and noted their inadequacies. As an alternate framework to guide decision-making, we proposed the use of cost benefit analysis. With this procedure the benefits and costs of a given land use could be evaluated and compared to establish whether or not society was made better-off by proceeding with that land use. The measurement of various present and future benefits associated with national parks was discussed as was the measurement of costs. A cost-benefit analysis was carried out for Warrumbungle National Park which showed that the recreation benefits alone (i.e. excluding conservation benefits, scientific benefits and so on) outweighed the costs of the park by at least an order of magnitude. In other words, the economic analysis shows that society gains much more benefit from the use of the land for a national park than from the alternative use, grazing.

As decisions surrounding national parks seldom consider only the benefits and costs of the park, but concentrate on the regional effects of parks, the study incorporated an analysis of the effects of Warrumbungle National Park on the town of Coonabarabran. Firstly, various approaches to regional economic impact assessment were examined. The only satisfactory methods of regional assessment are those which establish quantitative effects by the use of multipliers to gauge the ultimate impact of projects on regional income, sales and employment. The scope for applying this methodology to estimating future economic impacts was assessed. As long as the park does not markedly alter the structure of the regional economy it seems reasonable to use present multipliers for estimating short term future impacts. Based on the multiplier methodology it was concluded that, in 1978, Warrumbungle National Park contributed just over $500,000 per year to regional income and supported about 39 jobs in Coonabarabran.

In this project the only park benefit evaluated was that provided by recreation usage. This was done for two main reasons. Firstly, recreation benefits appeared in the first place to be the major benefit derived from the park by society. Accordingly, as project resources were limited, we concentrated on the evaluation of recreation rather than the apparently less important benefits of the park such as its conservation potential. As it turned out, evaluating recreation benefits alone was sufficient to show that the use of the land as a national park provided society with much greater benefit than if the land had been used for grazing. This is then the second reason for not proceeding to evaluate the other park benefits - it was unnecessary to add more benefits as the cost-benefit analysis considering only recreation benefits had shown already that national park usage of the land was the best use. If it were necessary to evaluate the other benefits in order to reach a decision, this could have been done, given the resources, as methods are available to do this as we pointed out in Chapter 8. When applying cost benefit analysis to other park proposals it may be necessary to evaluate these other benefits either because costs are high enough or recreation benefits low enough than an analysis considering only recreation benefits is inconclusive. The problem then becomes one of specifying the other benefits carefully and using appropriate measurement methods so that the values may be included in the cost-benefit analysis.

The success of the cost benefit analysis framework in this present case study demonstrates its feasibility as a criterion to assist decision making with respect to national parks. It provides a rational and consistent framework within which all the benefits and costs of a given park proposal may be compared.

BIBLIOGRAPHY

Archer, B.H., The Uses and Abuses of Multipliers, Research Paper 1, Tourist and Recreational Research Division of the Economics Research Unit, Bangor, Wales. 1973.

Archer, B.H., 'The Impact of Recreation on Local Economies" Planning Outlook, 1974 (Special Issue).

Archer, B.H. and Owen, C.B., "Towards a Tourist Regional Multipler" Regional Studies, Vol. 5, pp.289-294, 1971.

Archibald, G.C., "Regional Multipler Effects in the U.K." Oxford Economic Papers, Vol. 19, pp.22-45, 1967.

Beardsley, W., "Bias and Noncomparability in Recreation Evaluation Models", Land Economics, Vol. 47, pp. 175-180, 1971.

Blake, C. and McDowall, S., "A Local Input-Output Table" Scottish Journal of Political Economy, Vol. 14, pp.227-242, 1967.

Bohm, P., "Estimating Demand for Public Goods: An Experiment", European Economic Review, Vol. 3, pp. 111-130, 1972.

Boyden, S.V. and Harris, J.A., "Contribution of the Wilderness to Health and Wellbeing" Paper delivered to ACF Conference on Wilderness Conservation, Canberra, Oct. 1977.

Brownrigg, M. and Greig, M.A., "Differential Multipliers for Tourism" Scottish Journal of Political Economy, Vol. 22, pp.261-275, 1975.

Cicchetti, C.J. and Freeman, A.M., "Option Demand and Consumer Surplus: Further Comment", Quarterly Journal of Economics, Vol.85, pp.528-539, 1971

Cicchetti, C.J. and Smith, V.K., "Congestion, Quality Deterioration, and Optimal Use: Wilderness Recreation in the Spanish Peaks Primitive Area", Social Science Research, Vol 2, pp.15-30, 1973.

Clarke, E.H., "Multipart Pricing of Public Goods", Public Choice, Vol 11, pp.17-33, Fall 1971.

Colman, E.A., Vegetation and Watershed Management, Ronald Press Company New York 1953.

Common, M.S., "A Note on the Use of the Clawson Method for the Evaluation of Recreation Site Benefits" Regional Studies, Vol 7, pp.401-406, 1973.

Connaughton, C.A., "Yield of Water as an Element in Multiple Use of Wildland", J. For. Vol 14, pp.641-644, 1943.

Coomber, N.H. and Biswas, A.K., Evaluation of Environmental Intangibles, Genera Press, New York, 1973.

Dasman, R.F. Milton, J.P. and Freeman, P.H., Ecological Principles for Economic Development, Wiley and Sons Ltd, Lomdon, 1973.

Day, M.F., "The Role of National Parks and Reserves in Conservation" in Costin, A.B and Frith, H.J. (eds) Conservation, Penguin, 1971.

Downes, R.G., "Conservation in the Context of Land Use" in Fenner,F. (ed) A National System of Ecological Reserves in Australia, Australian Academy of Science Report 19, Canberra, August, 1975.

Erskine, H., "The Polls: Pollution and its Costs" Public Opinion Quarterly, Vol.36, pp.120-135, 1972.

Ferguson, I.S. and Greig, P.J., "What Price Recreation?" Australian Forestry, Vol.36, pp.80-90, 1973.

Fisher, A.C. and Krutilla, J.V., "Determination of Optimal Capacity of Resource-Based Recreation Facilities", Natural Resources Journal, Vol 12, pp.417-444 July, 1972.

Forster, R.R., Planning for Man and Nature in National Parks, IUCN Morges, Switzerland 1973.

Fox, T., Recreational Requirements and the National Park Systems of Australia, Report for the Fourth Ministerial Conference on National Parks, August, 1970.

Galt, G., Investing in the Past: A Report on the Profitability of Heritage Conservation, Mimeo. Heritage Canada 1974.

Garrison, C.B., "A Case Study of the Local Economic Impact of Reservoir Recreation" Journal of Leisure Research, Vol 6, pp.7-19, 1974.

Gibson, J.G., and Anderson, R.W., "The Estimation of Consumers' Surplus from a Recreation Facility with Optional Tariffs" Applied Economics, Vol 7, pp.73-79, 1975.

Gregory, G.R., "An Economic Approach to Multiple Use", Forest Science Vol 1, pp.13-20 1955.

Greig, P.J., "Forecasting the Demand-Response to Changes in Recreational Site Characteristics" in Elsner, G.H. (Ed) State-of-the-Art Methods for Researching, Planning, and Determining the Benefits of Outdoor Recreation, Papers presented to Working Party of the XVIth World Congress of the International Union of Forestry Research Organisations, Oslo, Norway, 1976.

Greig, P.J., Recreation Evaluation Using a Characteristics Theory of Consumer Behaviour, Unpublished Paper, Victorian Forests Commission, 1978.

Hansen, W.L. and Tiebout, C.M., "An Intersectoral Flows Analysis of the California Economy" Review of Economics and Statistics, Vol.45, pp.409-418, 1963.

Harmston, F.K. and Lund, R.E., Application of an Input-Output Framework to a Community Economic System, Uni. of Missouri Press, Columbia, 1967.

Helliwell, D.R., "Valuation of Wildlife Resources", Regional Studies, Vol 3, pp.41-47, 1969.

Helliwell, D.R., "Priorities and Values in Nature Conservation" Journal of Environmental Management, Vol 1, pp.85-127, 1973

Henry, C., "Option Values in the Economics of Irreplaceable Assets", Rev. Econ, Stud: Symposium on the Economics of Exhaustible Resources 1974, pp.89-104.

Isard, W. and Czamanski, S. "Techniques for Estimating Local and Regional Multiplier Effects of Changes in the Level of Major Governmental Programs" Peace Research Society (International), Chicago Conference Papers III, pp.19-45, 1965.

Jenkin, J.F. (ed), A Report of Surveys of Attitudes Amongst the Public to Aspects of Land Use in Victoria's Alpine Region Victorian National Parks Association, 1976.

Kalter, R.J. and Lord, W.B., "Measurement of the Impact of Recreatior Investments on a Local Economy" Am. J. Ag. Econ, Vol 50, p.243-256, 1968.

Karunaratne, N.D. and Jensen, R.C., Input-Output Models and Environmental Planning, Paper presented to a Conference on Environmental Economics, Canberra, May, 1978.

Krutilla, J.V. and Cicchetti, C.J., "Evaluating Benefits of Environmental Resources with Special Application to the Hells Canyon", Natural Resources Journal, Vol 12, pp.1-29, 1972

Krutilla, J.V. and Fisher, A.C., The Economics of Natural Environments, Johns Hopkins University Press for Resources for the Future, Baltimore, 1975.

Mc Calden, G. The Economic Base of Rural Towns; A Methodological Evaluation. Unpublished Master's Thesis, Univ. of New England, 1970.

McColl, G.D. and Throsby, C.D., "Multiple Objective Benefit - Cost Analysis and Regional Development" Economic Record, Vol 48, pp.201-219, 1972.

McMichael, D.F., Society's Demand for Open-Air Recreation, Wilderness and Scientific Reference Areas, Proceedings of the Institute of Foresters, Sixth Conference, May, 1971.

Mansfield, N.W., "The Estimation of Benefits from Recreation Sites and the Provision of a New Recreation Facility", Regional Studies, Vol 5, pp.55-69, 1971.

Mason, H.L., "Economic Values in Parks and Reserves" in Adams, A.B. (ed) First World Conference on National Parks, U.S. National Park Service Washington, 1962.

Mathur, V.K. and Rosen, H.S., "Regional Employment Multiplier: A New Approach" Land Economics, Vol 50, pp.93-96, 1974.

Mendenhall, W., Ott, L. and Scheaffer, R.L., Elementary Survey Sampling, Duxbury Press, California, 1971.

Moore, A.L., "Reservoir Recreation and Local Economic Growth" in Economic Studies of Outdoor Recreation, ORRRC Study Report 24, U.S. Govt. Printing Office, Washington, DC, 1962.

Morey, E.R., The Demand for Site-Specific Recreational Activities: A Characteristics Approach, Discussion Paper 03/78, Norwegian School of Economics and Business Administration, Bergen, 1978.

Mueller, E., "Public Attitudes Towards Fiscal Programs" Quarterly Journal of Economics, Vol 77, pp.210-235, 1963.

New South Wales Government, National Parks and Wildlife Act (Act No.80) 1974.

Ovington, J.D., "Management Problems of National Parks" in Webb, L.J., Whitelock, D. and Le Gay Brereton, J. (eds) The Last of Lands, Jacaranda Press, Brisbane, 1969.

Ovington, J.D., Groves, K.W., Stevens, P.R., Tanton, M.T., A Study of the Impact of Tourism at Ayers Rock - Mt Olga National Park A.G.P.S. Canberra, 1973.

Phillips, W.E., The Conservation of the California Tule Elk, Uni. of Alberta Press, 1976.

Piesse, R.D., "Recreational Demands and Conservation", in Webb, L.J., Whitelock, D. and Le Gay Brereton, J., The Last of Lands, Jacaranda Press, Brisbane, 1969.

Promkutkeo, J., Mook, R. and O'Hanlon, P.W., "The Relative Importance of Different Environmental Benefits and Costs", Occasional Paper of the Recreation and Tourism Unit, Univ. of New England, April, 1977.

