

# Guidelines for mountain protected areas

Duncan Poore

Commission on National Parks and Protected Areas (CNPPA), IUCN

1992

Keywords: mountains, mountain resources, mountain ecology, mountain development, environment, environmental services, conservation, protected areas, water resources, soil conservation, guidelines, environmental degradation.

## Contents

Background

Preface

Introduction: mountains in general

Mountain protected areas: to protect what?

General criteria for the selection of mountain protected areas (Guideline 1)

The preservation of biodiversity and physiographic features (Guidelines 2-17)

Transfrontier Mountain Protected Areas (Guidelines 18-29)

The religious and cultural significance of mountains (Guidelines 30-43)

Mountain protected areas and the cultural and economic life of the communities in them (Guidelines 44-51)

The owners and users of land within mountain protected areas (Guidelines 52-61)

Water and soil conservation in mountain protected areas (Guidelines 62-72)

Management to minimise physical and biological damage (Guidelines 73-121)

Fire (Guideline 73)

Trampling and other physical damage to vegetation and soils (Guidelines 74-79)

Pollution and waste disposal (Guidelines 80-84)

Alien organisms (Guidelines 85-89)

Dispersal of plant or animal pathogens (Guidelines 90-93)

Use of fuelwood (Guidelines 94-97)

Hunting (Guidelines 98-99)

Construction (Guidelines 100-105)

Grazing (Guidelines 106-110)

Traditional use of plant resources (Guidelines 111-114)

Scenery (Guidelines 115-121)

Management for visitors' health, safety and enjoyment (Guidelines 122-153)

Issues associated with climatic change (Guidelines 154-161)

Epilogue

Appendices:

IUCN Categories of protected areas

Participants in Parks, Peaks, and People consultation who wrote the guidelines

**IUCN:** The World Conservation Union

**Copyright:** (1992) International Union for Conservation of Nature and Natural Resources

Reproduction of this publication for educational or other noncommercial purposes is authorised without prior permission from the copyright holder.

Reproduction for resale or other commercial purposes is prohibited without the prior written permission of the copyright holder.

**Citation:** Poore, Duncan (Ed.), 1992. Guidelines for Mountain Protected Areas. IUCN, Gland, Switzerland and Cambridge, UK. 56 pp.

**ISBN:** 283 1701112

**Printed by:** Unwin Brothers Limited, Old Woking, UK

Cover photo: The rugged erosionshattered volcanic plug of Mawenzi (5149m) is a main feature of Mt Kilimanjaro National Park and World Heritage Site, Tanzania.

Photo credits (cover and text): IUCN/Jim Thorsell.

**Produced by:** IUCN Publications Services Unit, Cambridge, UK, on desktop publishing equipment purchased through a gift from Mrs Julia Ward.

**Available from:** IUCN Publications Services Unit, 18 la Huntingdon Road, Cambridge, CB3 ODJ, UK or IUCN Communications Division, Rue Mauverney 28, CH1196 Gland, Switzerland

The designations of geographical entities in this report, and the presentation of the material, do not imply the expression of any opinion whatsoever on the part of IUCN concerning the legal status of any country, territory, or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The views of the contributors expressed in this report do not necessarily reflect those of IUCN.

The text of this report is printed on Reprise Matt recycled paper.

## PREFACE

The special significance and characteristics of mountains require in many instances that major portions of them be afforded extra care or protection. Designation of areas as parks, reserves, sanctuaries and the like has recognised these special qualities and "senses of place".

Some reasons for protected area status and a few examples follow:

