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**Impacts of visitors on natural and historic
resources of conservation significance**

Part 2 - Research and information needs

by

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Preface

This report is derived from a workshop convened by the Department of Conservation, Wellington, 2 - 4 July 1996. The products of the workshop are presented in two parts. Part 1 comprised the proceedings of the workshop. These are presented in a separate report from Science and Research Division:

Cessford G.R. and Dingwall, P.R. (1997) Impacts of visitors on natural historic resources of conservation significance. Part 1 - Workshop proceedings. *Science and Research Internal Report No.156*. Science and Research Division, Department of Conservation, Wellington.

Part 2, which is this report, provides a synthesis of the main research and information needs derived from the workshop as the basis for developing a research action plan.

Abstract

This report provides a synthesis of conclusions about research and information needs derived and developed from a workshop on the impacts of visitors on natural and historic resources. This was done to provide the basis for developing a research action plan for addressing visitor impacts on the environment. It proposes a framework in which the priorities for research and information assessment tasks in this topic area may be better identified. This process is based upon the specification of key conservation values, integrating spatial distribution information with existing knowledge and baseline research results, and assessing where the visitor-use network interacts with key locations or distributions. The main objectives are to identify any visitor “hotspots” where use may significantly compromise key environmental values, and to identify where more research and information assessment is required to assist in this process. The framework represents a long-term process which requires strategic incremental contributions of information through case studies and multi-disciplinary approaches.

1. Introduction

1.1 BACKGROUND

The Department of Conservation held a workshop on the physical impacts of visitors on natural and historic resources (Wellington, 2-4 July 1996). The main purpose of the workshop was to identify the Department's research and information needs in this area. To achieve this result, which was essentially a problem identification and research task, selection of participants was oriented towards those Departmental staff who were required to manage visitor impact problems. This brought together some 50 Departmental management and research staff, along with other New Zealand and United States advisors, in a planned discussion on visitor impacts.

Over the three days of the workshop this discussion covered: Overview and examples of impacts (Day 1); Identification of key impact themes and information needs (Day 2); and Development of a research and information plan (Day 3). To set the scene, presentations were made giving the latest legislative and policy background to the Department's visitor impact management responsibilities. State-of-knowledge summaries on impact assessment and management processes were also presented from the experienced perspectives of a natural resource specialist from the U.S. Forest Service, and a park superintendent from the U.S. National Parks Service. In addition, several New Zealand case studies were discussed as examples of impacts problems and means to achieve solutions. The bulk of the work undertaken at the workshop took place in the working groups, where all participants contributed in the directed discussions to scope the types of problems, and identify the research and information needs.

A summary of the specific research questions specified by working groups is presented in Appendix 1. A comprehensive record of the many written and verbal contributions made in plenary discussions, presentations, working groups and summary sessions is documented in the workshop proceedings report (see Preface for reference).

1.2 PURPOSE OF THIS REPORT

This report synthesises the main research and information needs identified at the workshop, and provides the basis for developing a research plan to address these needs. The approach taken to achieve this is to discuss these findings under three main headings:

- Visitor effects on the environment
- Identifying key visitor impacts
- Research and information needs

It is important to distinguish some key terms before progressing further.

- Visitor effects - the physical consequences and processes associated with the presence of visitors in natural settings, which are natural phenomena and may or may not be adverse.
- Visitor impacts -the specific adverse effects of which represent tangible threats to the key conservation values specified by management.
- Conservation values - the specific elements of natural and historic resources which establish their significance for being assigned conservation priority by management agencies. These are the objects, species or associations attributed with greatest importance for conservation purposes (see Section 3).

The wording of these definitions may be debatable,¹ but the distinction between visitor effects and visitor impacts is an essential one if the significant impact problems are to be clearly identified, and then addressed most effectively by research and management processes. 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 need is most commonly expressed as a requirement for better 'baseline information'.

While some aspects of this report summarise workshop findings, other components represent the development of a new approach for addressing impact issues and defining research and information needs. Rather than continuing attempts to derive generic approaches, definition of what constitutes significant physical impacts from visitors are considered to depend more upon:

- 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.

This represents a re-orientation in overall approaches to impact assessment. It moves away from approaches which attempt to identify the range of possible impact types and then monitor passively for these with generic indicators across a variety of sites. It represents a more active and directed process 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.

¹ A similar definition of equivalent terms is made in various statutes. The explanations used here should be viewed as working definitions to achieve the purposes of this report.

