

An approach to assessing the environmental impacts of tourism

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Abstract

This paper summarises conclusions, derived from a Department of Conservation workshop, on the research and information needs about the impacts of visitors on natural and historic resources, and proposes a framework to assist in identifying the priorities in meeting these needs. This framework is based on the specification of key conservation values and their spatial distributions, and determining where the visitor use network specifically interacts with key locations or distributions of these values. The main objective is to identify any 'hot-spots' where visitor use may significantly compromise key environmental values, and to show where more research and information, and specific management actions, are required. Using the framework represents a long-term process which requires incremental contribution of information through case-studies and multi-disciplinary research and consultation processes. This approach is consistent with recent developments in the NZ Tourism Industry Association's Research Strategy, and with significant recent initiatives for tourism research under the Public Good Science Fund.

1. Introduction and background

1.1 TOURISM AND THE DEPARTMENT OF CONSERVATION

The Department of Conservation is a significant stakeholder in the New Zealand tourism sector. It manages some 30% of New Zealand's land area, including most of the significant natural settings and attractions that underpin the 'product' provided for international and domestic visitors by the New Zealand tourism industry. As well as undertaking the management required to sustain these natural settings, the Department provides an extensive range of visitor facilities and services (Department of Conservation, 1997). These include approximately: 10 000 km of tracks; 1200 km of roads; 1000 huts; 250 campsites; 15 000 structures (e.g. bridges, boardwalks, steps, platforms, shelters, signs); and information services at some 50 locations (e.g. urban information centres, park visitor centres; and management offices). Acknowledging that it does not have the sole responsibility for providing visitor facilities and services, the Department has entered into partnership arrangements with other service sectors, including tourism (Department of Conservation 1996). Accordingly, about 1500 concessions are currently in place to provide for commercial tourism business on public conservation lands.

1.2 MANAGEMENT, RESEARCH AND INFORMATION NEEDS

The provision of these facilities and services constitutes the main interface between conservation management and visitor use. The scope of this interface is defined by two of the Department's main management aims:

- First and foremost, to manage for conservation purposes all natural and historic resources on the lands it manages.
- Secondly, subject to fulfilling these primary conservation purposes, to foster the use of these natural and historic resources for recreation.

For the Department to achieve the best balance between these potentially conflicting aims, a high standard of research and information is required. This is because the department necessarily applies a precautionary principle in its management decision-making (Department of Conservation 1996), i.e. where doubt exists over potential environmental impacts from visitor use or some proposed tourism activity, the Department will always act in accordance with its statutory responsibilities to minimise the environmental risk. This may create tension between the aspirations of people involved in tourism business, and the responsibilities of conservation managers. In this context, an improved research and information resource would reduce uncertainty about the environmental consequences of different visitor activities in different places. This would aid managers in determining appropriate responses to changing trends in visitor use, or to proposals for new tourism ventures. It would also aid both managers

and the tourism sector in identifying potential visitor opportunities. An improved capacity for managers to make such decisions would:

- enhance the application of limited conservation management resources;
- increase the provision of recreation opportunities; and
- increase the opportunities for tourism business development and partnerships.

However, conservation managers and tourism interests in New Zealand currently receive little practical guidance from researchers about the environmental impacts of tourist visitors on protected natural areas. Recent reviews of the current state-of-knowledge of visitor impacts have concluded that it is fragmented and non-specific (Booth & Cullen 1995; Ward & Beanland 1996; Ministry for the Environment 1997; Parliamentary Commissioner for the Environment 1997). When concluding a comprehensive review of the state of New Zealand's environment, the Ministry for the Environment (1997) stated as their first and strongest conclusion that New Zealand's environmental information, including the collection and integration of data, needed to be improved. After reviewing recreation impact research in New Zealand, Booth & Cullen (1995: 134) made the following points:

- To manage recreational impacts it is important to understand the nature of impacts and the factors influencing those impacts. Within New Zealand, the research base associated with recreation is small and incomplete.
- The research literature concerned with visitor impacts lacks integration, which is problematic for managers who must account for both ecological and social issues.
- There is no predictable relationship between use parameters, such as amount or type of use, and impacts. The association is complex and relates to factors such as time, situation, and tolerance of ecological communities and social groups, as well as aspects of use intensity.
- Frameworks for impact management have not been applied within New Zealand. As a result, impact management remains ad hoc and intuitive.

This paper summarises outcomes from a physical impacts workshop convened by the Department of Conservation in response to the need for improved environmental information, and understanding of visitor impact issues. Results from this workshop suggest the adoption of a new approach to addressing visitor impact research and management.