Randall, A., Ives, B. and Eastman, C., "Bidding Games for Valuation of Aesthetic Environmental Improvements", Journal of Environmental Economics and Management, Vol 1, pp.132-149, 1974.

Reynolds, I.K., "The Relationship of Land Values to Site Characteristics - Some Implications for Scenic Quality Management" Journal of Environmental Management, Vol 6, pp.99-106, 1978.

Reynolds, I.K., The Opportunity Cost of, and Policies for, Increasing Woodland Aesthetic Quality, Unpublished Master's Thesis, University of New England, 1978.

Schaefer, N.T., *et al*, The Border Ranges National Park Proposal: An Economic and Environmental Evaluation, School of Town Planning, University of New South Wales, 1978.

Slatyer, R., "Ecological Reserves: Size, Structure and Management" in Fenner, F. (ed) A National System of Ecological Reserves in Australia, Report 19 of the Australian Academy of Science, Canberra, 1975.

Sinden, J.A., "The Evaluation of Extra-Market Benefits: A Critical Review" World Agricultural Economics and Rural Sociology Abstracts, Vol 9, No. 4, pp.1-16, 1967.

Sinden, J.A., "An Economic Case for Conservation?" in Costin, A.B. and Frith, H.J., Conservation, Penguin, 1971.

Sinden, J.A. and Musgrave, W.F., "An Economic Framework for the Conservation Decision", in Webb, L.J., Whitelock, D., and Le Gay Brereton, The Last of Lands, Jacaranda Press, Brisbane, 1969.

Sinden, J.A. and Smith, R.K., "The Analysis and Management of Forest Landscapes: Exotics, Eucalypts or Solitude?" Australian Forestry, Vol 38, no. 3, pp. 183-200, 1975.

Sinden, J.A. and Worrell, A.C., Unpriced Values: Decisions Without Market Prices, John Wiley and Sons, New York, 1979.

Smith, R.J., "The Evaluation of Recreation Benefits: The Clawson Method in Practice" Urban Studies, Vol 8, pp.89-102, 1971.

Smith, V.K. and Krutilla, J.V., Structure and Properties of a Wilderness Travel Simulator: An Application to the Spanish Peaks Area, Resources for the Future, Johns Hopkins Univ. Press Baltimore, 1976.

Smith, V. and Wilde, P., "The Multiplier Impact of Tourism in Western Tasmania" in Mercer, D. (ed), Leisure and Recreation in Australia, Sorrett Pub. Co. Melbourne, 1977.

South Australian Government, National Parks and Wildlife Act, 1972-1974.

Steele, D.B., "regional Multipliers in Great Britain" Oxford Economic Papers, Vol 21, pp.268-292, 1969.

Tiebout, C.M., "Community Income Multipliers: A Population Growth Model" Journal of Regional Science, Vol 2, pp.75-84, 1960.

Tisdell, C., "Provision of Parks and the Preservation of Nature - Some Economic Factors", Aust. Econ. Papers, Vol 11, pp.154-162, 1972.

Tracey, J.G., Webb, L.J. and Williams, W.T., "The Australian Flora" in Webb, L.J., Whitelock, D., and Le Gay Brereton, (eds) The Last of Lands, Jacaranda Press, Brisbane, 1969.

Ulph, A.M., Environmental Policy Under Uncertainty and the Choice of Discount Rates, CRES Working Paper R/WP25, 1978.

UNESCO, Final Report of Expert Panel on MAB Project 8: Conservation of natural areas and of the genetic material they contain, Morges, Switzerland, 1973.

UNESCO, MAB Task Force on: Criteria and Guidelines for the Choice and Establishment of Biosphere Reserves. Final Report, Paris, May, 1974.

Webb, L.J., "Australian Plants and Chemical Research" in Webb, L.J., Whitelock, D. and Le Gay Brereton, J., The Last of Lands, Jacaranda Press, Brisbane, 1969.

Weiss, S.J., and Gooding, E.C., "Estimation of Differential Employment Multipliers in a Small Regional Economy", Land Economics, Vol 44, pp.235-244, 1968.

Woodwell, G.M., "The Carbon Dioxide Question", Scientific American, Vol 238, No. 1, pp.34-43, 1978.

APPENDIX 1

THE SAMPLING PROCEDURE USED IN THE SURVEY OF WARRUMBUNGLE NATIONAL PARK VISITORS

The sampling procedure used in the survey was dictated by considerations of surveying cost. As only a small budget was available for allocation to the survey and most of this would be consumed by onsite labour costs (fixed per unit time), periods of the year in which maximum visitation would be expected were selected for sampling so that maximum coverage of park visitors could be obtained at the given cost. These sampling periods were the May and August - September School holidays, giving a total of approximately 4 weeks sampling time.

Due to both the layout of the park and the limited labour available (only 2 persons could be employed at any one time) sampling was conducted at the Information Centre in the park. (Each group entering the park is required to purchase entry tickets and, if applicable, camping permits at the Information Centre. As the Ranger regularly polices the camping areas to ensure that groups have purchased permits, any errors likely to be caused by missing groups from the sample are likely to be small). A variation to this procedure was used on peak visitation days. At these times, to avoid congestion at the Information Centre, the Park staff issued entry tickets at the main day use areas. (Campers were still required to register at the Information Centre). When this occurred, one of the sampling staff accompanied the park staff to one of the day use areas and issued a questionnaire to groups purchasing day use tickets there. The two main day use areas (Canyon Camp and Camp Pincham) were sampled on alternate days at peak times. This entailed missing some groups in the sample but as there were few of these peak days, the loss is not serious.

Each group purchasing a permit (for day use or camping) at the respective sites were issued with a copy of the survey questionnaire which was, for cost reasons, self administered. A total of 1684 questionnaires was handed out. Of these, 787 were returned (either at the Park or by mail) or 47% of the total issued.

The low response rate is probably due to two factors. Firstly, as little labour could be employed, personnel could not be spared to travel around the areas to collect completed schedules. Thus, some groups may

not have completed the questionnaire at all while some may simply have ommitted to return the schedule. Secondly, and compounding the effects of the first problem, was the influence of the weather. At varying times in the sampling periods, rain fell in and around the park. As the roads into the park are susceptible to closure after very little rain, most visitors pack up and leave soon after rain begins. In these circumstances, the completion and return of a questionnaire would take low priority. In all, 16 days of the sampling period were lost because of rain. (Note that the park can remain closed for some time after rain ceases, until roads become passable again). Under these circumstances, the response rate does not seem too poor.

Following is a description of the questionnaire.

Q1 sought information on activities undertaken in the park

Q2 sought information on expenditure in the park on entry and camping permits, purchases at the Information Centre and photography

Q3 sought information on the effects of visitor numbers on the respondent's visit

Q4 asked non-Coonabarabran resident groups to detail expenditure in Coonabarabran on their trip

Q5 asked for place of residence and start and finish time of their trip

Q's 6-8 asked the group to detail towns passed through on the trip.

Q's 9-11 asked the group to specify how much time was spent in Warrumbungle National Park and how much at other recreation stops

Q12 asked the group to estimate the distance travelled on the trip

Q's 13-15 asked the group to estimate the actual cost of travelling on the trip

Q16 asked for the number in the group on the trip to the park

Q17 sought for each person in the group, the following information:

- Age
- Sex
- Occupation
- Marital status
- Education status
- Income level

Finally some space was left for the respondents to add any desired comments.

APPENDIX 2

AN ACTIVITIES MODEL OF CONSUMER BEHAVIOUR WITH SPECIAL REFERENCE TO OUTDOOR RECREATION

1. Introduction

A standard problem in cost-benefit analysis is to measure the benefits of commodities for which no market prices may exist, such as recreation facilities. One approach to this problem, originating from Hotelling (1947) is to measure the willingness-to-pay for such unpriced commodities by considering people's consumption of complementary commodities. In the case of recreation facilities, the complementary commodities are the resources (including time) used to travel to and from, and stay at, the recreation site. We shall call such resources by the generic title 'travel costs', and the use of travel costs to proxy willingness-to-pay the 'travel cost method'.

The travel cost method has by now been widely used in the evaluation of transport projects and outdoor recreation projects (see Knetsch and David (1966), Lavery (1975), O'Rourke (1974) for surveys of the work in outdoor recreation). However, a survey of the various studies undertaken shows a diversity of approach which is quite worrying. Not many comparative studies exist - that is recalculating models with different assumptions but using the same data - but one such study, by Common (1973), suggests that the differences in approach can lead to significant differences in the measure of benefits one can derive, and hence can affect the decision being considered.

It would seem desirable, therefore, if a more consistent methodology could be adopted and this paper attempts to set out a general theoretical framework within which the underlying differences in approach can be assessed. Our interest will be the use of travel cost to evaluate benefits from outdoor recreation, specifically visits to national parks. However, much of the discussion will apply more generally. As a related matter, it is important to emphasise that travel cost methods can have two broad purposes - positive, to study the factors that affect the demand for outdoor recreation facilities or modes of transport, and normative, to help in cost benefit studies of new projects.

The structure of the paper is as follows. Section 2 sets out the activities model of consumer behaviour, without explicit recognition of time, which is introduced in section 3. The model is applied to the demand for visits to National Parks in section 4, and some of the difficulties that arise in applying the model in practice are discussed in section 5. The application of travel cost methods to evaluation of parks

is examined in sections 6 and 7, while section 8 provides some conclusions.

2. A Simple Model of Travel Cost Without Time

It may seem strange to begin a discussion of travel costs by omitting any reference to time, since, in the transport field at least, this has been a major area of contention. The reason for our approach is that there are some broad issues to be resolved initially, to which time adds complications and we wish to deal with these issues separately.

The simplest model to illustrate the methodology of travel cost is derived from the work of Becker (1965) and Lancaster (1966). Individuals derive utility not from goods and services *per se*, but from 'activities' which will require, possibly, the inputs of various goods and services; the activity of consuming a meal will require inputs of food, drink, the services of a table and chairs etc, while the activity of visiting a national park requires inputs of petrol and food on the journey, a ticket to enter the park, etc. The precise components of activities will be discussed later, but the model can be formalised as follows.

The level of the m possible activities consumed by the individual are denoted by $Z_1 \ldots Z_m$, and the required inputs of the n goods and services into each activity are given by the activities technology, specified in (1) as linear, and more generally in (2)

$$x_{ij} = a_{ij} Z_i \qquad \begin{matrix} i=1 \ldots m \\ j=1 \ldots n \end{matrix} \qquad \ldots (1)$$

$$Z_i = f_i (x_{i1} \ldots x_{in}) \qquad i=1 \ldots m \qquad \ldots (2)$$

The budget constraint, for this section, will be written simply as

$$\sum_{i,j} P_j x_{ij} \leq I \qquad \ldots (3)$$

where I is income, $P_1 \ldots P_n$ prices.

Taking the technology as specified in (1) we have

$$\max U(Z_1 \ldots Z_m) \quad \text{s.t.} \quad \sum_{i,j} P_j a_{ij} Z_i \leq I$$

which yields as first order conditions

$$U_i \leq \lambda \sum_j P_j a_{ij} \qquad Z_i \geq 0 \qquad \ldots (4)$$

where (4) holds with complementary slackness and λ is the marginal utility of money. Letting $\pi_i = \sum_j P_j a_{ij}$ denote the <u>full price</u> of activity i, then the activity model is equivalent to the standard consumer problem: $\max U(Z_1 \ldots Z_m)$

$$\text{s.t. } \Sigma \pi_i Z_i \leq I$$

so that the demand for any activity can be written as a function of full prices and income

$$Z_i = d_i(\pi_1 \ldots \pi_m, I)$$

Now to find the response of Z_i to a change in one of the input prices P_j we have

$$\frac{\partial Z_i}{\partial P_j} = \sum_{k=1}^{m} \frac{\partial d_i}{\partial \pi_k} \cdot \frac{\partial \pi_k}{\partial P_j} = \sum_k \frac{\partial d_i}{\partial \pi_k} \cdot a_{kj}$$

In the case of national park visitation we are interested in the response of visits to a change in park entrance fees. Letting i* denote the activity 'visits to national park' and j* denote the good 'park entrance ticket', and assuming that $a_{i^*j^*} = 1$, $a_{ij^*} = 0$, $i \neq i^*$, then we have

$$\frac{\partial Z_{i^*}}{\partial P_{j^*}} = \frac{\partial d_{i^*}}{\partial \pi_{i^*}}$$

i.e. the response of the number of visits to a change in park fee is equal to the own price effect of a change in the full price of a visit to a national park. This is the simplest justification for the use of travel cost, in the sense that it suggests that we can calculate how people would respond to hypothetical entrance fees by observing their response to real variations in full prices.