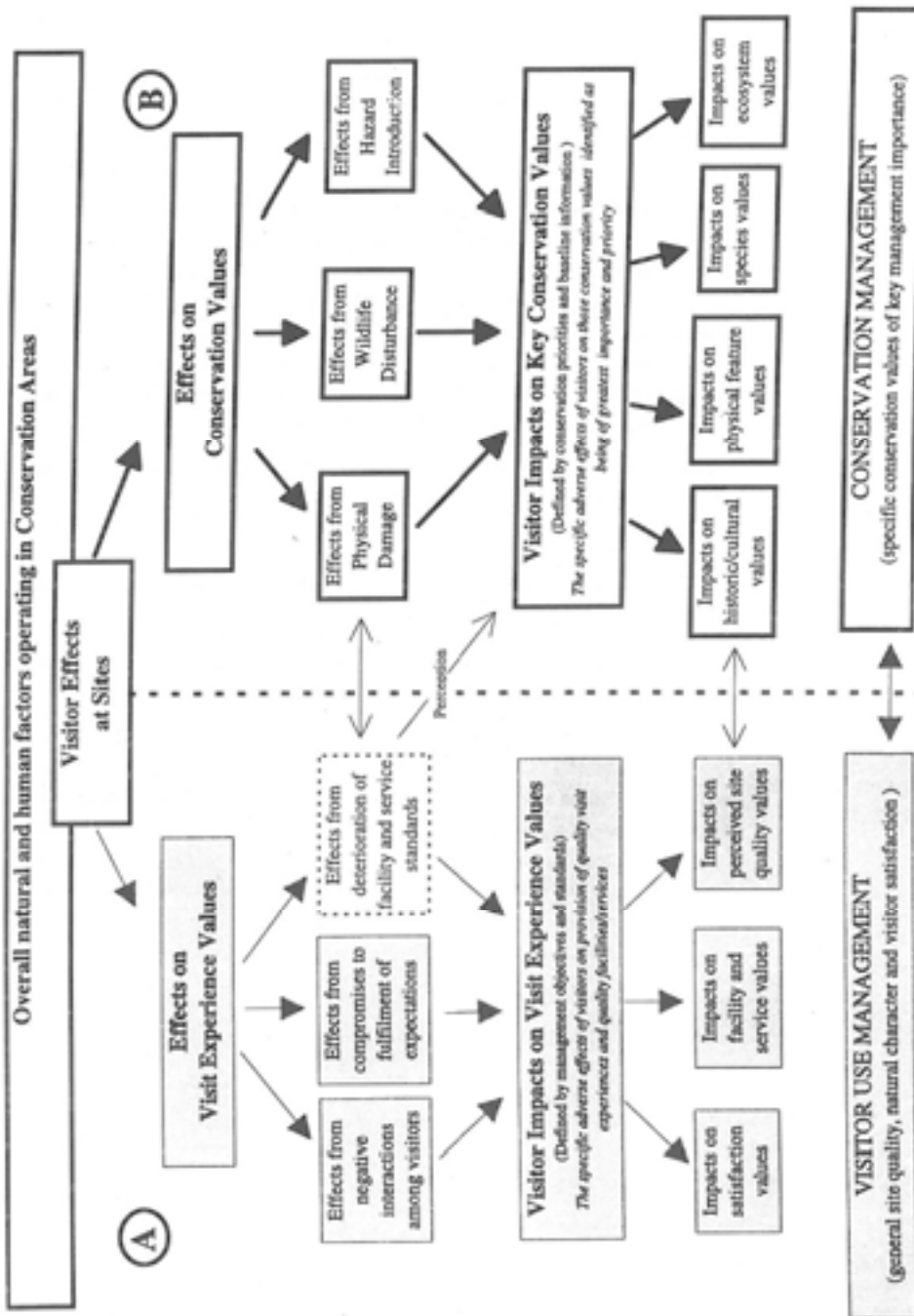


FIGURE 1 TYPES OF VISITOR EFFECTS AT SITES.

2. Visitor effects at sites

Three key points should be noted before the scope of visitor effects is discussed:

- Any visitor use will have effects on the conditions and values associated with a site
- Not all of these effects will result in negative impacts which detract from the important conservation values underlying the conservation management of a site
- Natural processes or external human influences may have greater impacts on site conservation values than any direct visitor effects

Visitor use of a site can have a great variety of consequences important to conservation managers. Figure 1 summarises the complete range of possible visitor effects. These effects fall into two main categories, depending on whether they have consequences for visitor experience values (A), or conservation values (B).

A. Effects on visit experience values

Effects related to visitor interactions, expectation fulfilment and facility/service standards can all contribute to impacts on key (management) values associated with visitor satisfaction, facility/service quality, and perceived environmental quality of sites. These effects are social impact issues, and as such were not specifically included in this workshop. However their importance was noted in many discussions, and they do have an influence on how some conservation values are perceived. In particular, the facility damage and deterioration effects (e.g. track damage) are highlighted as they have commonly been perceived as representing significant impacts on conservation values. This misrepresentation problem, and the consequent need to specifically distinguish these effects, is discussed further in Section 2.1.

B. Effects on conservation values

Effects related to physical damage, wildlife disturbance, and introduction of hazards can all contribute to impacts on key conservation values associated with species, ecosystems, physical features and values. These were the main focus of the workshop, and are the source of the most pressing research and information needs. The types of visitor effects which can impact on these conservation values are summarised in Section 2.2 (refer to Figure 2).

2.1 EFFECTS ON VISITOR EXPERIENCE VALUES

Most of these relate to complex social effect issues, which were specifically excluded from consideration at the workshop to keep clear focus on physical impact issues at this time. It is anticipated that a workshop can be conducted at a later time which concentrates on these social issues.

However, it was noted at several times during the workshop, that most management attention and visitor expressions of impact concern, were associated with a particular range of facility-related visitor effects. Many workshop participants observed that when people made reference to 'environmental impacts from visitors', the typical examples described were usually associated with track damage, campsite wear, and associated vegetation trampling. It was also noted that most management and research effort has consequently tended to be focused on this area, which was relatively simple to observe, understand and manage. However it was also noted that in terms of affecting significant conservation values, in most cases these types of effects were not usually very significant at all.

The impacts generated by these types of effects are not generally environmental, but are really related to (perceptions of) compromise to the natural character of settings, the quality of facilities and services (and associated maintenance requirements), and associated quality of visitor experiences. While these are important aspects for management attention, they are essentially part of normal management processes, and are largely dependent on how the sites are managed for visitor use (e.g. types of experiences catered for, standards for facilities and services, maintenance levels, appropriate levels of development, and visitor expectations of natural character). In most cases, these aspects are not closely related to the important underlying environmental values for which conservation management is most required. Clearly it is important to distinguish these types of visitor effects from those which may have the real significant impacts on the key conservation values.

Some key points can be considered here:

- Visitors are an accepted component of the environment, and management is aimed at achieving the appropriate compatible balance between use and protection. This involves accepting some managed impacts from facility/ service provision and maintenance, in order to limit the possibility of other uncontrolled visitor impacts.
- The 'natural character' or 'quality' values of sites are based on management specifications of appropriate visual, facility and experiential standards in different situations, and on an understanding of the relative expectations of the visitors. Public input would also be a necessary component of this process. As a result, a considerable component of the research and information needs in this area will be related to the social perceptions of impacts and their acceptability.
- Because managers define the appropriate conditions of facilities/services in this context (e.g. standards for tracks, huts, campsites, carparks, and viewing points), they are effectively defining the 'values' against which visitor effects may be assessed. So any monitoring in this context can be based upon a range of consistent specified standards².
- The major impact types in the context of facility and service values are likely to be generic to many sites. Most impact research and

2 The development of the Quality Conservation Management (QCM) system by the Department will promote specification of these standards.

management to date has concentrated on identifying such generic factors. A particular objective has been to eventually develop a suite of generic indicators of impact. Similar development of such an impacts "cookbook" has also been commonly promoted as a general objective for assessment of impacts on conservation values. However, this represents a completely different and far more complex challenge.