1.3 THE PHYSICAL IMPACTS WORKSHOP

In discharging its responsibilities for the conservation and management of natural and historic resources, the Department has a vital need for reliable information on the state of these resources, the effects of visitors on them, and any potential for detrimental impacts. The Department held a workshop on the physical impacts of visitors (Cessford 1997; Cessford & Dingwall 1997), the main purpose of which was to identify the Department's research and information needs on this subject. This brought together some 50 management

and research staff from throughout the Department, and included other selected New Zealand and American participants. All contributed to the workshop outcomes through a programme of plenary presentations, case-studies, and working groups. These outcomes are discussed below under three main headings: visitor effects on the environment; identifying key visitor impacts; and research and information needs. However, three key definitions (Cessford 1997) are required before commencing this discussion:

- ***Conservation values*** are the specific elements of natural and historic assets that underlie the high priority assigned to them by conservation management agencies. These are the objects, species or environmental associations attributed with greatest importance for conservation purposes.
- ***Visitor effects*** are the physical processes associated with the presence of visitors in natural settings, and may or may not be adverse. Any visitor use will have effects on the sites used. Not all of these effects will result in negative impacts.
- ***Visitor impacts*** arise when specific visitor effects present tangible threats to the key conservation values underlying the conservation management of a site. Other natural processes or external human influences may have greater impacts on site conservation values than any direct visitor effects. This working distinction between visitor effects and impacts is essential, and allows significant problems to be more clearly identified.

2. Visitor effects on the environment

The workshop findings demonstrated the complexity of assessing specific impacts (Cessford & Dingwall 1997), but also provided sufficient information to summarise the range of visitor effects on natural environments. Three overall categories of visitor-related effects can be defined (Figure 1):

- physical damage;
- wildlife disturbance;
- hazard introduction.

2.1 PHYSICAL DAMAGE EFFECTS

These comprise those direct structural changes to physical and biological features and environments that occur where visitors walk, ride, drive, swim, rest, and are accommodated. Typical effects relate to direct trampling or wheel action on rocks, soils, vegetation, and micro-fauna. For example, these effects can result in: plant and micro-fauna damage, displacement, or death; soil disruption; damage to natural surfaces or features; and damage to the physical integrity of historical or cultural features. These effects can also contribute to secondary diffusive processes, such as induced soil erosion; increased stream sediment loads; disruptions to species balances; and changed habitat viability. Visitor behaviour may also go beyond simple unintended effects, to deliberate negative impact behaviours such as vegetation breakage; graffiti; firewood collection; campsite clearance; specimen collection and removal. Some damage effects relate to the intended and unintended structural changes from management actions. Intended changes are anticipated effects in planned management processes, such as the clearance and disruption of vegetation, soils and wildlife during construction and maintenance of tracks, huts, and drainage channels. Unintended changes are often unanticipated physical effects from management actions, such as shading from buildings; on-flows from water-channeling; erosion and damage from wind-channeling; and hazards from wires and aerials in bird flightpaths.

While discussing physical damage effects, particular attention is required to the distinction between environmental effects and facility effects, a matter on which there is a common misconception (Cessford 1997). Many workshop participants observed that when people made reference to 'environmental impacts from visitors', the typical examples described were usually associated with physical trampling damage to tracks, campsites, and adjacent vegetation. Consequently, most management and research effort has tended to emphasise this issue, which is relatively simple to observe, understand, and manage. However, it was also noted that in most cases these types of effects were not usually very significant at all in their impact on conservation values. Moreover the impacts generated by them are not primarily environmental ones. They are