- Mountains are often associated with "sacred" aspects of nature. There may be pilgrimage to holy hills or taboo places of fear those present unusual management situations (e.g. Maria Lionza, Huang shan, Bromo-Tengger Sumeru).
- Mountains have mystique for scholars, visitors, and the general public. This has plus and minus effects (e.g. Kilimanjaro, Elbrus, Lorentz).
- Traditional indigenous groups with threatened cultures often occupy or use the areas. They add greatly to the interest, can contribute much, and represent a clear case for cultural diversity conservation. Cultural diversity may be more threatened than biodiversity (e.g. Pico de Neblina, Annapurna).
- They are headwaters of valuable surface water resources. Special care is needed to safeguard water quality for all downstream sites. The few remaining economically feasible water storage reservoirs for water and power are in mountain valleys. Of particular significance is cloudforest, which has endemic species and hydrological resources (e.g. Mount Kinabalu, Australian Alps).
- Mountain biotas, under climate stresses at the best of times, are particularly vulnerable to climate change from increasing greenhouse gases, as well as from exogenous air pollution. Protected areas crossing several altitudinal belts are needed. They offer great possibilities for global climate change and air quality research and monitoring (e.g. High Tatras, Great Smokies).
- Mountains are a last refuge for many rare plants and animals eliminated from more transformed lowlands. They are vital to biological diversity conservation. Freestanding mountains become biological islands (e.g. Taranaki, Mount Apo).
- These are dynamic landscapes of relatively rapid change. Volcanism, uplift, erosion, glacial outbursts, seismic activity, avalanches, and torrents all contribute to significant rapid alterations in topography, vegetation, and land use. These are high-energy environments where some control over human alterations is often needed (e.g. Hawaii Volcanoes, Tongariro).
- There is a concentration of high scenic value, attractions for tourists and recreational use. Management is needed to maintain these values (e.g. Mount Cook, Hohe Tauern).
- The concentration of recreation/access in confined corridors demands a proactive policy and management approach to avoid overcrowding,

- degradation of access routes and campsites (e.g. rubbish, sanitation) (e.g. Himalayan parks, Tasmanian/New Zealand national parks, Huascarán).
- Mountaineering expedition pressures demand positive control to avoid site degradation, and require that equipment/materials/refuse brought in be taken out (e.g. Sagarmatha [Everest]).
  - Mountain ranges often form country boundaries, and thus offer opportunities for the establishment of international border parks, peace parks and cooperative international action (e.g. Pyrenees Occidentals and Ordessa, Sagarmatha and Qomolangma, and the proposed Mont Blanc Park and convention on the conservation of the Alps).

Mountains are indeed special places. Many of them have received legislative recognition by designation as parks or reserves of various kinds. Worldwide, in fact, there are some 430 mountain protected areas representing a network of most of the outstanding mountain or mountain ranges on earth, and meeting fairly rigid criteria defined in Section 1.

It is for the planners and managers of this estate and any future areas that the guidelines in this booklet are intended. They were formulated for mountain protected areas in the widest sense of both terms "mountain" and "protected areas".

These are general guidelines or recommendations. Specific guidelines, hopefully using these as a foundation, need to be developed at a national level. At this level they should be much more specific, and should have local community input to meet the special needs and circumstances which prevail at any specific site. These guidelines are not presented in any paternalistic way, but offered as a sharing of experience by 40 scientists and managers in over 30 countries.

The scientists and managers produced these guidelines in working groups at an international consultation on "Protected Areas in Mountain Environments", more distinctively known as "Parks, Peaks and People". This consultation was organised by the East West Center's Environment and Policy Institute, and co-sponsored by IUCN's Commission on National Parks and Protected Areas, the International Office of the US National Parks Service, and the Woodlands Mountain Institute. The International Mountain Society was a collaborator. It was held in Hawaii Volcanoes National Park from October 27 to November 2, 1991.

It was the thesis of this consultation, and the rationale for convening it, that mountains possess biophysical and cultural characteristics which merit special consideration and treatment in the matter of preservation and conservation. These include their three-dimensional nature involving steep slopes, altitudinal belts of varying ecosystems in a short distance, their different exposures or

aspects and climates, and their frequent characteristics of spirituality, remoteness, inaccessibility and great cultural diversity islands in a sea of tamed and transformed environment. Because of their elevation and steepness and the processes of erosion, tectonic action and mountain building, they are earth features of a dynamic nature, subject not only to many natural hazards but also more susceptible to human initiated damage than are other terrains. Planning, design and management of mountain protected areas thus call for a great sensitivity to special cultural and biophysical attributes of these environments.

It was recognition of the special nature of mountains and the impact of development on them that led to a previous initiative by IUCN back in the late 1970s. Again, based on convocation of mountain researchers and land managers in New Zealand, Drs Ray Dasmann and Duncan Poore produced an excellent booklet Ecological guideline for balanced land use, conservation and development in high mountains. This present booklet is directed specifically to mountain protected areas, but is patterned on this previous publication.

In view of his long association as an ecologist in high country, and especially because of his previous authorship of the general ecological guidelines for mountains, it is very fitting that Dr. Poore took on the job of synthesis and editing of the work of the 40 mountain men and women at the Hawaii consultation.