Before considering criticisms of the model, we note two further aspects. The value of 'saving' an input j to the ith activity can be derived as

$$-\frac{dU}{da_{ij}} = \lambda P_j Z_i$$

that is the amount of the input that will be saved by a unit reduction in a_{ij} (i.e. Z_i), times the marginal utility value of such savings λP_j ; in money terms the savings would be valued as $-\frac{1}{\lambda}\frac{dU}{da_{ij}} = P_j Z_i$ i.e. just valued at the market price. Note that the value of saving the j input is independent of which activity it is saved in.

Second consider the technology as specified in (2). The model now is

$$\begin{aligned} &\max \quad U(Z_1 \ldots Z_m) \\ &\text{s.t.} \quad \sum_{i,j} P_j x_{ij} \leq I \\ &\qquad Z_i = f_i(x_{i1} \ldots x_{in}) \qquad i=1 \ldots m \end{aligned}$$

Introducing μ_i as the shadow prices on the second set of constraints we have as first order conditions

$$\frac{\partial U}{\partial Z_i} \leq \mu_i \qquad Z_i \geq 0 \qquad i=1 \ldots m$$

$$\mu_i \frac{\partial f_i}{\partial x_{ij}} \leq \lambda P_j \qquad x_{ij} \geq 0 \qquad \begin{matrix} i=1 \ldots m \\ j=1 \ldots n \end{matrix} \qquad \ldots (5)$$

from (5)

$$\mu_i \frac{\partial f_i}{\partial x_{ij}} \cdot x_{ij} = \lambda P_j x_{ij}$$

and summing over j we have

$$\mu_i \sum_j \frac{\partial f_i}{\partial x_{ij}} x_{ij} = \lambda \sum_j P_j x_{ij} \qquad \ldots (6)$$

Assuming constant returns to scale in activities production (6) becomes

$$\mu_i = \lambda \sum_j \frac{P_j x_{ij}}{Z_i} = \lambda \pi_i$$

where $\pi_i = \frac{\Sigma P_j x_{ij}}{Z_i}$ is the average (= marginal) cost or full price of the ith activity. Although the activity model can again be reduced to the standard consumer model: max $U(Z_1 \ldots Z_m)$ s.t. $\Sigma \pi_i Z_i \leq I$, there is now an important difference, for the π_i are no longer objectively determined, but have to be computed as part of the solution of the consumer choice problem. Another way of putting this is that even if all individuals face the same activities technology and the same input prices, they will not choose the same factor inputs to each activity, and hence will have different producer prices for the activities, because they are 'selling' the activities to different markets. Thus, although we can decompose the consumers problem into two parts - the standard consumer problem mentioned earlier, and the producer problem:

$$\max \quad \Sigma \pi_i - \sum_{ij} P_j x_{ij}$$

$$\text{s.t.} \quad f_i (x_{ij} \ldots x_{in}) = 1 \qquad i=1 \ldots m$$

the transfer prices π_i linking the two problems are part of the solution procedure.

A number of criticisms have been made of the activities approach, for example by De Serpa (1971), and we shall consider these now. Detailed problems about implementation of the travel cost method in the context of evaluating recreation benefits will be considered later.

The first point made by De Serpa is that the activity approach really adds nothing to the standard neoclassical approach where the arguments of the utility function are goods. To see this, consider equation (5), assuming that all $x_{ij} > 0$. Then for any j, we have

$$\frac{\partial U}{\partial Z_i} \frac{\partial f_i}{\partial x_{ij}} = \lambda P_j$$

Letting U_j denote this common value of the derived marginal utility of good j in each of the m activities we have

$$\frac{U_j}{U_k} = \frac{P_j}{P_k}$$

where j and k denote any pair of goods. The activity approach is thus just a reinterpretation of standard theory. While this is true, it is irrelevant, for we are concerned with trying to explain demand not for standard goods and services, for which traditional theory is adequate, but for other phenomena such as visits to national parks, for which there are usually no organised markets. The activity approach can thus be seen as providing an analysis of the demand for such phenomena using the same utility maximising framework as received theory, with the additional advantage that it preserves all the usual results when the model is focussed on standard commodities.

There are three other, more pertinent, criticisms of the activity approach made by De Serpa, all of a related nature. They have to do with the implications of the production structure of the activity model. First, it is not at all clear that the concept of 'activity' can be given any substantive interpretation, so that much of the above analysis is empty formalism. In particular, are the activity production functions supposed to be objectively observable, or do they depend on the individual's perception of what the production constraints are? If the latter it may be impossible to separate the utility function from the constraints. We shall return to this problem in the specific context of national parks later.

The second, related point, is that utility depends only on the level of activities, not on the way they are carried out, i.e. on their inputs. It is possible, as we noted, for individuals with different preferences to operate with different input combinations to an activity, even though they have the same activity technology and face the same factor price, because they impute different shadow prices to each activity, and these shadow prices will attract resources into more profitable activities changing input mixes as they do so. However, it is only through the pressure of shadow prices on the outputs that input mixes can respond. There is a feeling, however, in much of the value of time literature, that utility may also depend on the inputs to activities; in

particular utility may depend on the time spent in various activities. Thus, even if time could be more productively used in one activity people may decide to allocate it to another one because the use of time is more enjoyable in that activity. The third point is that a production specification implies that inputs to activities will be used efficiently, whereas it is frequently stated in the travel-to-work context that people may choose methods of commuting which are more expensive both in money terms and time terms.

An approach which we feel goes some way to tackling these objections is to extend De Serpa's concept of intermediate goods to intermediate activities. That is activities are undertaken not only because they generate utility but because they are required as inputs to other activities. Thus an activity of consuming a good may require as an input the activity of shopping for it, which in turn could require inputs of travelling etc. Formally the production technologies introduced earlier become modified as follows:

Linear Technology $x_{ij} = a_{ij} Z_i$ $\quad i=1 \ldots m,\ j=1 \ldots n$

$$Z_{ij} = b_{ij} Z_i \qquad i=1 \ldots m,\ j=1 \ldots n \qquad \ldots (7)$$

General Technology

$$Z_i = f_i(X_{i1} \cdots x_{in}, Z_{i1} \cdots Z_{im}) \qquad i=1 \ldots m \qquad \ldots (8)$$

where Z_{ij} is the amount of activity j used to produce activity i. There is now an additional set of constraints

$$Z_j \geq \sum_i Z_{ij} \qquad j=1 \ldots m \qquad \ldots (9)$$

The analysis will be done for the linear technology, similar results holding for the more general case. Our problem now is

$$\max \ U(Z_1 \ldots Z_m)$$

$$\text{s.t. } Z_j \geq \sum_i b_{ij} \cdot Z_i \qquad j=1 \ldots m$$

$$\sum_{i,j} P_j a_{ij} Z_i \leq I$$

yielding first order conditions

$$\frac{\partial U}{\partial Z_i} - [\lambda \sum_{j=1}^{n} P_j a_{ij} + \sum_{j=1}^{m} \mu_j b_{ij}] + \mu_i \leq 0 \quad Z_i \geq 0$$

or $$\frac{1}{\lambda} \frac{\partial U}{\partial Z_i} + \frac{\mu_i}{\lambda} \leq [\sum_j P_j a_{ij} + \sum_j \frac{\mu_j}{\lambda} b_{ij}] = \rho_i \text{ , say}$$

Now ρ_i is the output price of activity i, that is the average (=marginal) cost of producing a unit of Z_i. $\frac{\mu_i}{\lambda}$ is the input price of activity i, that is the price at which the activity is charged as an input to other activities. The two prices differ, in general, since

$$\frac{1}{\lambda} \frac{\partial U}{\partial Z_i} + \frac{\mu_i}{\lambda} = \rho_i \qquad \ldots (10)$$

Before interpreting this result, note that if $Z_j > \sum_i Z_{ij}$ then $\mu_j = 0$, that is if the production of the activity is more than is needed to meet input requirements for other activities, then the price at which that activity is charged to other uses is zero. We shall call activities for which $Z_j = \sum_i Z_{ij}$ and hence in general $\mu_j > 0$ pure intermediate activities.

Returning to (10), the conditions says that for an activity that is not a pure intermediate one we have the same optimality condition as before - the activity should be pursued up to the point at which the value of its marginal utility equals the marginal cost of producing one more unit. In the case of a pure intermediate good, (10) says that the activity should be produced to the point where the marginal cost of producing it equals marginal benefit, where marginal benefit is the sum of the value of the marginal utility of the activity and the implicit revenue it earns in other activities. Another way of putting this is to write (10) as

$$\frac{\mu_i}{\lambda} = \rho_i - \frac{1}{\lambda} \frac{\partial U}{\partial Z_i} \geq 0$$

Production of activity i now generates an externality (good if $\frac{\partial U}{\partial Z_i} > 0$, bad if $\frac{\partial U}{\partial Z_i} < 0$) so that production of the activity should be encouraged by a subsidy (on production costs) of $\frac{1}{\lambda} \frac{\partial U}{\partial Z_i}$ if that is positive, and discouraged by a tax (on production costs) of $-\frac{1}{\lambda} \frac{\partial U}{\partial Z_i}$ if that is positive. $\frac{\mu_i}{\lambda}$ cannot be negative for that would imply that the value of the marginal utility of the activity exceeded the marginal cost of producing the activity, in which case it would pay to increase one's consumption of that activity.

It is worth noting one further implication of the model. The value of saving the input of the jth good into the ith activity can be expressed as $-\frac{dU}{da_{ij}} = \lambda P_j Z_i$ so that again each unit of the good saved is valued, in utility terms at λP_j, in money terms at P_j, and this is independent of the activity in which the savings are made. Similarly, the savings of an input of the j th activity into the ith activity is given by

$$-\frac{dU}{db_{ij}} = \mu j Z_i$$

so that each unit of the activity saved is valued at μ_j in utility terms, $\frac{\mu_j}{\lambda}$, in money terms. This implies that for an intermediate activity the value of savings is $\rho_j - \frac{1}{\lambda}\frac{\partial U}{\partial Z_j}$ i.e. the value of the resources saved ρ_j, less the value of any marginal utility foregone (plus any marginal disutility avoided). For an activity which is not purely intermediary the value of savings is zero. The reason for this is quite simple; the level of activity chosen will be totally unaffected by the change in the input-output coefficient; all that happens is that, of the total output of the activity less is used as intermediary in other activities, more is consumed directly for its own sake. However, since utility depends on the <u>total</u> output of the activity this reshuffling of its constituents has no effect on utility.

We believe that the extended activity model meets De Serpa's criticisms, for now note that if, as in the case of travelling, many of the intermediate activities (driving, waiting, etc) have time as their major, perhaps only, direct input, then the value of those activities are given by the resource cost (dominated by time costs) adjusted by the marginal utility (disutility) of the activity. We believe this is the proper sense of what is meant by saying that the value of time depends on the activity in which it is used. (We discuss this further in the next section). Moreover, the same explanation allows people to choose apparently inefficient methods of performing activities, essentially because some of the inputs to the activity are really inputs to intermediate activities and therefore require valuing differently from pure resource cost methods.