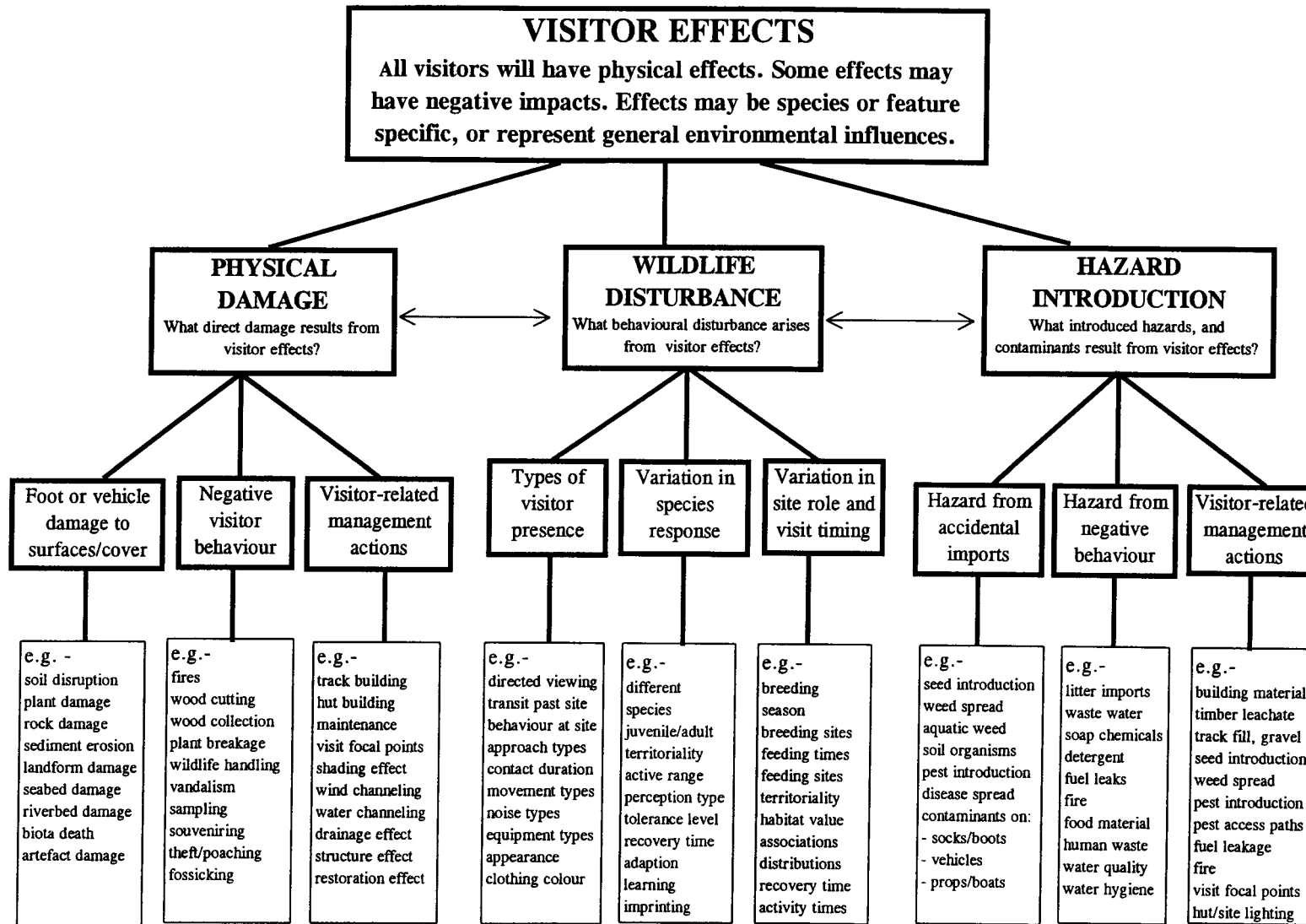


FIGURE 1. THE SCOPE OF VISITOR EFFECTS ON THE ENVIRONMENT. DERIVED FROM A WORKSHOP ON THE IMPACTS OF VISITORS ON NATURAL AND HISTORIC RESOURCES (CESSFORD 1997).

related more to perceived compromise to the natural character of settings, the quality of facilities and services, and associated quality of visitor experiences. While these are important aspects for management attention, they are essentially part of normal management processes. To achieve the best focus on the significant environmental impacts on conservation values, it is important to distinguish them clearly from those impacts on the facility and service values

2.2 WILDLIFE DISTURBANCE EFFECTS

Visitors can intrude upon wildlife in a variety of ways, from their visual presence to their movement, noise, and behaviour. Different species will perceive the consequent disturbance in different ways and for different reasons. Wildlife tolerance and response, and any impact consequence, will vary among different species, settings and times. Factors contributing to these variations can include different feeding patterns; territoriality; breeding seasons and behaviours; lifecycle maturity; alarm behaviours; and ecological niche competition. Some visitor effects, such as trampers passing by, may be incidental to wildlife, whereas others, such as ecotourism visits or photography, may be specifically directed at wildlife. Additional visitor-related effects can also arise from the ways in which wildlife responds to the presence of staff; any of their associated construction, maintenance and research activities; and the effects related to the presence of facilities and structures (e.g. huts, signs, tracks, lighting, reflections, colour, and noises).

2.3 HAZARD INTRODUCTION EFFECTS

When visitors come to a natural environment they can import harmful external material, substances, or biota. Visitors may accidentally introduce hazard sources such as exotic weeds, predators, and diseases. They may also introduce hazards from negative behaviours such as fuel leakage or disposal; soap chemicals from washing; littering; bringing dogs; or inappropriate fire practices. Similar hazards arise from the activities of management staff, both direct and indirect, in facility provision and maintenance. These may be direct-introduction effects, such as exotic seeds in track fill or building materials; leachate from timber; and chemicals from material degeneration. Or they may be indirect effects, such as providing access routes for predators; fire potential; and providing focal points for visitor congregation.