These individuals gave unstintingly of their time, and we are grateful to them. Their names are listed in an appendix to this volume. We thank those who laboured in the working group reports and those who reviewed the first draft. We wish to single out P.H.C. "Bin" Lucas who, at the time of the consultation and production of this booklet, was Chairman of the Commission of National Parks and Protected Areas. But most of all we doff our mountain berets to Duncan Poore, our synthesis writer.

We hope that the guidelines will be a catalyst for the national and site-specific strategies that must follow if we are to have harmonious and effective management of mountain protected areas around the world.

Lawrence S. Hamilton  
Vice-Chair (Mountains) CNPPA and East West Center, Honolulu, Hawaii, USA,  
and  
Jim Thorsell  
Senior Advisor (Natural Heritage)  
IUCN, Gland, Switzerland  
May, 1992

## I. INTRODUCTION: MOUNTAINS IN GENERAL

*There is much comfort in high hills  
and a great easing of the heart.  
We look upon them, and our nature fills  
with loftier images from their life apart.  
They set our feet on curves of freedom bent  
to snap the circles of our discontent.  
Geoffrey Winthrop Young*

We all know a mountain when we see it; mountain peoples all know that they are mountain peoples and are proud of it. Yet it is difficult to find a convenient definition that fits all mountains. There are, perhaps, only a few features which are common to all. They exhibit a vertical dimension which results in an altitudinal gradient and stratification of climate, soils and vegetation; and they have different aspects and exposures. All other generalizations have exceptions. Most mountains rise above the tree line, but some near the equator are obviously mountains though their summits are scrub covered; most are very steep or precipitous, but the volcano Mauna Loa in Hawaii, evidently a mountain, has gentle contours; most rise to considerable altitudes, but the highest of the mountains of the Scottish Highlands, exposed to rigors of a climate on the western seaboard of Europe, is no more than 1,344 metres above sea level and has a tree line at about 500 metres.

Mountains are very special places. For many they are sacred; to most they bring spiritual refreshment; to a few they bring fear. They are the home of many different peoples in every continent. They occur in all biogeographical regions of the world, where, because of their history, isolation and great variability of habitat, they are havens of high biodiversity and rich in endemic species. They contain a great variety of climates and geological and physiographic features. They provide magnificent scenery and the qualities of remoteness and wilderness a solace and a challenge to those who visit them. They are also the gathering grounds of much of the world's water. In fact, they are of untold value to those who live in them, those who visit them, and enjoy or study them, and those in the valleys and plains who count upon a dependable yield of high quality water from them.

Because of their steepness, extreme weather conditions, and the instability of their soils, many mountain areas are marginal for commercial agriculture, though many support excellent subsistence systems of farming, grazing and agroforestry. Most, too, are remote and inaccessible, so that mountain communities are far from markets and the provision of services for them is expensive; most of the communities have also, until recently, been very self-contained. Improved communications may prove a mixed blessing; as well as bringing the benefits of better services and more direct access to markets;

they facilitate emigration and provide greater opportunities for people from the lowlands to influence and exploit the resources and cultures of the mountains.

In many countries, the metropolitan centre has another conception of mountain areas. Because they frequently form international borders, they are important for defense. The people who live there are often proud, independent, and considered unruly. The mountains are often endowed with valuable minerals; have forests that can be exploited; and contain preferred sites for the impoundment of water for domestic and industrial use, for the generation of electricity and for irrigation. Mountains can be developed for tourism, recreation and for second homes. In fact, they are looked upon both as an economic asset and as a liability or special responsibility.

Since the earliest days of the establishment of protected areas, mountain areas have been a favourite choice. This has not always been for the best reasons. Many, it is true, have been selected because of their special merits, but others largely because of their remoteness and the fact that they were of limited value for more lucrative economic activity.

Thorsell and Harrison have recently carried out an analysis of existing mountain protected areas in the 1990 UN List of National Parks and Protected Areas(1). Out of 5310 of the more strictly protected areas (IUCN Categories IIV [2]) which between them cover 574 million hectares, protected areas in the world's mountains constitute eight per cent of the total number of sites and 42 per cent of the total area. This analysis has, for practical reasons, been confined to areas with a minimum relative relief of 1500 m and greater than 10,000 ha in area. There are many other mountain protected areas that do not meet these strict criteria. The coverage is therefore much more extensive than that of most other world biomes, but this does not mean that it is by any means complete or satisfactory. Moreover, it has mainly been concerned with the protection of pristine landscapes, natural ecosystems and magnificent scenery; in most instances, the way of life of any people who live in these landscapes has not been included in the criteria for selection.