There remain some problems, however. First De Serpa's first criticism, covering the definition of activities probably applies

a fortiori when activities can be subdivided into various intermediate activities. Moreover, there is the problem of actually determining the values to attribute to intermediate activities, since these depend not only on the resource costs of these activities but also their marginal utility/disutility, a subjective valuation.

However, how important these criticisms are really depends on the circumstances in which one seeks to apply the analysis, and we shall defer discussion of these points to section 4 of this paper where we discuss various problems of trying to apply the analysis of this section to measuring the demand for visits to national parks. In the next section of this paper we take up the issue of valuing time in the context of the analysis developed above.

3. Value of Time

The simplest text book approach for modelling value of time can be expressed as follows

$$\text{Max } U(L, H, C)$$

$$\text{s.t. } L + H \leq T$$

$$C \leq W H$$

where L is leisure time, H time spent at work, C consumption (treated as an aggregate with unit price), and W is the wage rate.

This has first order conditions

$$\frac{\partial U}{\partial L} \leq \nu \qquad L \geq 0$$

$$\frac{\partial U}{\partial H} \leq \nu - \lambda W \qquad H \geq 0$$

$$\frac{\partial U}{\partial C} \leq \lambda \qquad C \geq 0$$

where ν is the marginal utility of time, the marginal utility of money, and $\frac{\nu}{\lambda}$ can be interpreted as the value of time.

$$\frac{\nu}{\lambda} = W + \frac{1}{\lambda} \frac{\partial U}{\partial H}$$

so that the value of time equals the marginal wage rate plus the marginal utility of work.

Now in the text books, the term H used in the above model is usually suppressed, and this has led to a somewhat sterile debate, which as Flemming (1973) has shown is largely a matter of interpretation rather than substance.

We now add time to the model outlined in section 2. This yields a model very similar to that of Evans (1972), although our interpretation

of the results is somewhat different. We denote by Z_o the activity 'market' work, and by a_{io} the input of time per unit of activity i, i=0 ... m, with $a_{oo} = 1$. b_{ij} is again the input of activity j per unit of activity i, i=0, ... m, j = 1 ... m. That is we assume that market work is never an input to other activities, although other activities, such as travel, may be inputs to work.

Now the model is

$$\max \quad U(Z_o, Z_1 \ldots Z_m)$$

$$\text{s.t.} \quad \sum_{i=0}^{m} \sum_{j=1}^{n} a_{ij} P_j Z_i \leq W Z_o$$

$$\sum_{i=0}^{m} a_{io} Z_i \leq T$$

$$Z_j \geq \sum_{i=0}^{m} b_{ij} Z_i \qquad j=1 \ldots m$$

First order conditions yield

$$\frac{\partial U}{\partial Z_i} + \mu_i \leq \lambda \sum_{j=1}^{n} a_{ij} P_j + \nu a_{io} + \sum_{j=1}^{m} \mu_j b_{ij} \qquad Z_i \geq 0 \quad i=1 \ldots m$$

$$\frac{\partial U}{\partial Z_o} + \lambda W \leq \lambda \sum_{j=1}^{n} a_{oj} P_j + \sum_{j=1}^{m} \mu_j b_{oj} + \nu \qquad Z_o \geq 0$$

$$\rho_i = \sum_{j=1}^{n} a_{ij} P_j + \frac{\nu}{\lambda} a_{io} + \sum_{j=1}^{m} \frac{\mu_j}{\lambda} b_{ij} \qquad i=0 \ldots m \quad (11)$$

We can rewrite the conditions as

$$\frac{1}{\lambda} \frac{\partial U}{\partial Z_i} + \frac{\mu_i}{\lambda} \leq \rho_i \qquad i=1 \ldots m \qquad \ldots (12)$$

$$\frac{1}{\lambda} \frac{\partial U}{\partial Z_o} + W \leq \rho_o \qquad \ldots (13)$$

Again we can interpret ρ_i as the resource cost of producing activity i, including the cost of direct goods and services, the cost of indirect activities, and the cost of time, valued at $\frac{\nu}{\lambda}$. This applied to all activities, i=0 ... m. For activities i=1 ... m, $\frac{\mu_i}{\lambda}$ is the input price of activity i, i.e. the price at which intermediate activities are to be charged to other activities.

Again $\frac{\mu_j}{\lambda} = \rho_j - \frac{1}{\lambda} \frac{\partial U}{\partial Z_j} \geq 0$

with $\mu_j = 0$ when $Z_j > \sum_{i=0}^{m} Z_{ij}$

Assuming that

$a_{oj} = 0$, j=1 ... n, and $b_{oj} = 0$ j=1 ... m

(13) just becomes

$$\frac{\nu}{\lambda} = W + \frac{1}{\lambda} \frac{\partial U}{\partial Z_o} \qquad \ldots (14)$$

which is just the result derived from the simpler model earlier in this section.

Now consider the value of saving time in activity i. This can be derived as

$$- \frac{dU}{da_{oi}} = \nu Z_i ,$$

or in money terms

$$- \frac{1}{\lambda} \frac{dU}{da_{oi}} = \frac{\nu}{\lambda} Z_i \qquad i=0 \ldots m$$

Again, the value of saving time is the same (per unit of time saved) irrespective of where time is saved, and it is also equal to the addition of one more unit of time to the total time budget. The result which Evans, Flemming, De Serpa and others need to obtain, that the value of time savings depend on the activity in which the savings are made, can be interpreted in our model as follows. Consider the value of saving a unit of some intermediate activity j in activity i

Then

$$-\frac{1}{\lambda}\frac{dU}{db_{ij}} = \frac{\mu_j}{\lambda} Z_i = \left(\rho_j - \frac{1}{\lambda}\frac{\partial U}{\partial Z_j} \right) \cdot Z_i$$

Now if we assume that time is the only input to activity j (a somewhat unrealistic assumption), and that $a_{oj} = 1$, so that the activity is measured in units of time, then we have

$$\frac{\mu_j}{\lambda} = \frac{\nu}{\lambda} - \frac{1}{\lambda}\frac{\partial U}{\partial Z_j}$$

Thus the value of saving one unit of an intermediate activity, for which time is the only input and which is measured in units of time, is not the same as the value of saving one unit of time. However, it is not clear to us why we should say that the value of time is different in activity j than in any other activity - for by doing so we are confusing the use of time as an input to an activity and the use of that activity (which may well be measured in units of time). Thus we should distinguish between saving the amount of time used as in input to, say, driving, from saving the amount of driving used in, say, travelling to work. The two are not the same, but we should clearly never have expected them to be.

Thus we believe that our model, although yielding the result that time has the same value whatever activity it is used in (or saved in), captures the spirit of what De Serpa and others have been trying to demonstrate. As we said earlier, our model is very similar to that of Evans, although he draws the conclusion that the value of time differs in different activities. We also believe that our model is superior to that of De Serpa or Flemming who derive the result that the value of time may differ in different uses by using a model of the form

$$U = U(x_1 \ldots x_n, t_1 \ldots t_n)$$

where x_i is consumption of good i and t_i is the time allocated to consuming it. We prefer our model to theirs for a number of reasons. First by focusing on goods and services rather than activities (which De Serpa certainly intends, although Flemming seems to be indifferent to the interpretation), it prevents us from analysing such non market

goods as visits to parks. Second the time required to consume a good is difficult to specify; if the good is a meal, for which one possibility is that it is eaten at home, then time will be required for shopping, preparation of the food, cooking of the food, and eating of the food. These are all different activities, yet would seem to be simply aggregated and associated with the commodity meal. By contrast our model will distinguish these different intermediate activities and allow them to be valued separately. Finally, we believe that it is really the intermediate activity, to which time is an input, that people have views about, not just the time associated with it.

4. Demand for Visits to National Parks

In this section we will apply the model developed in the two previous sections to examine the demand for visits to a National Park.

Assuming that visits to national parks are desired for their own sake, over and above any input they might have to other activities, then, denoting the activity Z_i as visits to a national park the impact of park fees on the number of visits is given, as shown in section 2, by

$$\frac{\partial Z_i}{\partial F} \quad \frac{\partial Z_i}{\partial \rho_i}$$

where ρ_i is the 'full-price' of a visit to a national park. The question now is how do we measure the full price of such a visit? We have seen (equation (11)) that the full price consists of the cost of goods and services directly consumed in the activity, the value of time directly used in the activity, and the value of intermediate activities required. Considering the latter first, there are a number of activities which might be considered as intermediate. A visit to a park will entail travelling to and from the park, eating meals while on the journey and in the park, sleeping under shelter if the visit lasts more than a day, shopping for goods and services consumed during the visit, etc. It can be argued that only the first of these is really important - the activity of travelling to the park. The activities of eating and seeking shelter are clearly activities which people engage in beyond their use as inputs to other activities, and so are zero-priced in other activities.

The amount of shopping activity can be deemed unimportant. So the major intermediate activity is travel to the park.

The other major components of the price of a visit to a park are therefore the cost of goods and services bought for use in the park itself, such as films for cameras, and the value of time spent in the park. Thus we can break down the full price of a visit to the park as

$$\rho_i = C_s + V.t_s + M_j.Z_j \qquad \ldots (15)$$

where C_s is the cost of on-site goods and services, t_s is time-on-site, V is the value of time, Z_j is the input of travel activity (which we can measure in time units) and M_j the price of each unit of travel. These three terms correspond to the three terms of equation (11), the first the cost of commodities purchased, the second the value of time, and the third the cost of intermediate activities.

Now V and M are unknown, although we can get a little further for, using equation (14) for the simple form of the value of time, we have,

$$M_j = C_j + V + U_j \quad \text{and} \quad V = W + U_w$$

where C_j is the cost of goods and services (per unit of time) spent while travelling (essentially cost of petrol and car services), W is the marginal wage rate, U_j the value of the marginal utility or disutility of travelling, and U_w the marginal utility of work. Substituting for M_j and V in (15) we have

$$\rho_i = (C_s + W\, t_s + C_j\, t_j + W\, t_j) + U_w\, t_s + (U_w + U_j)\, t_j$$

$$= (k + W\, t) + \alpha t_s + \beta\, t_j$$

$$= c + \alpha t_s + \beta\, t_j \qquad \ldots (16)$$

where t_j is travel time.

Equation (16) gives us the full price for a visit to a national park. Suppose now we assume some functional form for the demand curve for visits to a national park. This will be a function of the own price of visits, the price of all other activities, and the level of income. For the moment we shall focus on the own-price demand curve, other variables being held constant. Thus, suppose we have some functional form

$$Z = f_i\ (\rho_i)$$

Then we can substitute equation (16) for ρ_i into the demand function and estimate the parameters of f_i and the unknown parameters α and β. For example, assuming a linear demand function, we have

$$\begin{aligned} Z_i &= a - b\ \rho_i \\ &= a - bc - b\alpha t_s - b\beta t_j \\ &= \gamma_0 + \gamma_1 C + \gamma_2\ t_s + \gamma_3\ t_j \end{aligned}$$

We can thus identify not only the demand parameters but also the value of time and the value of the marginal disutility (utility) of travelling.

If we assumed a more complex functional form, for example, log-linear, then we would need to use non-linear estimation procedures. Clearly, it would be ideal if we derived the demand function from some general specification of a utility function, such as translog. Very few studies give much consideration to the choice of functional form (but see Morey (1978)). However, as we shall see, the demand function is not always what should be of interest anyway, so we shall defer discussion of functional form to section 7.

As we have already noted, previous travel cost studies reveal a wide range of approaches to estimation of even the simple demand function, and we shall complete this section by surveying what previous researchers have assumed about the independent variables in the demand function. Further difficulties with the travel-cost method will be discussed in the next section. We shall begin by considering the determination of the full-price of a visit to a national park, since this is the area of greatest debate.