Summaries of visitor effects are similarly provided in other reviews, both in New Zealand (e.g. Devlin et al. 1995) and internationally (e.g. Kuss et al. 1990). However, while the wide range of possible visitor effects across a diversity of sites can be summarised in these ways, the critical question still remains - how do we distinguish from among all these effects the situations of significant visitor impacts?

3. Identifying key visitor impacts

The most important information required to identify and assess impact problems is better definition and prioritisation of the key conservation values in different sites and management situations. This information allows managers to clearly specify their conservation management objectives at different sites. In concluding their major impact visitor impacts review, Kuss et al. (1990: 242) noted that there was strong agreement in the literature that managing visitor impacts must begin with the setting of specific objectives. When reviewing the progress made after 10 years' extensive application of the Limits of Acceptable Change (LAC) impact management process, Cole & McCool (1997: 61) specified that a new step was required at the start of the LAC process - explicitly defining the goals and desired conditions of management. The widespread recognition of this fundamental need leads to the conclusion that greater effort is required to determine which environmental aspects of a site are of most critical conservation importance.

3.1 A NEW APPROACH TO IMPACT ASSESSMENT

The summary report from the physical impacts workshop describes a new approach for addressing impact issues, and for defining research and information needs (Cessford 1997). This involves a re-orientation in the overall approach used for impact assessment. It moves away from the traditional approach of trying to identify the range of possible impact types, followed by passive monitoring of these using generic indicators across a variety of sites. Developing such generic lists of visitor impacts and indicators across a variety of **sites** and circumstances can be helpful, particularly for assessing visitor impacts on facility values associated with track, campground, and but standards. However, it is not a productive way to deal properly with the need to manage for key impacts on complex conservation values. Reliance on generic approaches and standard manuals or 'cookbooks' can be oversimplistic. It can create overwhelming and misplaced demands on management and research resources to address visitor effects which are simply not important.

A conceptual impact management approach was derived from the workshop. It proposes that to achieve a productive focus on the key impact issues, we must begin by identifying those specific conservation values of most importance. Once these are identified, then the key visitor impact issues will become clearer, and limited research and management resources can be more effectively and efficiently applied. Under the revised approach, significant visitor impacts would be distinguished where the visitor effects, in particular, were compromising the key objectives for conservation management (e.g. sustained or enhanced biodiversity, species viability, representativeness). This approach is more active and directed, based upon identifying the key sites for priority conservation values, and concentrating time and resources on specific situations

where visitor use potentially puts these values at direct risk. Thus, instead of continuing attempts to derive generic 'top-down' approaches to defining important visitor impact issues, such definition should be a 'bottom up' approach based on an understanding of the key conservation values.

A wider research and information framework is required to integrate whatever knowledge of conservation values and visitor effects is currently available, and to direct resources at the most relevant research and information gaps. Figure 2 outlines a framework, and an approach, for more systematically integrating research and information knowledge to identify key visitor impact issues (Cessford 1997). This is based on a sequence of:

- improving general ecological baseline research and information;
- identifying the key conservation values of importance to management;
- locating where these values occur at specific key sites; and
- assessing visitor interactions with these values at the key sites.

3.2 IMPROVING USE OF ECOLOGICAL BASELINE INFORMATION

The vital ingredient for assessing visitor impacts on key conservation values is independently derived ecological baseline information. In this context, 'baseline' information comprises a general understanding of ecological components and their interactions and associated physical processes. This enables key conservation values and threats to be better defined, prioritised, and spatially located.

A common misinterpretation is to loosely view baseline information as defining some ideal 'baseline state', to which subsequent generic monitoring may be related. It is commonly associated with top-down impact assessment approaches. This type of baseline monitoring function can be applied more appropriately and productively later in the impact management process. Once key values and threats are identified and the need is established to address particular impact issues, then case-specific standards, indicators and thresholds can be defined for any specified baseline state that may be required.

Ideally, for any given category of conservation value, the relevant baseline research and information resource of knowledge should already have established the following:

- what values are most important;
- what the main impact vulnerabilities are; and
- what the key sites in their distributions are.