It is evident that there are several issues which are of special importance to the management of protected areas in mountains. Some of these are related to the changing numbers and way of life of resident populations; some to the effect of visitors and the development of facilities on fragile soils and ecosystems, and on the customs of the residents; and some linked with the special opportunities and problems which may be caused by the accelerated changes of climate which are now expected. An additional complication is the great variability of environment within a small compass.

The satisfactory conservation of protected areas in mountains depends, as indeed it does in other biomes, on the effective application of a number of procedures.

- A clear articulation of the purposes for which areas are to be protected and the criteria applicable to each of these purposes (e.g. preservation of biodiversity, protection of water catchments, etc.).
- The identification of those areas which qualify to meet each of the defined purposes. For this a survey must be made of the relevant resources.
- Legislation to provide for protection and the resources of staff and money to make the application of the law effective.
- Consultation with local communities who may be affected (and perhaps also with the wider public) on matters concerning the choice of area, the objectives for its management, and the details of management. Some permanent mechanism for continuing consultation is desirable.
- The precise definition of objectives of management of the protected area as a whole and of parts of it where these have special requirements. This should form the basis of a formal but flexible management plan.
- The implementation of management.
- The compilation of baseline information and regular monitoring thereafter to follow the effectiveness of management. Monitoring should embrace not only physical and biological aspects but also sociocultural effects.
- Research specifically directed towards the solution of problems which arise in the course of management.
- The periodic revision of the prescriptions and practice of management as a result of experience and conclusions derived from monitoring.

The sections which follow are largely based upon the main themes of the International Consultation on Parks, Peaks and People, themes which were selected to cover topics of wide general interest and applicability(3). Most of them address, to a greater or lesser extent, all the topics listed above. It was felt best to leave much of the resulting duplication as the importance of each of these themes is emphasised by being repeated in a different context.

The sections which follow deal in turn with:

Mountain protected areas: to protect what?

- general criteria for the selection of mountain protected areas
- the preservation of mountain biodiversity and physiographic features;
- Transborder mountain protected areas;
- the religious and cultural significance of mountains;
- mountain protected areas and the cultural and economic life of the communities in them;
- the owners and users of land in mountain protected areas;
- the conservation of soil and water resources in mountain protected areas;
- management to minimise physical and biological damage;
- management for the health and safety of visitors to mountain protected areas;
- Issues associated with climatic change and air quality in mountains.

## II. MOUNTAIN PROTECTED AREAS: TO PROTECT WHAT?

It is broadly true to assert that protected areas in mountain regions have hitherto been mainly chosen for their spectacular scenery, their quality of wilderness, their wildlife, and the opportunities they offer for tourism; and the criteria used to select them have been based on these values. In many respects these criteria are the same as those used in other biomes. Moreover, additional relatively pristine mountain environments need formal protection. Many existing mountain protected areas are empty of resident people, or nearly so; but there are others which have substantial populations, especially in the valleys. Here the landscapes have often been shaped by long occupation, and many of their special qualities lie in the contrast between the tamed and the wild. These people, over centuries, have reached a way of life which is broadly in balance with the setting in which they live. Both they, and the pressures upon them, are now changing fast; and the changes are in many instances harmful to the environment and too rapid or too violent to allow for harmonious adaptation by the local communities.

Because most mountain protected areas have been chosen for their physical, biological and scenic qualities, the role of local people has usually been seen as one of maintaining these physical, biological and aesthetic qualities. Their own way of life, the protection of it from unnecessary disruption, and the conservation of the resources upon which it is based, has not been seen as special features which should be protected and upon which areas should, therefore, be selected for protection. It is questionable whether this is any longer a tenable attitude. To provide sufficient protection to enable the ways of life of resident communities to develop without undue disruption should be one of the central aims of protected areas in mountain regions consistent, of

course, with broader environmental conservation. Ways of choosing the communities which deserve such protection should, therefore, be among the criteria for selection of protected areas.

If resident populations are to be included as an essential element in some mountain protected areas, this has direct consequences for the category of protected areas to be chosen and for the objectives of management. The IUCN Categories cover a wide range of characteristics and objectives and, by defining different zones within a protected area, many of these different objectives can be included in one area.