(a) Full Price of a Visit to a National Park

We shall consider the time and money costs separately.

Time Costs

There appear to be two issues involved in the literature. Firstly there is the question of which time should be valued - travel time only or travel time and on site recreation time. Knetsch (1963), Pearse (1968), Beardsley (1971) and Knetsch and Cesario (1976) recommend the former while McConnel (1975) and Woodfield and Cowie (1977) recommend the latter. McConnell (1975) advocates the aggregation of time into total time, an approach followed empirically by Woodfield and Cowie (1977). Smith (1971) is alone in considering only "excess travel time" - the time taken over and above that which would be considered average for the given trip. It is not obvious why this is a useful or meaningful distinction. The present model indicates that the total time spent on the visit needs to be considered, and in two categories - "travel time" and "on site time".

The second question surrounding the use of time in travel cost studies is the appropriate money value for time. A common approach is to value time at some proportion of the wage rate. For example Pearse (1968), having divided his sample into income classes, takes the midpoint of each class and divides by 240 (the approximate number of working days in a year) to give the average value of a day's working time for that class. Knetsch and Cesario (1976) and Cesario (1976) use some function of the relevant wage rate, based apparently on empirical results obtained in commuting research. Woodfield and Cowie (1977) and McConnell (1975) use the wage rate itself. McConnell (1975) qualifies this by stating that if work was not the alternative activity to the recreation activity in question then the appropriate value of time to use is the willingness-to-pay for the next most favoured activity.

Smith (1971) values a unit of "excess time" at the change in money costs which would have the same influence on visit rates as the change of one unit of excess time. This approach is similar to that proposed by Cesario and Knetsch (1970) although it is less prone to subjective bias than the latter.

Ad hoc approaches such as that taken by Pearse (1968) and Smith (1971) and arbitrary methods such as the Cesario and Knetsch (1970) time-money trade off are clearly unsatisfactory. Further it is by no means clear what fraction of the wage rate, if any, is appropriate as a time value. For example, Mansfield (1971) considered that if the recreationer was indifferent to or enjoyed the time spent, it should be valued at zero.

As equation (16) shows our model suggests that time should be valued in a number of ways. In the first term travel plus on-site time is valued at the marginal wage rate and included as part of total money costs. But there are two other "disutility" aspects of uses of time which have to be estimated from the data. The disutility of work is estimated as the coefficient of on-site time (the second term of full price) while the disutility of travelling is derived from estimates of the coefficient on travel time (the third term of full price). Thus, our model suggests that the value of time cannot be determined *a priori* but needs to be estimated from actual behaviour.

Beardsley (1971) performed this task for travel time only while Brown and Nawas (1973) did the same using distance travelled as a surrogate for travel time. (In passing, it should be noted that distance travelled may not be an adequate surrogate for travel time since the distance covered in a given unit of time will depend on the mode of transport and average speed).

Money Costs

The present model indicates that the money costs which should be considered in a travel cost analysis are the cost of on-site goods and services consumed and expenditure on goods and services made whilst travelling (essentially the cost of petrol and car services).

In contrast to this, the following variety of costs are used by authors of travel cost studies.

i) Total operating costs of the vehicle per trip is used by Trice and Wood (1958) in their work forerunning travel-cost.

ii) Total operating costs per person in the vehicle is used by Clawson (1959).

iii) Sinden (1967), Pearse (1968), Ferguson and Greig (1973), Brown and Nawas (1973), Common (1973), Gibson and Anderson (1975) and Woodfield and Cowie (1977) all use or advocate variable costs of travel per trip or per person as the appropriate cost.

iv) Travel costs and on-site costs. Gibbs (1974) attempted to explain the length of visits by using both these variables (among others). He found length of stay was positively related to travel costs and negatively related to on-site costs. Stoevener and Brown (1971) similarly used average variable cost/day to explain the days of use at a site but used distance instead of travel cost as the other explanatory variable.

v) Several authors use some form of "generalised cost" in their work - a combination of travel and time costs. Cesario and Knetsch (1970) outline a subjective method of determining the appropriate cost. Mansfield's (1971) method of arriving at the generalised cost is obscure while McConnell (1975) uses the cost of travel plus foregone earnings or willingness to pay for alternative recreation. Cesario (1976) uses variable vehicle costs plus a value of time determined from other studies.

vi) Burt and Brewer (1971) use total expenditure on the trip plus the average variable cost of car travel as the relevant money cost.

vii) A final approach is illustrated by Smith (1971) and Mansfield (1971) who used <u>perceived</u> travel costs in their methods. The users were asked to state what they thought the cost was and these estimates were then used in the analysis (Smith added the cost of the entry fee onto each estimate). Mansfield used perceived cost as he considered the method aimed to value the utility of recreation so the <u>perception</u> of users was important. Common (1973) argues that <u>actual</u> not subjective prices are used elsewhere in the economy and, for comparability ought to be used in analysing recreation demand also.

We believe it is better to treat this as an errors-in-variable problem, with perceived costs differing from actual by some random error. Since a similar problem arises in any demand estimation, we agree with Common that, for consistency, one should use actual prices.

The costs used by Gibbs (1974) are essentially those which the present model indicates should be assessed. The other studies only partially treat these costs or, alternatively, use a completely different cost measure with no justification.

We turn now to analyse the other independent variables in the demand function.

(b) Other Variables in the Demand Function

Although we have focussed so far on the own price effect of a rise in park entrance fees (which is important for welfare analysis) it is also of interest to know how park visits will respond to changes in other variables, especially income and prices of substitute activities. The former would be important for forecasting growth of demand, the latter for determining the effect of establishing a new park on demand at other sites. Thus demand for park visits should be a function of own price, income, and price of substitute activities.

The various approaches that have been taken to specifying the "own price" of recreation activities were outlined above, beginning on page 185. Generally, the relationship between own price and demand has then been established by regression analysis (using linear or logarithmic functional forms). Several authors mention the possibility that the income levels of recreationers may influence the results obtained in travel cost studies (e.g. Hines (1958), Clawson (1959), Knetsch (1963), Sinden (1967), Pearse (1968), Cesario and Knetsch (1970) and Woodfield and Cowie (1977)). Seckler (1966) is very strong in stating that allowance must be made for the influence of income on the derived demand curve and advocates that the demand function, when formulated, should include (p.488) a variable reflecting income distribution. If the coefficient is significantly different from zero, the income distribution is affecting demand and needs to be considered in the analysis. Several authors follow Seckler's (1966) suggestion and include income as an explanatory variable in estimating the demand function. For example Stoevener and Brown (1967), Burt and Brewer (1971) and Gibbs (1974) include annual family income as an explanatory variable while Beardsley (1971) uses the average income of the visitors from each zone. McConnell (1975) prefers to estimate a demand function for each income group in the sample, not one demand function covering all groups. This is a similar

approach to that suggested by Pearse (1968) who proposed a division of survey respondents into income classes to assess total consumers surplus by aggregating the surpluses from each group. However, Gibbs (1974) showed that the results given by this method were a function of the number of income classes used; this number is determined subjectively by the researcher.

Results reported from some studies where measures of income were included in the demand function estimation indicate that income does not greatly affect the nature of the derived demand curve (see for example, Stoevener and Brown (1967) and Beardsley (1971)). Burt and Brewer (1971) report income elasticities about the mean of income ranging from 0.093 up to 0.71 while the result reported by Gibbs (1974) indicates income elasticities in the lower end of this range, for likely levels of income. It appears, then, that income may affect demand for recreation (park visits) and should be included in the estimation of the demand function.

As mentioned above, the demand for park visits should, in part, be a function of the price of substitute activities. Knetsch (1963 p.391) appears to be the first to mention the importance of substitutes in determining the demand for recreation visits. Sinden (1967) and Cesario and Knetsch (1970) follow. Smith (1971) attempted to empirically assess the effect of substitute trout fishing possibilities on his study area but his results were inconclusive, possibly due to the construction of his variables. Burt and Brewer (1971) in a household survey used the minimum distances to various recreation areas (lakes) to specify the price of recreating at each area for the respondents in their survey. The respondents were asked to state how many days were spent on trips to each category of sites (among other things). Distances were converted to prices by using car-travel costs. Cross-price elasticities were derived and ranged from -1.10 to 1.44 (p.824) indicating that the possibility of visiting substitute (or complementary) areas could have a marked effect on the demand for recreation at a given site.

5. Difficulties with the Model

The previous section derived a model of travel-cost analysis based on the framework developed in sections 2 and 3, and showed how the approach suggested by the model contrasted with that of other studies.

However, there remain areas of travel cost analysis which are not fully covered by the analytical framework developed earlier, and these are examined in this section.

(a) Park Visits as Intermediate Activities

It is possible that for some people, visits to parks are not ends in themselves but inputs to other activities, particularly forms of outdoor recreation such as skiing, swimming, fishing, etc. This does not mean that people do not derive benefit from visiting parks, since, as the model implies, the cost of using a park for outdoor recreation is given by

$$\frac{\mu_i}{\lambda} = \rho_i - \frac{1}{\lambda}\frac{\partial U}{\partial Z_i}$$

so that assuming that a visit to the park yields positive utility, this has the effect of making parks a cheaper location for outdoor activities than other locations, *ceteris paribus*.

As far as travel cost methods are concerned, the effect of an increase in park fee is the same as for people for whom park visits are ends in themselves, since

$$\frac{\partial Z_i}{\partial F} = \frac{\partial Z_i}{\partial(\frac{\mu_i}{\lambda})} \cdot \frac{\partial(\frac{\mu_i}{\lambda})}{\partial F} = \frac{\partial Z_i}{\partial(\frac{\mu_i}{\lambda})} \cdot \frac{\partial \rho_i}{\partial F}$$

The point to note, however, is that it is only the full cost of visiting the park that should be included in the travel cost method; costs of sporting equipment etc. bought to be used in the final activity should not be included.

Although the use of parks as inputs to other activities makes no difference in principle to the procedure, when it comes to estimation it is probably better to assume that those who use parks for different purposes have different utility functions, so that the implicit assumption of identical preference that underlies most estimation should be used for subgroups not for the sample as a whole.

Carey (1965) recognised, fairly early, the necessity of estimating a demand curve for each different type of visitor as the homogeneity

assumption would be less certain to hold across groups than within groups. Examples of this approach are rare in the literature. Woodfield and Cowie (1977) in their study of the recreation value of the Milford Track in New Zealand divide users into two groups - "tourist walkers" (those on guided tours) and "freedom walkers" (backpackers) - but conclude on the basis of their results "that nothing is to be gained by attempting to discriminate among users in this fashion" (p.107). However, although the results indicated "insignificant differences in the inter-group (price) elasticity estimates" (p.107), which is, perhaps, not too surprising given that the activities are still fairly similar, they suggest at least qualitatively, relationships which could be expected between such groups. For example, the results suggest that the back-packers were slightly more responsive to changes in actual travel costs than were the guided tourists and were willing to pay less than the guided tourists to reach the track. This might be expected if, say, backpackers were less wealthy as a group than the guided tourists. The results also suggest that the backpackers were less responsive than the guided tourists to changes in the costs and time involved in walking the track and were willing to pay more for the experience. This might be expected if backpackers visited the track as the sole purpose (or one of few purposes) of their trip in contrast to a multipurpose trip by the guided tourist. A refinement in measurement techniques or larger samples could allow the determination of these results with more certainty but they seem to indicate that division of recreationers into subgroups might not only be a valid procedure but could yield empirical data more useful in valuation and management than would an aggregated sample.