However, it was clear from workshop discussions, and reference to resource information, that the current state of knowledge in most environmental research disciplines is incomplete and fragmented. In particular, the importance of this type of baseline information for addressing visitor impact issues has not been widely apparent in most research and management considerations to date. In fact, investigations related to visitor impacts in a particular research discipline

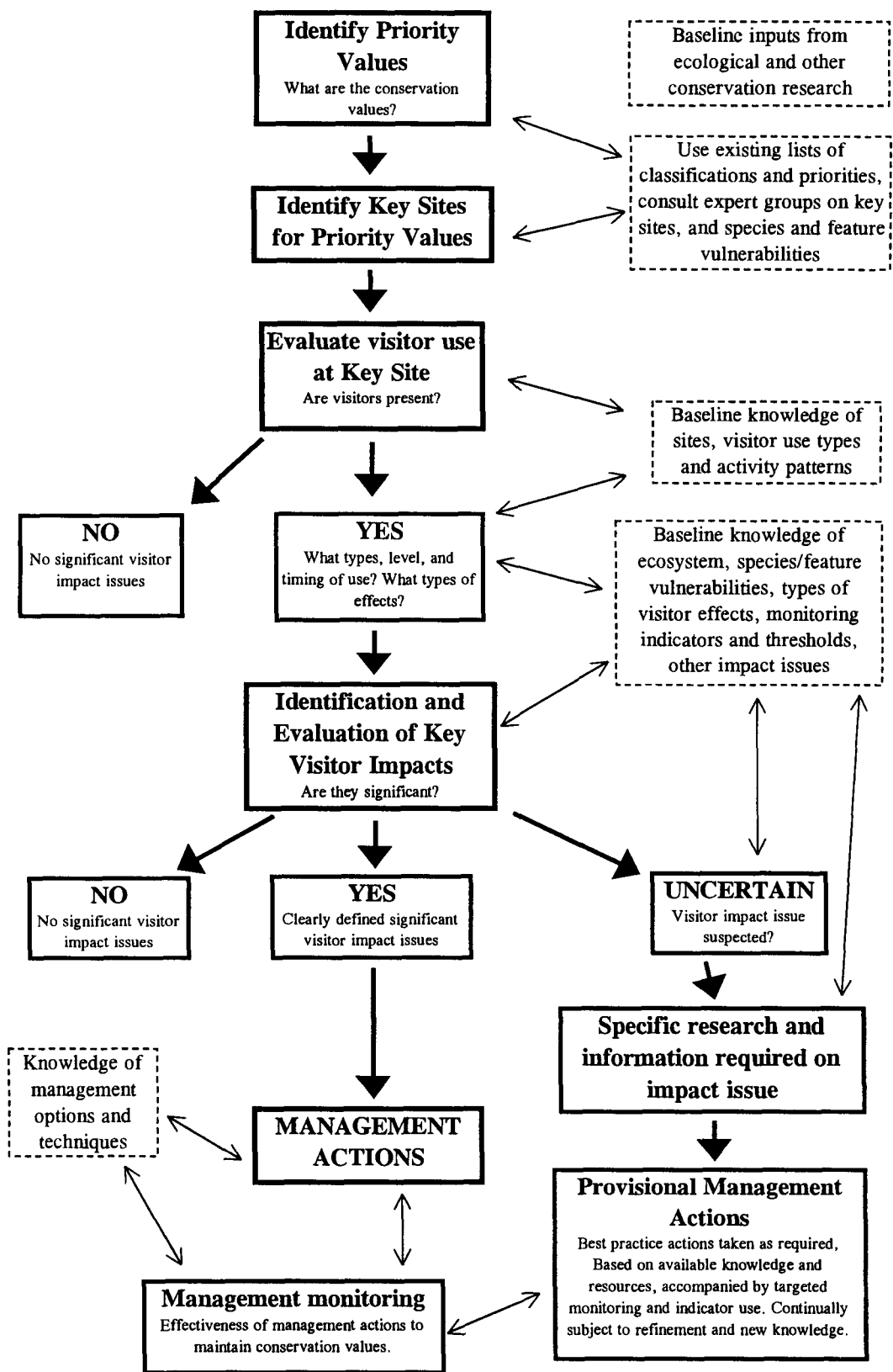


FIGURE 2. A PROCESS FOR IDENTIFYING KEY VISITOR IMPACTS ON CONSERVATION VALUES. DERIVED FROM A WORKSHOP ON THE IMPACTS OF VISITORS ON NATURAL AND HISTORIC RESOURCES (CESSFORD 1997).

tend to be considered peripheral or of low priority. Overall, the logical links between specific research needs for visitor impacts, and the mainstream processes of environmental research and information gathering have not been well established.