- In most cases, simple observation and application of maintenance standards and schedules may be sufficient to manage facility/service impacts effectively. If required, application of generic indicators and monitoring approaches can be considered a realistic option. However, as is discussed further in Section 3, the same option is not particularly realistic or desirable for impacts on conservation values.

2.2 EFFECTS ON CONSERVATION VALUES

While the workshop demonstrated the complexity of assessing specific impacts, it did provide sufficient information to summarise the range of visitor 'effects' on natural environments. As shown initially in Figure 1, three overall categories of visitor-related effects can be defined:

- Physical
- Wildlife disturbance
- Hazard introduction

These effects can be attributed to a wide variety of visitor and management actions. The causes range from inadvertent physical acts through to deliberate negative behaviour. They may relate directly to the consequences of visitor presence, or indirectly to the consequences of management actions associated with visits. All these are summarised briefly in the descriptions below, and also in Figure 2 (see next page).

2.2.1 Physical damage effects

Visitor effects

These comprise those changes to environments where visitors walk, ride, drive, swim, and sleep for example. Typical effects here relate to direct trampling or other impact forces on rocks, soils, vegetation and micro-fauna (e.g. plant and micro-fauna damage/displacement/death, soil disruption, damage to natural surface/features, and damage to integrity of historical/cultural features) and also to any secondary diffusive processes enhanced erosive processes, increased sediment loads, species balance disruptions, and habitat viabilities). Visitor behaviour may also go beyond simple unintended effects to specific negative behaviours (e.g., vegetation breakage, firewood collection, campsite clearance, fossicking for specimens, and species removal).

Associated management effects

These relate to the intended and unintended changes from visitor-related management actions. Intended changes are part of planned management processes and can be anticipated and controlled (e.g., clearance/

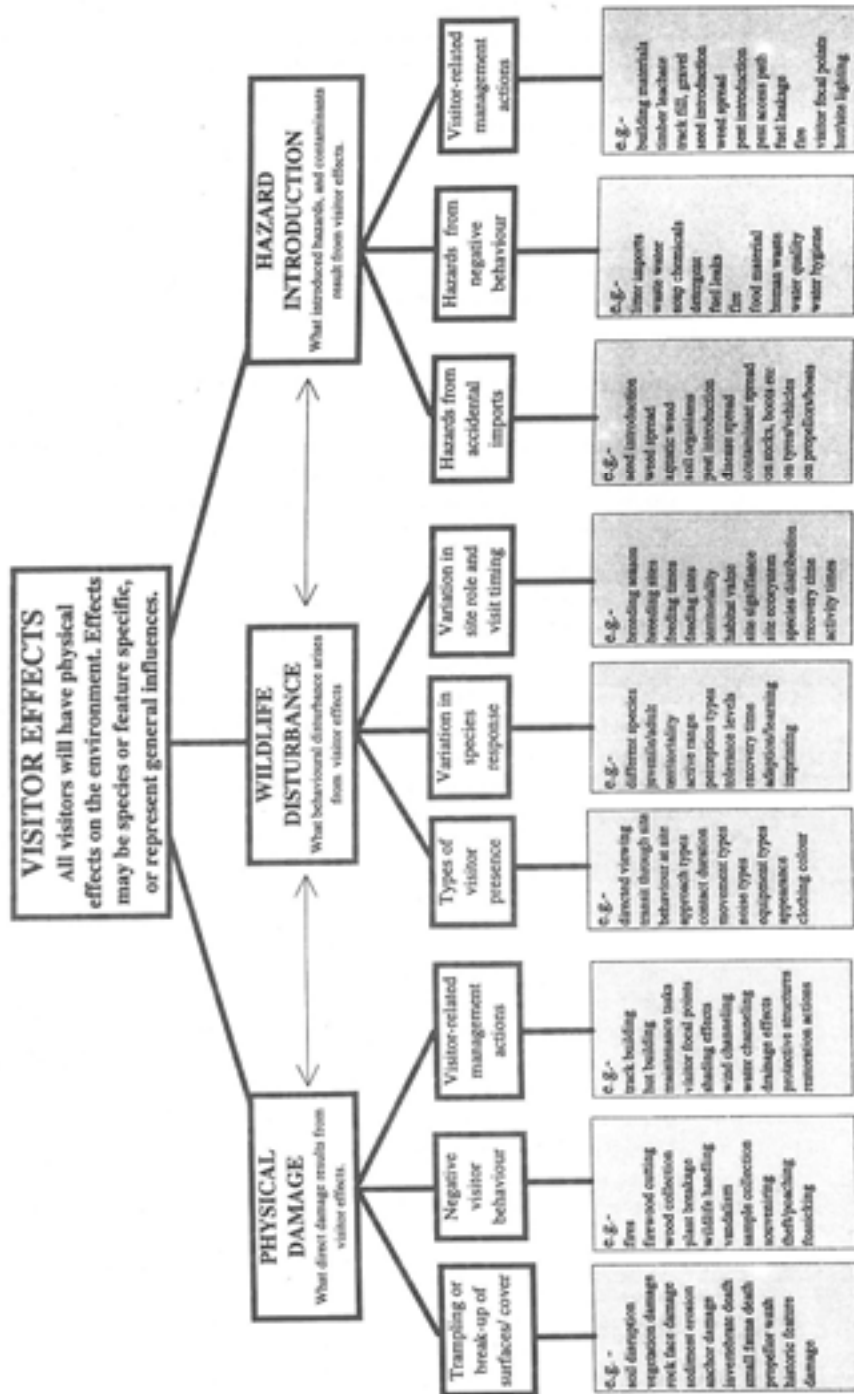


FIGURE 2 SUMMARY OF VISITOR EFFECTS ON CONSERVATION VALUES (REFER TO TEXT).

distruption of vegetation, soil and for construction and maintenance of tracks, huts, and drainage channels). However, other unintended physical effects may also occur (e.g. shading from buildings, on-flow from water channelling, wind channelling, wires and aerials in bird flightpaths).