(b) Identical Values of Time

The estimation procedure outlined earlier in this section is designed to reveal not only the parameters of the own-price demand function for visits to parks, but also the shadow prices attached to the marginal utility of work and travelling. We have already noted that estimation procedures rely on the assumption that everyone in the sample has the same preferences, but, in fact this implies something stronger, for it assumes that the shadow prices for work and travelling are the same for everyone. Even with identical preferences,

these shadow prices can vary since they will depend in general on the precise level of consumption chosen, and this will vary across the sample because of differences in incomes and full price. Procedures, of varying degrees of sophistication, could be applied to the problem. As a first step one could estimate the model as if U_w and U_j in equation (13) were constant; if they are not, and are systematically related to other variables in the model, this will introduce heteroscedastic errors, which can be tested for. As a next stage, one could try to model the determination of U_w and U_j and, at best this will make the estimation procedure non-linear, at worst will make the problem one of simultaneous non-linear estimation.

In general, this problem has not been explicitly approached in the literature. Several authors implicitly assume that the shadow price on the marginal utility of work is the negative of the wage rate by omitting to place any value on on-site time at all. The value of time is given by the wage rate plus the value of the marginal utility of work. If the value of time is zero, then the value of the marginal utility of work must be the negative of the wage rate. Of the literature reviewed only McConnell (1975) advocates including on-site time in valuing recreation benefits. The value of time he uses is foregone earnings if work was the alternative activity to the recreation activity or the willingness-to-pay for the next most preferred recreation activity if work was not possible. Essentially then, McConnell (1975) ignores the value of the marginal utility of work in his time valuation method. Moreover he aggregates on-site and travel time into total time disallowing the possibility of identifying different shadow prices for the marginal utilities of work and travel.

As far as the shadow price on the marginal utility of travel is concerned no travel cost authors directly consider the problem. It is implicitly assumed to be zero. Both Mansfield (1971) and Common (1973) mention the utility of travel in their works but confuse it with the issue of the value of time spent in travel which, as the present model shows, is a separate concern.

(c) Definition of the Dependent Variable

The dependent variable in the analysis so far has been referred to as park visits, but this requires some elaboration. Of particular

importance is the question of how to handle trips of various lengths (this refers only to the time spent in the park) - i.e. should one measure number of visits or number of visitor-days?

On the assumption made in section (4), constant returns to scale, it is not possible to distinguish between one visit of three days and three separate day visits, so one should measure visitor-days. But, of course, constant returns to scale do not apply - the costs involved in travelling to the park (including costs of time and disutility/utility of travelling) are independent of length of time spent in the park; it is only on-site costs that might vary with length of stay. This raises two problems, at the individual level and for the population as a whole.

For the individual, length of visit and number of visits are now separate choice variables. (In this respect the analysis of section 4 was unnecessarily restrictive in assuming fixed input-output coefficients, although the analysis can be easily weakened to any constant returns to scale technology, in which case length of visit is once again a choice variable). Ideally, one should model these decisions as being taken simultaneously, but for a large-scale analysis this becomes too complex. Domencich and McFadden (1975), in the context of urban travel, propose that such decisions be modelled as a hierarchy. With the travel cost method, the individual would first decide on the optimal length of trip, on the assumption that he had decided to undertake the trip. Then, by using some measure of consumer surplus for the optimal level of trip, one would decide whether or not to undertake the trip. Although this introduces an element of separability into the decision, it is important that there be feedback from the length of visit decision to the trip/no trip decision. Thus, while, intuitively, it is clear that on-site costs will affect the length of stay decisions, and travel cost will affect the trip decision, one cannot simply separate these decisions as McConnell (1975) proposes.

Now the difficulty is that while the length of stay decision is similar to the standard economic model, with individuals making marginal adjustments to length of trip in response to changes in variables, the trip/no trip decision cannot be handled by such marginal analysis; small shifts in prices will not, generally, cause the individual to switch his decision. This leads into the second problem, modelling the decision

by the population as a whole.

It is traditional in travel cost, as in standard demand modelling, to assume that preferences are identical, with variations in taste being taken out as part of the random error. For discrete decisions, this is no longer appropriate, for if preferences were identical everyone would either decide to go or not to go on a trip. The approach required now is to explicitly model variations in preferences, so that there is a given probability that any individual will take a particular decision (which will depend on the parameters of the problem). Applying this to the population as a whole one will predict, consistent with observations, that only some proportion of people undertake trips. However, one needs some explicit model of the randomness of the individual's decision (such as the logit or probit models discussed by Domencich and McFadden). This probability model converts the non-marginal decision of the individual into a marginal decision for the population as a whole, so that small changes in prices will lead to small changes in the probability that an individual will make a specific decision.

While this more sophisticated approach is being applied in transport demand studies, we have not yet seen such methods in recreation demand analysis. The dependent variable in reported studies either takes the form of trips or visits or involves a consideration of length of stay such as visitor days. When aggregation of respondents into origin zones is used, the dependent variable is expressed relative to the population of the zone, for example V_i/P_i where V_i represents the number of visits from zone i and P_i the population of zone i. This has led to difficulties when logarithmic functions are used as there will be no price at which visitation will be zero potentially indicating an infinite value for the recreation resource. To overcome this problem, some authors have arbitrarily added a constant (1) to the dependent variable, thus driving visitation rates to zero at some finite cost. (See for example, Smith (1971) and Gibson and Anderson (1975)). This practice needs to be examined critically since, as Taylor (1971) notes, the data transformations and functional forms used may play a significant part in the results achieved.

(d) Multiple Visits

A related point to the previous one is that not only may there be economies in spending several days at a time at one park, there may also be economies in combining visits to a number of recreational activities on the one trip. Our model gives no guidance on how to treat this problem but, if the benefits of a given park are not to be overstated, some means of accounting for visits to more than one recreation area on a trip must be developed.

Any method developed must recognise the possible different level of benefits gained at each site visited on the trip. In this respect, the method employed by Smith (1971, p.95) fails. He uses only the marginal distance travelled to a site in assessing its benefits. Clearly this may not reflect the benefits of the visit. For example, the site where the majority of benefits are gained on a given trip may be only a short distance from a previous "less beneficial" stop and its benefits would then be assessed at low levels. Equally, the site for the less beneficial stop may be a large distance from the previous stop and its benefits may be overstated. Trice and Wood (1958) attempt to include considerations of benefit levels by apportioning travel costs according to the ratio (for site i)

$$\frac{\text{Time spent at site i}}{\text{Total trip time}}$$

Beardsley (1971) uses a similar ratio but omits travelling time

$$\frac{\text{Time spent at site i}}{\text{(Total trip time)-(Travel time)}}.$$

Beardsley's method appears superior to that recommended by Trice and Wood. The latter would reflect relative benefits gained at different sites but not the absolute benefits gained at each site whereas Beardsley's formulation would allow absolute benefits to be measured. For example consider a trip on which two recreation stops are made, taking up 10% and 20% of the total trip time, leaving 70% of trip time for travelling. Under the Trice and Wood formulation, the benefits attributable to the two sites would be 1/10 and 1/5 of travel costs while with Beardsley's method the benefits would be 1/3 and 2/3 of travel costs respectively. The Trice and Wood method preserves the relative benefit levels but leaves 70% of travel costs unallocated.

Beardsley notes (p.177) that his "procedure is appropriate if it can be assumed that visitors allocate both their expenditures and time

in proportion to the benefits received from the several sites visited". There are clearly cases where this may not be so and another approach might be required such as relying on users' perceptions. The users could be asked to rank, on a percentage basis, the importance or levels of benefits gained at various stops made or contemplated on the trip. Such a method assumes that revealed preferences are the same as actual preferences.

(e) Aggregation

The usual method of conducting travel cost studies is to sample park users as they arrive at the park. Users are then usually grouped into various residential locations and the dependent variable used in the analysis is the number of visitor-days or visits per head of population for each of the locations. Other variables are averaged within the residential location zones.

By grouping observations on a locational basis, one considerably reduces the amount of information available for regressions, since the number of observations is now the number of locations. The reason for grouping is, of course, that by sampling only park users one is not taking account of the people who could have visited the park but decided not to, which is just as important in determining the underlying preferences. Averaging the number of visits over the whole population from a particular area is a way of taking account of the zero-demand observations. If, however, one wished only to assess the benefits to users of the site, not the population as a whole, grouping would not be necessary and individual observations could be (e.g. Pearse (1968), Brown and Nawas (1973), Gibbs (1974)).

Two difficulties arise however. First considering the income measure, studies generally use the average income of the visitors from each location. Now the justification for aggregating is that one implicitly assumes that the users are a random sample from each location; but if income has any effect on demand, then users cannot be a random sample of the population - they must be drawn from higher income groups if the income effect is positive, lower income groups if negative. The kind of bias that could be introduced can be seen by the following examples. Consider two communities of equal population, in which the one that is closer to the park (and hence, *ceteris paribus* finds it cheaper

to visit the park) has a very much lower mean income than the more distant community. Then, if income effects are strongly positive, one could find a higher visitor/head figure from the more distant community, implying an upward sloping demand function. Thus the income of the sample really needs to be related to the income of the population location to avoid biases.

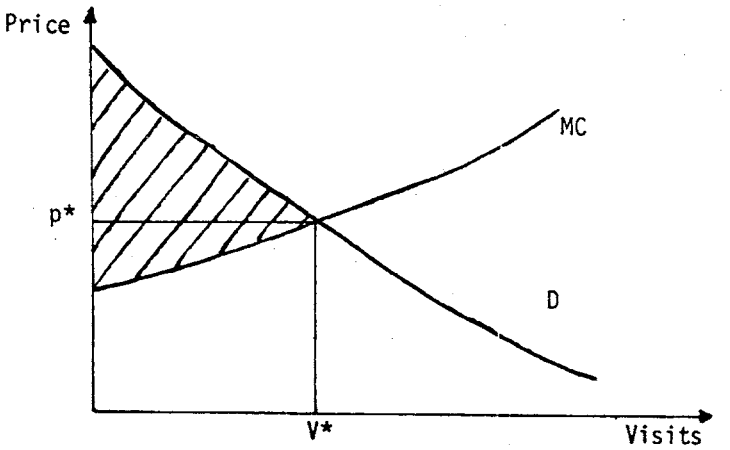
The second difficulty with aggregation is obviously that it is wasteful of observations. The only way to avoid this would be to sample households directly rather than park users (except in the instance noted above), as was done by Burt and Brewer (1971). This makes increasing sense when one wants to study recreational behaviour in general, or wishes to view a number of parks as a system of recreational opportunities, rather than study each park individually. As people come to consider these broader aspects they may well move away from sampling users to sampling the population at large.

6. The Welfare Measure of Park Benefits

As we noted in the introduction, travel cost methods can be used either for positive purposes - determining how park visitation responds to particular variables - or for normative purposes, to help decide whether or not it would be worthwhile establishing a park. Just as the travel cost method itself displays an alarming variation in methodology, so the calculation of welfare benefits has been less than rigorous, and in this section we attempt to provide a framework for such evaluations.

The reason one requires some form of welfare measure for the benefits of recreation is that the high fixed cost nature of parks prevents them being supplied by markets; if the parks were provided at marginal cost, they would run at a loss, so the only way for them to be supplied privately is to have prices above marginal cost. (Tisdell (1972) discusses this issue in detail while Sinden (1977) provided empirical evidence on it. Both conclude that the private market will under-supply parks for this and, perhaps, other reasons). If instead it is decided that parks should be publicly provided, (at marginal cost) then how does the government decide if it is worth establishing the park? To answer this requires an evaluation of consumers surplus. The situation is illustrated in Fig. 1.

Fig. 1



MC is the marginal cost of additional visits to the park, D the demand curve for visits (defined later). Investment in the park should be decided by charging marginal cost to visitors, resulting in price P* and number of visits V*, and then evaluating whether the shaded area is sufficient to cover the fixed costs of the park. The shaded area below P* is the operating profit of the park, the shaded area above P* the consumer surplus. A more rigorous justification for this analysis can be found in Malinvaud (1972) pp.219-229.