Filling the gaps in this baseline knowledge, or overcoming difficulties in collating and integrating what information and knowledge already exists, are together the most prominent current research and information needs in resolving visitor impact problems. General ecological understanding is essential to distinguish among wider ecosystem changes (natural or human-induced), the effects of visitors, and the instances where these visitor effects represent real impacts. Ongoing research and information investigations enhancing such understanding should be encouraged to progressively improve the necessary baseline information for visitor (and other) management needs. Appropriate investigations to this end could include assessing species lifecycles, behaviour and ecosystem roles; ecosystem structures and physical processes; conservation status of particular values; and vulnerabilities to impacts. This approach would link the manager's need for visitor impact information to progress in mainstream research disciplines. It also highlights the increasing importance of adopting multi-disciplinary consultation and research approaches.

3.3 IDENTIFYING KEY CONSERVATION VALUES

Clearly defined conservation values and priorities are the vital baseline information requirements for achieving an optimum balance between management outcomes for visitor and conservation purposes. A summary framework for categorising the range of conservation values is essential. Where not already available, systematic approaches need to be developed for identifying and prioritising key conservation values. These would cover the species, ecosystems, associations, or physical features of greatest conservation importance.

Consultations and investigations outside the immediate visitor research and management disciplines are required. Consultation should be encouraged with a variety of specialists, and key collectives such as Department of Conservation Programme Groups (who assess research investigation proposals for the Department), Species Recovery Groups (who develop and implement species recovery plans for the Department), and professional associations in different research disciplines. This process should also identify any additional baseline research and information for facilitating development of value classifications or for determining value priorities.

3.4 LOCATING SITE-SPECIFIC CONSERVATION VALUES

Once priorities are established in different value categories, the distributions of the higher priority values should be mapped, and the key sites or occurrences located. This would require some spatial inventory of value distributions,

preferably making more use of advanced spatial database and analysis systems, such as those represented by Geographical Information Systems (GIS). In many cases, much of this spatial information for different conservation values will already be recorded in existing database resources, but to date these have not been integrated into any consistent framework. Such integration is essential for any approach to systematically identify site-specific visitor impact issues. This will be based on identifying the high-priority sites for the high-priority conservation values.

3.5 IDENTIFYING VISITOR IMPACT HOT-SPOTS

The process for identifying high-priority sites will also identify their associated site-specific conservation management objectives. Once key sites and objectives are defined, then the most important environmental threats to the priority conservation values can be more directly evaluated. These threats may involve normal environmental processes such as natural environmental fluctuations, catastrophic events, or wildlife predation. However, in some situations, specific visitor effects may pose the most significant threats. In any case, having a site focus combined with a rationale for specific management objectives will be a major advance.

Where key sites for certain conservation values have been identified, assessment of current visitor use will be required (e.g. presence of visitors, types of use, and levels of use) as part of the general threat assessment. If some characteristics of visitor use pose significant threats to key values, then greater focus will be required on visitor research and management. If visitor effects are not important, then resources can be directed to managing the primary threats. The visitor impact will be more clearly defined by already knowing the key environmental values and the significance of the key site. If the potential impact problems can be resolved by management actions, then visitor use can continue. If not, then a clear basis for management actions or further research is established.

Workshop discussions noted that if the zones, areas or sites of key conservation values could be mapped, then overlays of visitor use systems could be applied. The visitor use systems comprise the visitor 'nodes' (e.g. huts, campgrounds, viewing points, carparks, climbing sites, river entry points, etc), and 'flows' (e.g. roads, tracks, and rivers). These overlays would enable visitor 'hot-spots' to be defined: i.e. the situations where visitor activity patterns intersect directly with key sites for priority conservation values. They would provide an immediate indication of where impact issues may be occurring. And they would also provide more direct guidance for deciding where assessment, research, monitoring and management action may be appropriate, and what methodologies should be applied.

3.6 POSSIBLE EXAMPLES OF THIS APPROACH

One example of what might be possible with this new approach was provided in the Mingha Valley of Arthurs Pass National Park, where a section of track passed through 400 m of riverbed considered key habitat for the endangered blue duck (Harding 1997). The priority conservation value was clearly known and located; the visitor/value 'hot-spot' was identified and defined; and the appropriate site-specific management action identified. In this instance, the specific track section was relocated outside of the riverbed (Figure 3), with funding assistance from a multi-sport event business for whom valley access was a critical component of their premiere event (A. Thompson pers. comm.).

Another example was provided at Taiaroa Head, where there was a progressive shift in royal albatross nesting sites away from the line-of-sight of a high-use public viewing facility. This resulted in movement to less viable bird-nesting sites, and in a reduced quality attraction for visitors. The significant visitor/value 'hot-spot' was clear, and a negative environmental impact was identified from issue-specific monitoring over time. The eventual management action taken was to replace the clear viewing-windows with tinted glass. This reducing the visitor movement observed by the birds, and led to nest sites progressively returning to line-of-sight. A conservation value was sustained, and a visitor opportunity enhanced. Both these ad-hoc examples suggest that a more systematic approach to locating hot-spots of conservation values and visitor use will provide a highly valuable management tool. The need to apply precautionary management would thus be reduced, as more impact certainty would be provided.