2.2.2 Wildlife disturbance effects

Visitor effects

When visitors intrude upon wildlife, different species will perceive the consequent disturbance in different ways and for different reasons (e.g. the simple visual presence of humans, their movement, noise, and behaviour). In this context the visitor effects really comprise the ways in which the visitor's presence disturbs the wildlife and how the species subsequently respond. Wildlife tolerances, responses and consequences will vary between different species, in different settings, and at different times (e.g. different bird species, adults and juveniles, different invertebrate species, encounters in territories, and encounters during breeding seasons).

Associated visitor management effects

These are related to how wildlife responds to staff presence and any associated construction, maintenance and research behaviours (e.g. the visual, noise, movement and behaviour of staff), and also their reactions to ongoing long-term facility and structure presence (e.g. huts, signs, tracks, lighting, reflections, colour, and noises).

2.2.3 Hazard introduction effects

Visitor effects

When visitors come to a natural system they can bring external material, substances or biota with them. Visitors may accidentally import hazard sources (e.g. exotic plant/weed species, predator species, and diseases), or introduce hazard sources from negative behaviour (e.g. fire, fuel leakage or disposal, soap chemicals from washing, littering, bringing dogs to parks).

Associated management effects

Management staff have the same potential for hazard introduction as visitors. And a distinct array of additional hazard introduction possibilities are also provided by their activities in facility provision and maintenance. These may be direct exotic plants/seeds in track fill or building materials, from timber, and chemicals from material degeneration), or indirect (e.g. access routes for predators, fire potential, and providing focal points for visitor congregation).

While the range of possible visitor effects can be summarised, the difficulty still remains of determining when these become significant impacts. Section 3 discusses an approach which reorientates the focus of attention to first specifying the conservation values, and then using these to determine specific situations where visitors have a significant impact potential. This also provides the basis for a process to identify key research and information needs much more specifically.

3. Identifying key visitor impacts

Developing generic lists of visitor impacts and indicators across a variety of sites and circumstances can be helpful, but is not a productive way to deal properly with managing key impacts on complex conservation values. Reliance on generic approaches can be oversimplistic, and can create overwhelming and misplaced demands on management and research resources to address visitor effects which are simply not important. A clear message from the workshop was an acknowledgement of the complexity of ecological systems, and our relatively limited state of knowledge about them.

To achieve a productive focus on the key impact issues, it is vital to begin by identifying those specific conservation values that are most important. Once these are the key visitor impact issues will be more clear, and limited research and management resources may be most effectively and efficiently applied. In this situation, significant visitor impacts would be occurring where the visitor effects were compromising the key objectives for conservation management (e.g. sustained or enhanced biodiversity, species viability, and representativeness). The key conservation values underlying conservation management priorities can be broadly classified under the following headings (these should be seen as provisional, subject to refinement following later consultations):

Species (e.g., rare/threatened/unique)

- birdlife
- invertebrates
- mammals (terrestrial/marine)
- vegetation
- aquatic (freshwater and saltwater)

Ecosystems

- representative ecosystem examples
- unique associations (vegetation/wildlife/physical)
- key habitat/setting for other values

Physical features

- representative physical feature examples
- geological key sites/unique formations
- geothermal key sites/unique formations
- unique landforms/special geomorphic features
- unique landscapes/associations

Historical/cultural

- historical key sites/structures
- cultural key sites/structures
- historical/cultural site associations

Some summary points can be made about the main information needs associated with these types of conservation values:

- The key to assessing visitor impacts on such values is to have independently derived baseline information
- In this context, 'baseline' information should be seen as representing general understanding of ecological components, their interactions and associated physical processes, which enables key environmental values to be better defined and located. A common misinterpretation is to view baseline information as defining a 'baseline state', to which subsequent monitoring may be related. This function, where required, can be fulfilled more productively by defining case-specific standards, indicators and thresholds later in the management process.
- this baseline information should already have established and prioritised what values are most important, have evaluated as far as possible what the main vulnerabilities to impact may be, and the key sites/ settings of their locations or distributions. However, it was clear from workshop discussions and reference to resource information that the current state of baseline information is incomplete and fragmented.
- The importance of this type of baseline information for addressing impact issues has not been widely addressed in research and management considerations. The logical links between visitor impact issues and general ecological research and information processes have not been well established.
- Gaps in this baseline information, or difficulties in collating and what information and knowledge already exists, are together the most prominent current research and information needs in the visitor impacts field.

A framework is required to whatever baseline information is currently available, and to direct resources at the most relevant research and investigation investigations if needed. This is required to shift the focus towards the key conservation values and their management in specific sites/ settings. A model process for systematically applying improved baseline information in identification of key visitor impacts, and consequent research and information needs, is described in Figure 3 (next page). The associated discussion in Section 4 describes some of the main research and information tasks required to allow such a process to function.

In this context of a more site-specific and value-specific assessment process, any indicators of impacts could be more precisely defined and applied, and their monitoring may result in more prescriptive measurement outcomes. These types of outcomes may also define the problem more clearly, and preclude the need for further monitoring. However, the operational complexity of tasks in any specific monitoring processes would be greater, would require more skilled and specialised staff, and would be more consuming. Application of such approaches may be more appropriate to specific investigations associated with baseline research, rather than providing simple indicator tools for ongoing and long-term monitoring options.