Now the crucial point about this analysis is that the appropriate demand curve for measuring consumer surplus is not the own-price demand curve (with other prices and incomes held constant), but the compensated demand curve, (with other prices and utility held constant). Seckler (1966), hints at this point, but not very clearly. The problem then is how to estimate the compensated demand curve.

One approach would be just to assume that consumers surplus on the own-price curve is a good enough approximation to the consumer surplus on the compensated demand curve. Given the uncertainties involved in all such exercises, this may not be unpalatable and is the approach taken in travel cost studies thus far.

Alternatively we could try to amend the own price demand curve to the compensated one using the Slutsky-Hicks equation

$$\frac{\partial X_i^c}{\partial P_i} = \frac{\partial x_i}{\partial P_i} + x_i \frac{\partial x_i}{\partial I}$$

where X_i^c is the compensated demand curve for good U and x_i the uncompensated one.

However this is not particularly helpful. Finally one could assume some specific functional form for the underlying utility function and derive both the ordinary demand function and compensated demand functions. As a simple illustration of what would be involved, suppose one assumes that the underlying utility function, for a two-good world, is Cobb-Douglas

$$U = A\, x_1^{\alpha}\, x_2^{\beta}, \qquad \alpha + \beta = 1$$

Then it is well known that this yields uncompensated demand functions

$$x_1 = \frac{\alpha I}{P_1}, \quad x_2 = \frac{\beta I}{P_2}$$

Thus observation of expenditure shares allows us to derive the parameters α and β of the utility function. It can be readily shown that the expenditure function (that is the minimum amount of money required to achieve a given utility level at a given set of prices), is

$$E(P_1, P_2, U) = \frac{U}{A\alpha^{\alpha}\beta^{\beta}}\, P_1^{\alpha}\, P_2^{\beta},$$

so that we have the following compensated demand functions.

$$x_1^c = \frac{\partial E}{\partial P_1} = \frac{U}{A\alpha^{\beta}\beta^{\beta}}\, P_1^{\alpha-1}\, P_2^{\beta}$$

$$x_2^c = \frac{\partial E}{\partial P_2} = \frac{U}{A\alpha^{\alpha}\beta^{\alpha}}\, P_1^{\alpha}\, P_2^{\beta-1}$$

Observation of actual purchases again allows us to determine the parameters α and β, and we know that the current level of utility is $\bar{U} = A \bar{x}_1^{\alpha} \bar{x}_2^{\beta}$, and putting this into the above equations we have

$$x_1^c = \frac{\bar{x}_1^{\alpha} \bar{x}_2^{\beta}}{\alpha^{\beta}\beta^{\beta}} \cdot P_1^{\alpha-1} P_2^{\beta}$$

$$x_2^c = \frac{\bar{x}_1^{\alpha} \bar{x}_2^{\beta}}{\alpha^{\alpha}\beta^{\alpha}} \cdot P_1^{\alpha} P_2^{\beta-1}$$

Both these functions can be determined by observations on actual expenditure, and so consumer surplus can be calculated.

Of course a Cobb-Douglas utility function is not a particularly satisfying assumption, but it is not clear whether more plausible utility functions will yield analytically tractable compensated demand curves. The important point, however, is that given the need to work with compensated demand curves one should think quite carefully about the choice of functional form for the estimation of the uncompensated demand curve.

7. Welfare Evaluation of a New Park

Most of the studies of travel cost applied to parks consider only individual parks, but some studies (Mansfield (1971), Burt and Brewer (1971)) recognise that when dealing with a new park, one has to consider the effect that establishing the park will have on visitors to other parks. It is perhaps worthwhile noting why such consideration is of relevance, since it is not usually considered in conventional cost-benefit analysis. For instance, in evaluating a new plant to build motor cars, one would not consider the fact that the people who buy the cars may well reduce consumption of other commodities. The reason such effects are ignored is that it would lead to double counting of costs, for if the resource inputs are correctly valued at their opportunity cost, they will in fact measure what consumers have to give up in order to purchase new cars. Why then do we have to consider the effects of a new park on demand for other parks? Precisely for the same reason we have to use a measure of consumer surplus, the increasing returns nature of park investment. In the case of the car example the loss of consumer welfare

from giving up other consumption is exactly matched by the resources saved (and transferred to the new project). However, with significant fixed costs, a reduction of demand at other sites may be accompanied by no such withdrawal of resources; in the extreme case of completely fixed cost, the reduced demand at other sites has no effect at all on the costs of resources devoted to them. Thus the fact that a new park may draw visitors from existing sites needs to be taken into account in conducting the welfare evaluation of a new park.

Mansfield (1971) analyses the effect of establishing a new recreation area by considering the new area "as an homogeneous extension" (p.63) of the present recreation area. Thus, the demand relations derived for the present area can be applied to the new area, assuming of course that underlying preferences and other parameters are held constant over time. The benefit of the new recreation area is not equal to the surplus accruing from all trips to the new area. Rather, the benefit is equal to the sum of the benefits generated by trips made to the new area which would not otherwise have been made to the old area and the benefits in terms of costs saved for trips made to the new area which otherwise would have been made to the old.

Burt and Brewer (1971) view the problem in, essentially, a similar manner but in a wider context. Demand equations were estimated for various types of water-based recreation areas, one type of which represented existing examples of the proposed type of recreation area. (The derived equations were functions of own price, cross prices and income). To assess the benefits of the new recreation areas, the authors first computed the benefits the average household would gain by operating within an altered matrix of visit prices. (The prices of the new areas were derived for each sample cluster from their distances from the sample cluster. For clusters close to the new areas, prices were less than those of existing corresponding areas. Thus the benefits accrue, in part, from a cost saving on existing trips and partly from additional trips made to the new area at the lower cost as with Mansfield's analysis). The household totals were then multiplied by the number of households in the cluster to give a total benefit to the particular cluster of having the new sites.

However, there is a significant problem with using travel cost to evaluate the benefits of new recreation areas and it is illustrated in

both the above studies. Travel cost relies on historical data on visits to an already established site, and for a prospective new recreation area, these do not exist. Hence, demand relationships derived for existing areas must be used to measure the benefits of the new site. Clearly, then, if the measure of benefits derived for the new site is to be "correct", the old and new areas must be identical and this would seldom be the case. Rather, in general, the characteristics of a prospective new recreation area will be different to those observed at existing areas, making the application of travel cost as conducted by Mansfield and Burt and Brewer infeasible. A different approach based on, for example, Lancaster's (1971) model of demand for the characteristics of goods and services, appears more applicable. The consumers' expenditure (here travel cost) is assumed to be incurred in consumption of a given set of characteristics. The model presented in earlier sections would be extended so that utility is derived not from activities but from the characteristics which such activities possess. Provided one can obtain some objective measurement of the characteristics of any site, then it is possible to translate the standard travel cost data into willingness-to-pay for characteristics, rather than willingness-to-pay for a specific site. This requires that there be at least as many sites as there are characteristics. Greig (1978) and Morey (1978) provide examples of the characteristics approach. It is important to note, however, that the characteristics approach does not obviate the need to consider problems posed by the need to estimate compensated rather than uncompensated demand curves, and to consider the impact of a new site on visits to existing sites.

8. Conclusions

In this paper we have pointed out the wide variety of methods actually employed by researchers when using travel cost methods to evaluate recreation benefits. We believe these differences of approach should be resolved, and that this can best be done by establishing more clearly the theoretical principles that underly the travel cost approach. The model we outlined in the early sections of this paper goes some way to doing this, but, as we noted in section 7, there are still some outstanding difficulties. First, there is a need to consider the sequence of decisions involved in undertaking outdoor recreation - decisions about

how many sites to visit, how long to spend at each site, whether or not to undertake a trip at all. A careful specification of these decisions would lead to the use of the logit-type of models being developed in the transport field. Second, to examine new sites or changes in the management of existing sites, the models should be based on a characteristic approach rather than the simpler activities approach. Third, there is a need to recognise that one is interested in compensated rather than uncompensated demand curves. Perhaps the most daunting aspect of this list of developments is the need to incorporate them all into the modelling simultaneously.

REFERENCES

BEARDSLEY, W., (1971) "Bias and Noncomparability in Recreation Evaluation Models", Land Economics, Vol.47, No.2, pp.175-180.

BECKER, G.S., (1965) "A Theory of the Allocation of Time", Economic Journal, Vol.75, pp.493-517.

BROWN, W.G. and NAWAS, F., (1973) "Impact of Aggregation on the Estimation of Outdoor Recreation Demand Functions", Am.J.Ag.Eco. Vol.55 (2) pp.246-9.

BURT, O.R. and BREWER, D., (1971) "Estimation of Net Social Benefits from Outdoor Recreation", Econometrica, Vol.39, No.5, pp.813-827.

CAREY, O.L., (1965) "The Economics of Recreation: Progress and Problems", Western Economic Journal, pp.172-181.

CESARIO, F.J., (1976) "Value of Time in Recreation Benefit Studies", Land Economics, Vol.52, No.1, pp.32-41.

CESARIO, F.J. and KNETSCH, J.L., (1970) "Time Bias in Recreation Benefit Estimates", Water Resources Research, Vol.6, No.3, pp.700-704.

CLAWSON, M., (1959) Methods of Measuring the Demand for and Value of Outdoor Recreation, Reprint No.10, Resources for the Future.

COMMON, M.S., (1973) "A Note on the Use of the Clawson Method for the Evaluation of Recreation Site Benefits", Regional Studies, Vol.7, No.4, pp.401-406.

DE SERPA, A.C., (1971) "A Theory of the Economics of Time", Economic Journal, Vol.81, pp.828-846.

DOMENCICH, T.A. and McFADDEN, D., (1975) Urban Travel Demand: A Behavioural Analysis, North-Holland Pub. Co, Amsterdam.

EVANS, A.W., (1972) "On the Theory of the Valuation and Allocation of Time", Scottish Journal of Political Economy, Vol.19, No.1, pp.1-17.

FERGUSON, I.S. and GREIG, P.J., (1973) "What Price Recreation?", Australian Forestry, Vol.36, No.2, pp.80-90.

FLEMMING, J.S., (1973) "On the Theory of the Valuation and Allocation of Time: Some Comments", Scottish Journal of Political Economy, Vol.20, No.1, pp.65-71.

GIBBS, K.C., (1974) "Evaluation of Outdoor Recreational Resources: A Note", Land Economics, Vol.50, No.3, pp.309-311.

GIBSON, J.G. and ANDERSON, R.W., (1975) "The Estimation of Consumers' Surplus from a Recreational Facility with Optional Tariffs", Applied Economics, Vol.7, pp.73-79.

GREIG, P.J., (1978) Recreation Evaluation Using a Characteristics Theory of Consumer Behaviour, Unpublished paper, Victorian Forests Commission, Australia.

HINES, L.G., (1958) "Measurement of Recreation Benefits: A Reply", Land Economics, Vol.34, No.4, pp.365-7.

HOTELLING, H., (1947) Letter referred to in "Economic Evaluation of Outdoor Recreation Benefits" in Economic Studies of Outdoor Recreation, ORRRC Study Report 24, 1962, US Govt. Printing Office, Washington, D.C.

KNETSCH, J.L., (1963) "Outdoor Recreation Demands and Benefits", Land Economics, Vol.39, pp.387-396.

KNETSCH, J.L. and CESARIO, F.J., (1976) "Some Problems in Estimating the Demand for Outdoor Recreation: Comment", Am. J.Ag.Eco. Vol.58, pp.596-7.

KNETSCH, J.L. and DAVIS, R.K., (1966) "Comparisons of Methods for Recreation Evaluation", in Kneese A.V. and Smith S.C. (eds) Water Research, Johns Hopkins Press for Resources for the Future, Inc. Baltimore.

LANCASTER, K.J., (1966) "A New Approach to Consumer Theory", Journal of Political Economy, Vol.74, No.2, pp.132-157.