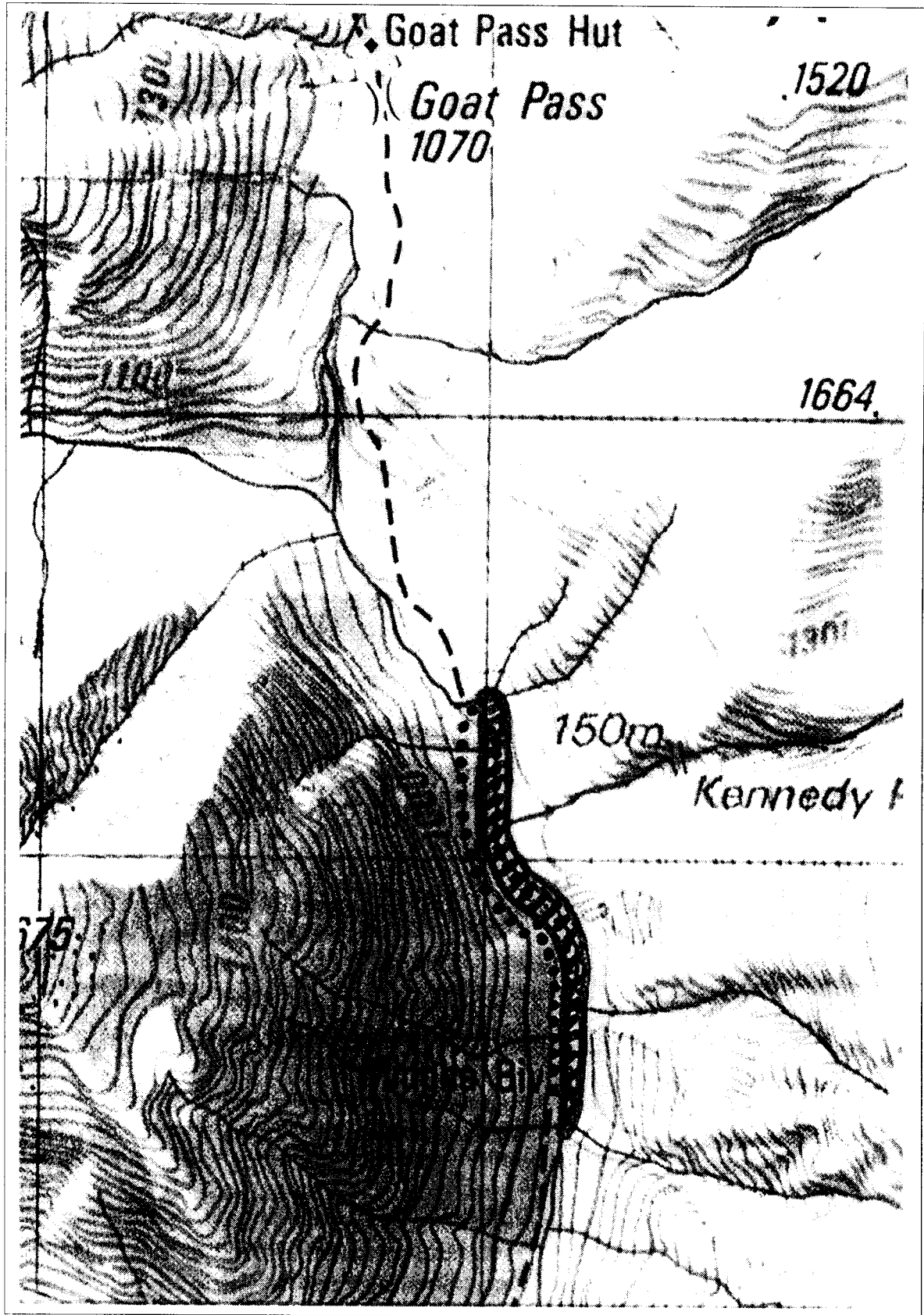


FIGURE 3. AN EXAMPLE OF A VISITOR-IMPACT 'HOT-SPOT' IN ARTHURS PASS NATIONAL PARK - BLUE DUCKS AND RECREATION VISITORS. THIS ILLUSTRATION DEMONSTRATES HOW GIS-BASED INTEGRATION OF VISITOR USE DATA AND CONSERVATION VALUE DISTRIBUTIONS COULD AID MANAGEMENT DECISION-MAKING AND THE DEFINITION OF NEW RESEARCH NEEDS. SHADED AREA, BLUE DUCK HABITAT; DOTTED LINES IN SHADED AREA, OLD TRACK ROUTE; DOTTED LINES OUTSIDE SHADED AREA, REALIGNED TRACK ROUTE.