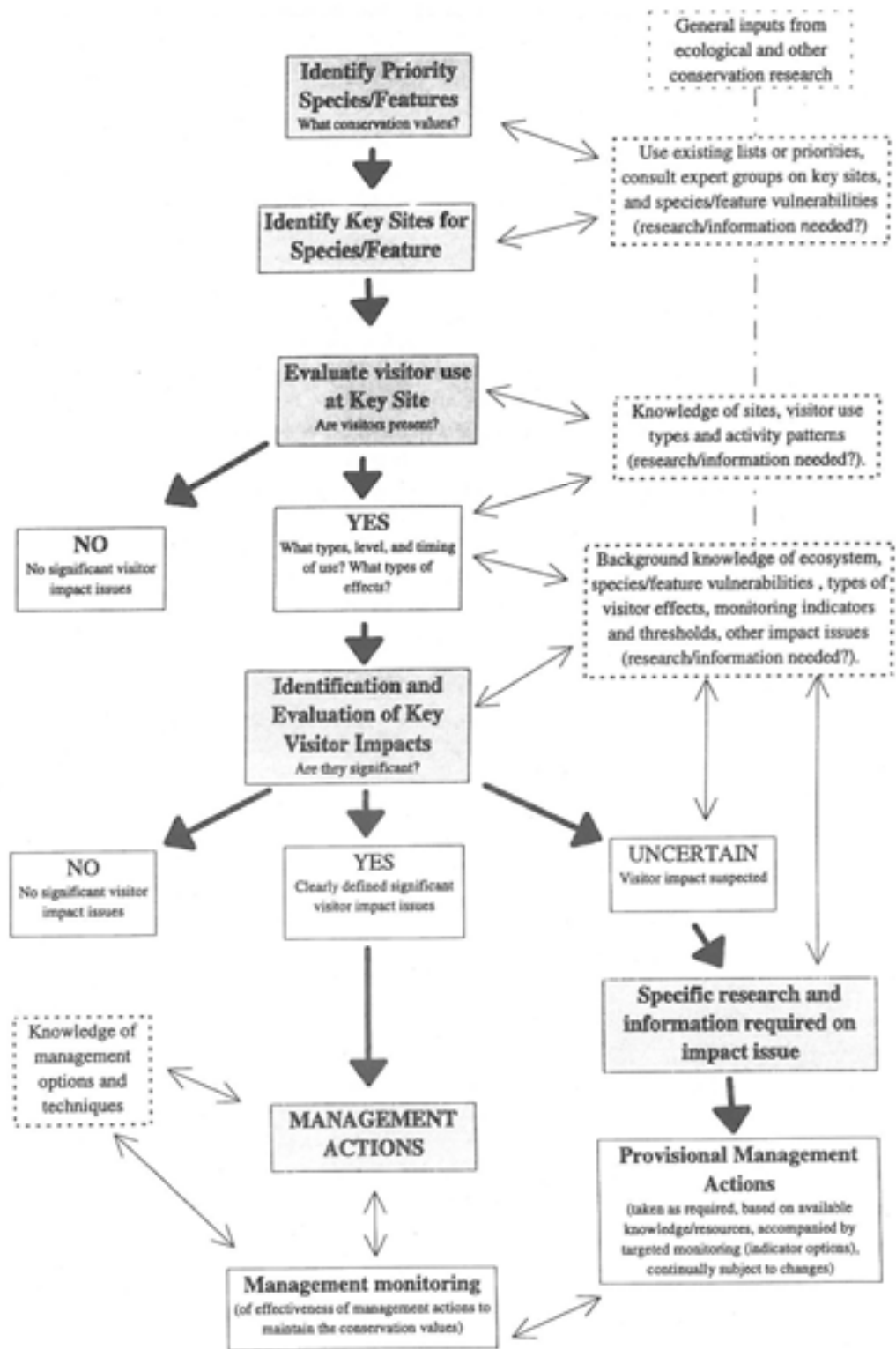


FIGURE 3 PROCESS FOR IDENTIFYING KEY VISITOR IMPACTS ON CONSERVATION VALUES.

4. Research and information conclusions

The research and information conclusions from the workshop are expressed in two ways.

Specific impact questions raised from workshop discussions

These were a variety of specific questions identified by the working groups. They are documented in Part 1-The proceedings (see Preface for reference), and a summary is presented here in Appendix 1. Some of these may provide the basis for developing proposals for research and information investigations.

Overall research and information needs

These represent overall research and information themes which require specific attention to allow the Department to achieve best practice in visitor impact research, assessment and management. These provide the basis for developing a research and information plan.

The main research and information themes are listed and discussed below. Although they are described individually, they are inter-related. These interrelationships are also apparent from Figure 3, which presents a process for applying these baseline information types to identify key visitor impacts.

- General ecological baseline research and information
- Processes for key conservation values
- Processes for key sites for conservation values
- Identifying visitor/conservation value 'hot-spots'

4.1 GENERAL ECOLOGICAL BASELINE RESEARCH AND INFORMATION

General ecological understanding is essential to distinguish among wider ecosystem changes (natural or human-induced); the effects of visitors; and 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 types of investigations include addressing ecosystem classification; species taxonomy, lifecycle, behaviour and ecosystem roles; identification of key ecosystem components and physical processes; and assessment of species and association vulnerability to impacts.

³ Investigations and consultations to achieve better understanding of historical and cultural values should also be encouraged.

This links manager needs for visitor impact information to mainstream progress in general research and information disciplines. It also highlights the increasing importance of adopting multidisciplinary consultation and research processes. Consultation would be encouraged with a variety of specialists and key collectives such as Specialist Groups (who assess investigation proposals for the Department) and Species Recovery Groups (who develop and implement species recovery plans for the Department).

Research and information actions

- In further development of visitor research strategies and planning, formally acknowledge the role of general ecological research as providing baseline information for visitor management issues. Establish the link between visitor impact questions and general ecological concerns, by proposing similar formal recognition in other Departmental research strategies.
- Initiate work to compile bibliographic reference lists on visitor impact issues. Initially, the classification of conservation values presented in Section 2 can be used to provide provisional topic headings. This will initially involve using bibliographic material compiled as part of the workshop, and approaches to specialists and key collectives such as Departmental Specialist Groups for leads on obtaining additional material. A bibliography will provide a summary of what baseline information is available, and a resource for initiating research and information investigations on specific topics.
- Use available review material (e.g. bibliographies) or specialist advice to identify the main topic areas in which improved ecological information is most required to provide baseline for visitor management purposes. Establish the main areas of information deficiency.
- Consult with Departmental research managers to assess the options available for directing the general ecological research effort into those topic areas identified as being most useful for baseline information associated with visitor management needs. Consider how research resources beyond the visitor research field, both within and outside the Department, can be strategically encouraged to address appropriate baseline information needs.
- Assess whether any viable indicators of overall ecosystem health have or are being actively used for management or research purposes, and evaluate their possible contribution to identification of any visitor impact problems. Identify any specific examples of successful monitoring and indicator applications.
- Initiate case studies to scope the types of vulnerabilities associated with a specific conservation value (e.g. a particular endangered species). Some of this type of work may have already been undertaken (e.g., risk and hazard assessments), and this may provide useful examples. Specialist Groups, Species Recovery Groups and any other key sources could be requested to assist identification of any useful examples.