LANCASTER, K.J., (1971) Consumer Demand. A New Approach, Columbia University Press, New York.

LAVERY, P., (1975) "The Demand for Recreation. A Review of Studies", Town Planning Review, Vol.46, No.2, pp.185-200.

McCONNELL, K.E., (1975) "Some Problems in Estimating the Demand for Outdoor Recreation", Am.J.Ag.Eco. pp.330-334.

MALINVAUD, E., (1972) Lectures on Microeconomic Theory, North-Holland Pub. Co., Amsterdam.

MANSFIELD, N.W., (1971) "The Estimation of Benefits from Recreation Sites and the Provision of a New Recreation Facility", Regional Studies, Vol.5, pp.55-69.

MOREY, E.R., (1978) The Demand for Site-Specific Recreational Activities: A Characteristics Approach, Discussion Paper 03/78 Norwegion School of Economics and Business Administration.

O'ROURKE, B., (1974) "Travel in the Recreational Experience - A Literature Review", Journal of Leisure Research, Vol.6, pp.140-156.

PEARSE, P.H., (1968) "A New Approach to the Evaluation of Non-Priced Recreational Resources", Land Economics, Vol.44, No. 1, pp.87-99.

SECKLER, D.W., (1966) "On the Uses and Abuses of Economic Science in Evaluating Public Outdoor Recreation", Land Economics, Vol.42, No.4, pp.485-494.

SINDEN, J.A., (1967) "The Evaluation of Extra-Market Benefits: A Critical Review", World Agricultural Economics and Rural Sociology Abstracts, Vol.9, No.4, pp.1-16.

SINDEN, J.A. (1977) "The Provision and Use of National Parks in Victoria: Empirical Tests of the Tisdell Propositions", Australian Economic Papers, Vol.16, pp.175-193.

SMITH, R.J., (1971) "The Evaluation of Recreation Benefits: The Clawson Method in Practice", Urban Studies, Vol.8, No.2, pp.89-102.

STOEVENER, H.H. and BROWN, W.G., (1967) "Analytical Issues in Demand Analysis for Outdoor Recreation", Journal of Farm Economics, Vol.49, No.5, pp.1295-1304.

TAYLOR, P.J. (1971) "Distance Transformation and Distance Decay Functions", Geographical Analysis, Vol.3, No.3, pp.221-238.

TISDELL, C.A., (1972) "Provision of Parks and the Preservation of Nature - Some Economic Factors", Australian Economic Papers, Vol.11, pp.154-162.

TRICE, A.H. and WOOD, S.E., (1958) "Measurement of Recreation Benefits", Land Economics, Vol.34, No.3, pp.195-207.

WOODFIELD, A. and COWIE, D., (1977) "The Milford Track: Valuation Estimates of a Recreation Good", Aust. J.Ag. Eco. Vol.21,No.2, pp.97-110.

APPENDIX 3

Unimproved Capital Value of Rateable Land (UCV) Coonabarabran Shire[1]

Year	UCV	Adjusted UCV[2]
1953	4772948	4772948
1954	4704856	5017740
1955	4710980	5262533
1956	NA[4]	5507325
1957	4681084	5752117
1958	4686864	5996910
1959	6241702	6241702
1960	NA	6431173
1961	6236760	6620644
1962	6250580	6810115
1963[3]	6248000	6999587
1964	6273000	7189058
1965	6256000	7378529
1966	7568000	7568000
1967	7553000	7755286
1968	7580000	7942571
1969	7607000	8129857
1970	7611000	8317143
1971	7638000	8504429
1972	7662000	8691714
1973	8879000	8879000
1974	8822000	8879000

Notes [1] Source Local Government Statistics NSW Various Issues.

[2] Since shire valuations are performed intermittently the rise in UCV is stepped. A smooth rise is more likely so the UCV series has been adjusted to give this by averaging rises over the years between valuations. Adjustment after the last valuation is not possible.

[3] Values reported to the nearest $1000.

[4] NA Not available.

Unimproved Capital Value of Rateable Land (UCV)

Coonamble Shire[1]

Year	UCV	Adjusted UCV[2]
1953	6200460	8676542
1954	9715898	9715898
1955	9682990	10203816
1956	NA[4]	10691735
1957	9620188	11179653
1958	9620194	11667571
1959	9775174	12155490
1960	NA	12643408
1961	9851506	13131327
1962	9970842	13619245
1963[3]	9867000	14107163
1964	9866000	14595082
1965	15083000	15083000
1966	15082000	15924500
1967	15075000	16766000
1968	15072000	17607500
1969	15068000	18449000
1970	15072000	19290500
1971	20132000	20132000
1972	20120000	20120000
1973	20148000	20148000
1974	20143000	20143000

Notes

As for previous table

APPENDIX 4

CHOICE OF THE DISCOUNT RATE

The choice of an appropriate discount rate is a difficult issue and has been (and is) the centre of much argument. It is of great practical importance in cost-benefit analysis since the result depends very much upon the interest rate selected. For example, consider the following stream of cash flows for a project:

Capital Cost	$100 m
Year 1 Benefits	$50 m
Year 2 Benefits	$50 m
Year 3 Benefits	$50 m

If a discount rate of 10% is used, the project shows a net present value of +$24.34 m and would be a profitable investment. If a discount rate of 30% were used, however, the net present value is - $9.19 m and the investment would be unprofitable. Given, then, that the interest rate can have a crucial bearing on the outcome of an analysis, what are the issues involved in its selection?

Several authors argue that the source of the funds used by the government in the particular investment should indicate what interest rate should be used. For example, the following positions can be noted:

(a) If the funds come from within the government sector and are diverted from other forms of government expenditure and if the interest rate on government bonds is considered to be the rate of return on marginal government expenditure, that rate of interest should be used (Winch, 1971).

(b) If the funds are diverted from private sector investment (for example, by taxation or bond issues), the marginal rate of return in private investment ought to be used. (Winch, 1971; Mishan, 1972).

(c) If the funds are diverted from private consumption, the appropriate rate to use is society's rate of time preference.[1]

(d) If funds for the project come from both sources in (b) and (c), some combination of those rates should be used, depending on the proportion of funds from each source (Mishan, 1972).

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1 This interest rate reduces future consumption to present values. The rates in (a) and (b) are examples of the Social Opportunity Cost approach - using the rate obtainable on the alternative use of the funds. In perfect markets, the rates would be the same.

Using the social opportunity cost approach seems the simplest way of selecting an appropriate discount rate, since the rates are given and presumably not subject to the manipulation of the analyst. Yet, the real problem has still not been faced - do these predetermined rates have any meaning, or, in other words, do they really reflect the rates of time preference in the public and private sectors? If they do not, they do not represent the true opportunity cost of capital. So the appropriate rate of time preference to be used in governmental projects still needs to be determined.

Central to this determination is the problem of risk and its treatment in private and public investment.[1]

Different authors take different positions on this point. For example, Hirshleifer *et al.* (1960) consider that risk should be viewed in the same way for public investments as for private investments and, consequently, the private discount rate should be used for public investment decisions as well. They argue that to treat risk differently in different sectors (i.e. to have different interest rates) will result in a distorted capital allocation between sectors.

Samuelson and Vickrey (1964) argue that, as the government spreads its investments over a much wider range of projects than would a private investor, it can spread its risk over its many projects thus decreasing the risk of a given project in relation to its range of projects. Therefore, they argue that it is appropriate to remove the risk component from the interest rate and thus use a lower rate for government investment than for private investment.

Marglin (1963) goes further in stating that the private interest rate should have no bearing on the selection of a public rate, since an individual's rate of time preference as far as his own actions are concerned may be quite different from his rate of time preference in the

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1 A risky investment (i.e. one in which uncertainty surrounds the values of future benefits and costs) will require, *ceteris paribus*, a higher interest rate than a certain one (one in which the values of future benefits and costs are known).

collective actions of society.[1] Rather, the interest rate should be set as a matter of government policy.

Arrow and Lind (1970) argue that the government should ignore risk in its investment decisions and thus choose a risk-free interest rate, since it spreads the risk of its investments over a large number of risk-bearers, each of whom then bear negligible risk. They show that under certain conditions (most importantly when each individual bears little cost and obtains little benefit, the total cost and total benefit being divided by the population of risk bearers), the total cost of risk-bearing is negligible so should not be considered in establishing interest rates.

Fisher (1973) has challenged that this result may not apply in the environmental field as the benefits and costs here have the characteristics of public goods, i.e. no matter how many people participate, the environmental costs and benefits for each individual remain about the same. Therefore, if these benefits and costs are uncertain, as is usually the case, the interest rate used should contain a risk component. (Ulph, 1978, agrees with Fisher's conclusion but for different reasons. He considers that it is the non-excludable characteristic of public goods, not the joint-supply characteristic, that is the problem since the benefits and costs of the project cannot be internalised and spread throughout the community but fall on smaller numbers of people.)

From all this, it can be concluded that the appropriate discount rate to use for government investment decisions should be lower than the private rate but should still take into account some element of risk. However, it is still not possible to conclude what "the rate" should be.

One approach which could be taken in practice avoids the *a priori* selection of an interest rate. This is to compute the internal rate of return[2] of the project. The resulting rate can then be examined as to its acceptability by the appropriate decision-maker. However, this approach is only useful for the simple case where the decision is whether

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1 This poses considerable theoretical difficulties for welfare economics (the theory underlying cost/benefit analysis) which assumes an individual's utility is independent of the utility of other members of society.

2 The discount rate which when applied to the streams of benefits and costs yields a net present value of 0.

or not to undertake a given project. It is less satisfactory for looking at different scales of project or for mutually exclusive alternatives, since it ignores the timing of benefits and this may be crucial in the decision. The present value approach can, however, cater for this. In any case, use of the internal rate of return approach assumes the existence of an appropriate social rate of discount with which the I.R.R. can be compared, so the approach does not really avoid the difficulties mentioned previously.

In the face of these difficulties, how should the analyst proceed when conducting a cost/benefit analysis? Two approaches seem applicable. Firstly, he can specify a range of interest rates within which the appropriate social rate of discount is likely to fall and conduct the analysis for the extremes of this range to determine the efficiency, or otherwise, of the project at likely social discount rates. This approach is taken in this report. A second, and similar approach, is to conduct the analysis for a series of interest rates (none of which might be the appropriate social discount rate) to determine the sensitivity of the project result to the interest rate. If the project remains profitable at high interest rates (e.g. 10% or 15%), it would be safe to conclude that, at the appropriate social discount rate, the project would be acceptable. If, however, it is unprofitable even at low rates (e.g. 2% or 3%), the project could be rejected or subjected to much closer scrutiny.

REFERENCES

ARROW, K.J. and LIND, R.C. (1970) "Uncertainty and the Evaluation of Public Investment Decisions", American Economic Review, Vol. 60, pp. 364-378.

FISHER, A.C. (1973) "Environmental Externalities and the Arrow-Lind Public Investment Theorem", American Economic Review, Vol. 63, pp. 722-726.

HIRSHLEIFER, J., DE HAVEN, J.C. and MILLIMAN, J.W. (1960) Water Supply: Economics, Technology and Policy, University of Chicago Press.

MARGLIN, S.A. (1963) "The Social Rate of Discount and the Optimal Rate of Investment", Quarterly Journal of Economics, Vol. 77, pp. 95-111.

MISHAN, E.J. (1972) Elements of Cost-Benefit Analysis, Unwin University Books, London.

SAMUELSON, P.A. and VICKREY, W. (1964) "Discussion", American Economic Review, Proceedings, Vol. 59, pp. 88-96.

ULPH, A.M. (1978) "Environmental Policy Under Uncertainty and the Choice of Discount Rates", CRES Working Paper, R/WP25.

WINCH, D.M. (1971) Analytical Welfare Economics, Penguin, Harmondsworth.

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