4. Research and information needs

Apart from the ongoing need for continually improving general baseline information resources, the main requirements for initiating this type of systematic and integrated approach to assessing the environmental impacts of visitors can be summarised as follows:

- classification processes for determining conservation value categories;
- prioritisation processes for elements in conservation value categories;
- databases for the visitor use system and priority conservation values.

4.1 CLASSIFICATION AND PRIORITISATION PROCESSES

Processes for classification and prioritisation are already well established in many disciplines, and are subject to ongoing revision as baseline information grows and threatened status changes. For example, Molloy et al. (1994) document the results of a major prioritisation process for New Zealand's threatened plants and wildlife. They provide immediate focus on what species conservation values are more immediately important. Other work in the Department of Conservation is also beginning to address methodologies for setting ecosystem priorities. While acknowledging that much of the relevant classification information may exist in different research disciplines and management agencies, it is clear that it is usually confined to discrete disciplinary areas. To date there has been no systematic integration into a wider management framework that includes visitor use patterns. However, two recent database developments by the Department of Conservation may provide the practical means by which the approach described here may be realised.

4.2 DATABASE DEVELOPMENTS

The Department has established a visitor asset management system (VAMS), which is based on the definition of around 3700 specific visitor sites. These are places where the Department spends money to provide facilities (assets) for domestic and international visitors. A central database has been established which provides an inventory of site-specific locations, site conditions, visitor assets, and basic visitor use characteristics. It was designed to have multiple uses and to be evolutionary and modular, allowing components to be added as required. Among its other management functions, this integrated database resource represents the core of a spatial inventory of visitor use. The spatially defined sites that form its functional basis may also provide the reference points of visitor use relative to key sites for conservation values.

What is lacking is a matching database of conservation assets. In this context, assets could refer to those priority conservation values with specified priority site locations. So there could be both visitor assets and environmental assets. The Department is making progress towards developing a basic data model for optimising how it uses such asset information for conservation management. Put simply, this conceptual model is based on the idea that specific assets can be related to specific places and processes. This type of core conservation model will allow managers to do the following:

- for any place, list all the assets there, and what processes might be affecting them;
- for any process, list all the assets known to be affected by it, and in what places this occurs; and
- for any asset, list where it occurs, and what processes might be affecting it.

While the Department is only in early stages of development towards this integrated information system, the implications for improved management outcomes are highly positive.

5. Conclusion: where to from here?

The Department of Conservation is developing further applications of the VAMS and gaining momentum in developing a comprehensive and integrated information system. As a result, it is very likely that the proposed visitor impact assessment approach can eventually be applied. This has major implications for future research related to tourism impacts. General investigations of the different types of effects that visitors may have are not a great priority, as they are largely unfocused on the environmentally significant visitor impacts, and have already been extensively dealt with internationally. This also applies to attempts to determine generic environmental impact indicators and carrying capacities. Both represent tools that might be applied by managers once significant visitor impact issues are identified, and their applications are considered necessary for case-specific impact control or monitoring purposes.

Research should, therefore, be re-orientated towards more precisely identifying visitor impact 'hot-spots' on the basis of site-specific conservation values. Programmes of research and information that promote the identification, classification and prioritisation of conservation values will be particularly important. Also important will be research, information and consultation that promotes development of data models, integrated database information systems, and development of GIS applications for these. Clearly this represents a wider research brief than has been associated with tourism-related research to date. Much of this research may have little apparent relationship with day-to-day tourism activity and business. However, the validity of such research for tourism is acknowledged in a recent research strategy for tourism (Tourism Industry Association 1998), which specifies an 'Operating Environment' research area in its research framework. This relates to development of an operating environment that supports tourism development. The natural areas of New Zealand, and how these are managed by the Department of Conservation, are clearly fundamental components of tourism's operating environment. Further acknowledgement of the importance of this work is seen in the recent initiative by the Foundation for Research, Science and Technology to fund a research programme on developing criteria for evaluating the environmental impacts of tourism.

Reiterating from the introduction to this paper: greater management and business certainty about visitor impacts on the environment will increase the potential opportunities for tourism development. This certainty can be enhanced by more integrated research links between the tourism, conservation and science sectors. Sponsors, funders and providers of any new tourism-related research on visitor impacts, such as that recently tendered by the Public Good Science Fund, should specifically note the findings generated by the physical impacts workshop (Cessford 1997), and be aware of the recent development directions in Department of Conservation information systems.

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