4.2 PROCESSES FOR IDENTIFYING KEY CONSERVATION VALUES

Where not already available, systematic approaches need to be developed which identify or prioritise key environmental values, representing the species, ecosystems, associations, or other natural/historic/cultural features of greatest conservation importance. This will require involvement in consultation and investigations the immediate visitor research and management disciplines. This is the main area that will require work if well-managed visitor/ environmental outcomes are to be achieved.

Research and information actions

- Initiate a process of investigation and/or consultation to define a summary classification of keys types of conservation values (similar to that presented in Section 3).
- Use this classification (in initial approaches to Science and Research Specialist Groups) to assess what may be the specific array of key conservation values associated with each class. It will be required to also consider whether priority lists or statements of conservation importance have already been developed for some of these values. In some cases there may be priorities already determined,⁴ but these need to be recognised and co-ordinated.
- Identify any research and information requirements to develop classifications or to determine priorities. This may require promotion of additional baseline research to refine existing material.
- Acknowledge the existence of some generic visitor effects on facilities and services which can compromise the perceived natural character of some sites, and the acceptable quality of some facilities and services. Initiate investigations to define these effects as far as is practicable. Note that this will require a combined assessment of visitor effects, social perceptions and management specifications. The Link to social impact issues should be acknowledged.

4.3 PROCESSES FOR IDENTIFYING KEY SITES FOR CONSERVATION VALUES

The spatial distributions of the key values identified in processes such as that in Section 4.2 should be evaluated, and the key sites or occurrences defined. Applications of advanced spatial database and analysis systems, such as those represented by Geographical Information Systems (GIS), should be investigated where they assist in developing and operating this type of process. It should be emphasised here that these types of systems represent possible tools of the process and not the objective.

⁴ A key example is the Department of Conservation report 'Setting priorities for the conservation of New Zealand's threatened plants and animals' (2nd edn 1994). Similar processes for other types of conservation values are required.

Research and information actions

- Consult the various database managers in the Department to establish what database resources are available, the types of information relevant to each, and to what extent spatial location is included. This should include reference to any relevant external systems and specialists.
- Consult with staff currently involved in interactive database and GIS-types of applications about possible use of such approaches to specify the locations/ distributions of key environmental values. Reference to other database options will be implicit.
- Promote initiation of a long term process to achieve systematic mapping of key locations and/or distributions of important environmental values, as defined by independent prioritising processes. Ideally, some interactive computer-based database system would be achieved in the long term from these incremental processes.
- Propose some cases-studies of important environmental values (e.g. a key species, a particular geologic feature etc), which involve specific identification of key sites or distributions. Existing systems such as the PNA (Protected Natural Areas) programme may provide useful examples where this is already done.

4.4 IDENTIFYING 'HOT-SPOTS'

Once key sites are identified, the most important environmental threats to key conservation values should be evaluated. These threats may involve normal environmental processes such as natural fluctuations, catastrophic events, and predation. However, in some situations visitor impacts may pose the most significant threats.

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). If some characteristics of visitor use represent significant threats to key values, then greater focus will be required on visitor research and management. The visitor impact will be more clearly defined by already knowing the key environmental values and the significance of the site. If the problems can be resolved by management, then visitor use can continue, but if not, then a clear basis for management actions or further research is established.

Pre-workshop discussions (among the workshop team) noted that if zones, areas or sites of key values could be defined spatially and mapped, then overlays of visitor use systems (e.g. nodes such as huts, campgrounds, viewing points, carparks, anchor points etc., and flows such as roads, tracks, and rivers) could enable visitor 'hot-spots' to be defined where visitor presence intersected with key value occurrences. This provides an immediate indication of where impact issues may be occurring, and gives focus to deciding where assessment, research, and monitoring exercises or case studies may first be appropriate.

Research and information actions

- Promote initiation of a long term process to achieve eventual based inventory and mapping of the locations of visitor nodes (e.g. huts, campsites, shelters, wharves, car parks, picnic areas, viewpoints, lookouts, anchor/mooring points, and visitor centres) and visitor flows (e.g. tracks, short walks, roads, rail links, and landing sites).
- Initiate some case-studies where values are defined, key sites/distributions identified, and visitor use characteristics at these sites determined. Assess then the likely occurrence of important visitor impact issues, and consider the comparable threats posed by other environmental factors. Case studies have particular value as they represent the most productive way to achieve tangible results in the short term.
- Collate any existing information which attempts to define impact 'hot spots', and evaluate where the issues raised represent significant impacts to key conservation values. If examples can be identified, some focus for specific case-study approaches may be provided. Reference to Specialist Groups and others in the Department may also be used to possible examples and issues.

5. Summary: The basis for a research action plan

The research and information conclusions presented in this report represent a long term for progressively improving the resource: for management of visitor impacts. There are no short term easy answers or quick fixes. Progress will be incremental as the results from different research and information disciplines and sources are incorporated into an overall process framework for Departmental needs. Work to establish such a process framework should be given general long term priority in overall research planning and policy. This is not a need confined to the information requirements of visitor management.

When considering priorities in the short term, priority should be assigned first to work which assists the systematic definition of key conservation values.

The other most productive short term research and information investigations which could be initiated should address:

- Concise state-of-knowledge reviews for those key conservation values being identified
- Case-study investigations of specific situations where the overall approach can be applied, allowing evaluation of the approach and also providing short term tangible results
- Initiating investigation of inventory processes and mapping options for defining the spatial distributions and priority sites for the range of key conservation values
- Initiating investigation of inventory processes and mapping options for the spatial distributions and priority sites of visitor use (e.g. nodal points and connecting paths), and different visitor activities
- Identification of options for developing interactive computer database tools, incorporating assessment of existing database resources

Development of a research action plan can be based first on addressing these main points, and then on the other research and information conclusions drawn in Section 4.

This report primarily provides a synthesis of research and information needs for visitor environmental impact management. However, the integration of these research and information needs with those of overall conservation management is clear. It has applications across the range of environmental management tasks carried out by the Department. Future strategic initiatives to optimise investment of resources and to better prioritise research and information tasks should take account of the conclusions of this report.

6. Acknowledgements

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Participants at the July 1996 visitor impacts workshop should also be acknowledged as their input to that extensive forum provided the basis from which this synthesis was derived.

Appendix 1

SPECIFIC RESEARCH QUESTIONS FROM THE WORKSHOP

These were the specific research and information questions identified by working groups. The questions were not framed as investigation proposals. However, some represent current needs of managers, and may provide the basis for development of investigation proposals for submitting to the Science Board. In addition, some of the questions raised may also represent topics which external research providers may find useful in approaches to external funding and support sources. Some of these questions relate to consideration of non-visitor ecological issues, and also to social impact questions.

These specific questions are separate from the conclusions on overall research and information needs (Section 3) although they did contribute to deriving them. Here these questions are presented according to their topic headings, and include reference to additional working group conclusions where these provide additional guidance. The current state-of-knowledge about the respective question topics has not been assessed, and in some cases solutions may already be available.

A1.1 Vegetation and soils

Research and information approaches need to begin from a baseline understanding of the different ecosystems and their dynamics, and development where possible of some appropriate indicators of ecosystem health. Reference to systems and databases such as those underlying the Protected Natural Areas (PNA) approach will be required. Where possible, spatial systems locating important environmental values and visitor pressure points could be applied (e.g. Geographical Information Systems). The main constraint to using such systems is the lack of available information, and/ or the lack of appropriate co-ordinated databases.

An ecosystem approach of this type is necessary to understand the specific relationships between visitor use and ecosystem health. This will better define which visitor impact issues are important management concerns, and in which locations. A number of particular ecosystem types were identified as being vulnerable to negative impacts, and specific questions were proposed in relation to each. These often go beyond specific visitor management issues, but this reflects the greater need to integrate these issues with general environmental management and baseline information.

Coastal ecosystems

- Identify vehicle based impacts of visitors on dune ecosystems, relative to those from other natural processes (e.g. weather, weeds, grazing, etc).
- Identify key native species for dune restoration and stabilisation.
- Evaluate the effects of mixing native and exotic species in restoration techniques.

- Identify role of visitor impacts in mangrove and other estuarine communities
- Establish indices of ecosystem health for main coastal ecosystem types
- Review coastal ecosystems for situations of possible visitor impacts

Alpine ecosystems

- Establish the relative magnitude of visitor impacts on different systems, and assess vulnerability in terms of different recovery times (e.g. such as in cushion-plant communities)
- Examine interrelationships between alpine communities and recreational facilities, for example, how do ecosystems react from construction disruptions and introduction of exotic material (e.g. weed introductions, leaching from timber, nutrification from sewage, restoration of ground cover after disturbance)
- Identify the ecosystem components of scree communities, and address susceptibilities to impacts generally (e.g. from grazing, climate, mass movement, weeds, etc.) and from visitors (e.g. trampling, displacement)
- Evaluate the effectiveness of management to 'harden' tracks and reduce runoff erosion on pumice soils (e.g. do actions succeed, are they 'cost-effective').

Wetland ecosystems

- Identify wetland soil-vegetation associations most susceptible to direct trampling disturbance and destruction, and also to other disruption from indirect visitor impacts (e.g. fire, weeds, etc).
- Evaluate disruption from providing protective facilities for access in wetland areas (e.g. boardwalks), and any ongoing problems (e.g. leachates from timber).
- Relate conclusions from wetland and alpine investigations to Sub Antarctic soils and vegetation
- Identify where visitor pressure may occur to levels at which wetland, Subantarctic, and riparian wetland areas are likely to be damaged.
- Distinguish between visitor uses across riparian strips (e.g. to access rivers) and along them (e.g. walking, biking, driving, fishing, etc), and evaluate respective impact types and significance.

Kauri forests

- Identify locations where visitor use is likely to disrupt interactions underneath major Kauri trees.
- Contrast soil/vegetation conditions between sites with protective facilities (e.g. boardwalks) and those without.
- Identify the regeneration process and evaluate success in different reserves.
- Evaluate processes of visitor-related weed spread into reserves

A1.2 Wildlife

A number of information gaps became apparent, and recognition of these led to some research and information outcomes being identified as important.

General conclusions

- Need for better research and information focus on habitats and ecosystem health.
- Where possible, generic conclusions/generalisations about impacts are required across different settings and species.
- Species-specific features characteristic of vulnerability to impact need to be identified (e.g. what affects species, and where do visitor impacts fit in).
- Where possible, identify specific cases of distinct site-species impact relationships
- Assess the cumulative effects of a variety of impact factors affecting target species, and the role and status of visitor-related effects amongst these where may visitor impacts represent the 'last straw' for a depleted species?)

Research reviews/state-of-knowledge summaries

- Approaches are required that combine literature review with assessments of anecdotal experiences (e.g. covering where literature resources are insufficient).
- Assessments of species-specific impact vulnerabilities and current situations are required (e.g. status of species and current threats).
- Site-specific examples of significant visitor impacts need to be documented
- Situations need to be identified where visitor impacts may affect species viability more significantly through indirect habitat alterations than by direct damage.
- Reviews are needed on how to best to apply indicators and monitoring.
- Situations need to be defined where overseas reviews and experience may be insufficient to address unique New Zealand ecology and associated impact issues.

Forecasting and problem anticipation

- Identify the distinctive characteristics and vulnerabilities of long-lived species, especially if limited by slow reproductive rates.
- Review changes in recreation use patterns and development of new activities and resource requirements.
- Investigate processes for prediction of likely impact pressure points
- Develop risk-assessment procedures for specific endangered species.

Management initiatives/developments

- Review impact mitigation techniques and access paths to external advice sources, to develop more systematic management approaches (e.g. less *ad hoc* response).
- Improve internal and external information transfer, particularly of key research and information reviews and conclusions.
- Initiate more outcome evaluation processes as part of developments.
- Investigate wider research funding options, fund visitor-impact related research from more output classes, consider more targeted and co-ordinated use of concessionaire levies, and promote more general topics for external funding (e.g. promoting topics for university or consultant bids to PGSF for example).

Summary

- The wildlife research and information tasks/questions were summarised as follows:
- Develop a database of world-wide published and unpublished including reference to selected anecdotal, notebooks, file notes, information on general visitor impacts on wildlife, with emphasis on examples relevant to New Zealand.
- Establish baseline data (e.g. species characteristics, behaviours, vulnerabilities, distributions) on high priority species.
- Identify key sites for the viability of priority species, and evaluate visitor presence and activities at these sites where visitor impacts may be a significant problem
- Where possible, design simple guidelines for monitoring visitor impacts on vulnerable species, where such monitoring is clearly required to assist ongoing management of species and visitor use at the same sites (e.g. may require a case-by-case basis).
- Investigate whether early warning indicators can be identified for measuring impacts on breeding success using known case studies as examples (e.g. blue duck, royal albatross).
- Determine if meaningful indicators can be used to detect unknown impact effects. Can we identify and provide easily measurable indicators sensitive to general impacts, using examples of specific species (e.g. can we get early warning of negative changes?).

A1.3 Aquatic/Water/Air Quality

The following research and information questions were derived from working group considerations:

- What are the key ecosystems and species in New Zealand aquatic areas? This simply represents a need to know more about aquatic ecosystems, what features are of greater significance, and where these may be located. Clearly this is a large question, and some re-definition and classification of aquatic ecosystem types will be required to reduce the questions to smaller manageable components.
- What are the types of impacts of watercraft on aquatic ecosystems, and how do these vary for different craft types and in different ecosystems? This question suggests a literature review is required to provide a more refined perspective on the important issues. It aims to promote a scoping of the key problem areas. This would be complemented by an ongoing collection of qualitative/anecdotal observations about specific significant impact examples from staff. The overall review may also serve to sub-divide the range of impacts into more specific topic/problem areas.
- What are the damage and disturbance impacts from watercraft anchoring in a New Zealand context? This would require a review of overseas knowledge on anchoring effects, but would be tempered by consideration of New Zealand recreational boating levels, and identification of any key seabed sites where anchoring could cause a significant impact, even at relatively low use levels (e.g. Milford Sound - black coral).

- Will the provision of moorings reduce the environmental impacts associated with anchoring, or will it create another suite of problems? This comparative review is necessary as the main management response to uncontrolled anchor damage is to provide controlled mooring sites.
- Review the overseas research on the introduction and spread of weeds/pest species on diving/fishing gear and boats to define the type of problems this can represent.
- Does fish-feeding behaviour by visitors pose any significant threat to viability and ecological values of the Marine Reserves where it takes place? This behaviour does occur, but the effects are unknown. This work may be particularly important if sites of the impact are concentrated, or the frequency of the behaviour is increasing.
- What knowledge do we have on the ecology and behaviour of whitebait, and what is the effect of the whitebait catch, and its seasonal timing? This appears to be one of the main fisheries issues still substantially under the direct control of the Department. It is locally significant in coastal areas such as Westland, and is becoming an important focus for promoting wetland restoration.
- What is the ecological significance of alpine tarns? There appears to be little available knowledge on this unique ecosystem type, and it appears a review is necessary to identify any key values other than simply general conservation.
- What differences in water quality and ecological conditions can be identified between tarns which are impacted by humans in known ways, and similar ones which are not? This type of work may provide a better picture of the importance of tarn systems, and the most visitor sensitive components. Along with this comparison should be an assessment of where visitor activities are perceived to be resulting in most impact problems.
- Is a manual documenting the features, appearance and behaviour of different aquatic weeds and pests available to assist field staff identifying the presence of potential threats, and if not, can such a manual be devised? This is more a question of information collation and distribution than research, unless not all the information required is known.
- Is sufficient known about the behaviour and lifecycle of giardia to assist managers minimise its spread?
- Are there any significant visitor-related impacts on air quality in New Zealand? This is an issue overseas, but few local examples are identified. It may only be an environmental impact issue in cave environments. It may be a visitor satisfaction problem due to fumes in huts, or from smoke sources (e.g. steam trains).

A1.4 Geological/Geothermal

The key specific research questions related to impacts on geological and geothermal values were summarised as follows:

- Develop an inventory of New Zealand cave systems, including associated biological values and types of visitor use.
- In what locations and in what amounts does the introduction of material (CO₂, humidity, light, lint, temperature, sediments) have an

- adverse impact on cave formations/features.
- What are the cave formations/features most susceptible to physical impact (including trampling, touching, light).
- What are the range of susceptibilities of different associations in geothermal areas. And to what extent are visitor impacts important relative to other natural change processes or localised catastrophic events.
- Are hot pool environments important biological systems and what are the key features and susceptibilities to change.
- What are the visitor impacts on these hot pool environments.
- What is the extent and site specific impact of climbing on rock-faces and on associated vegetation/soils.
- What plants/biota are uniquely associated with rock faces used for rock climbing. Are these settings significant as species refuges or as unique adaptive associations, and what are the impacts of rock climbers on these features.

A1.5 Historical/cultural

The following were identified as the priority physical impacts issues from visitor use:

- Assessing visitor wear and tear on structures/buildings.
- Assessing visitor-exacerbated erosion on sites
- Establishing indicators and monitoring methods for assessing long-term conditions
- Identifying appropriate visitor loading/facilities carrying-capacity
- Identifying appropriate protection techniques

An extensive matrix was also developed which arranged these issues against important sites throughout New Zealand. This is presented in the associated Proceedings Report (see Preface). More specific research questions were also proposed, although some were not related directly to physical impact issues. These were summarised as:

- Identification of suitable species for use as protective covers/canopies over historic sites (those subject to erosion from rainfall, trampling, wind?).
Develop or identify generic indicators of long term site condition at certain sites (e.g. Te Porere Redoubt).
Research into applying long term monitoring of conditions/features using techniques such as photo-points/detailed condition maps.
- Assessing the impacts of root growth through archaeological layers/formations and structures.
- Initiating archival research to better define the historically true landscapes/ features at some sites.
- The options for and uses of vandal proof materials for site facilities and protective measures (pros and cons).
- Community values attributed to historical/cultural sites and site-associations, and any relationships between these and promoting desirable visitor behaviour.
- Review of expertise and documented information on what may comprise acceptable management solutions/options (e.g. use of visitor barriers, site stabilisation techniques, signage).