Perhaps the most flexible category is Category V (Protected Landscapes), because this in theory affords broad protection to the whole, while it can give greater protection to parts for specially defined purposes. The legislation and controls and incentives; the nomenclature is less important.(4)

It is not suggested that this flexible approach must be adopted for all mountain protected areas there is clearly a place for areas which fall firmly into Categories I or II most existing mountain protected areas indeed are in Category II. But the whole concept of protected area, applied flexibly, does provide for graded degrees or zones of protection within the chosen area which will enable development to take place in a controllable way and at a controllable rate to the greatest possible advantage of both local communities and the environment. Indeed, there would be merit in extending the general principles to policies affecting all mountain regions, whether formally protected or not.

### **III. GENERAL CRITERIA FOR THE SELECTION OF MOUNTAIN PROTECTED AREAS**

The selection of protected areas in the mountains should be related primarily to the sets of values which it is desirable to protect physical features, biodiversity, catchment characteristics, metaphysical aspects, human cultures and the resources upon which they depend, and scenery. But consideration should also be paid to the uses which may be made of these areas based upon their protected status scientific or cultural studies, various forms of recreation or, simply, pure enjoyment for it is the use made of such areas that will convince governments and the public that protection is in the national and public interest. Many of the difficulties of managing mountain protected areas are concerned with establishing the correct balance between protection and use.

*There should be protected areas in every mountain range in the world, selected to protect the whole range of features for which mountains are valued and designed to meet various uses.*

## Guideline

1. Within each mountain range, it should be the responsibilities of the governments which contain parts of it, to ensure that protected areas are set up which adequately include the biological, physical, and cultural variation within their boundaries.

## IV. THE PRESERVATION OF BIODIVERSITY AND PHYSIOGRAPHIC FEATURES

Protected areas in the mountains have a particularly important contribution to make to the preservation of world's biodiversity (species, ecosystems and the range of variation within species) and of its many different geological and physiographic features.

Mountain areas are significant reservoirs of biodiversity, containing rich assemblages of species (and their genotypes) and of ecosystems. There are a number of reasons for this richness, among them the following:

- The isolated nature of many mountain ranges has led to the development of a high degree of local endemism.
- Mountains contain many different rocks, parent material and soils.
- Mountains are dynamic and unstable; thus many different successional stages of vegetation are present.
- Because of the small scale pattern of variability in physical conditions temperature, radiation, moisture and wind exposure, snow cover many different communities occur in a small compass.
- Because mountains are often remote, their ecosystems have been less modified by human action than those in more accessible areas.

The maintenance of biodiversity transcends the boundaries of protected areas. Many species within protected areas depend on resources outside them, and the existence of the protected area likewise affects areas outside.

Both geological and physiographical features are also richly represented in mountain areas different rock types, folding, volcanism, degrees of metamorphism, glacial features, etc. These should be preserved in their own right.

The steep environmental gradients and close proximity of different altitudinal zones have in the past allowed the migration of biota in response to climatic change. Protected areas in mountains have therefore a particular importance

for the conservation of biodiversity in view of the high probability of future climatic changes involving temperature or changes in air quality.

Peoples living in the mountains have developed many cultivars which are well adapted to local conditions and have special knowledge of the uses of local plants and animals in food and medicine. It is important that the cultivars should be preserved and that the knowledge possessed by local people should not be lost.

*The preservation of the full range of biodiversity and of physical features is an essential element in the selection of mountain protected areas. As an integral part of planning, provision should be made for the protection of large examples of natural ecosystems and of populations of plant and animal species, together with sites illustrating the principal geological and physiographic features and the processes at work in the landscape. These should be supplemented by the protection of a larger number of small areas representing the full local variety of species and ecosystems, including intraspecific genotypic variation.*

#### Guidelines

2. Areas should be selected for protection, and established as protected areas, which will, as far as possible, ensure the maintenance of all genotypes, species, and communities (ecosystems). They should encompass the full range of variation of altitude, aspect and rock type and be large enough to ensure long term viability.
3. The involvement of local people in the planning, and management of areas protected for their biological diversity is essential for their long term security, as so much of this depends upon suitable land use practices and restraint in hunting or gathering. Those people who are most directly affected by the establishment of mountain protected areas should be the first to share in their economic benefits and returns.
4. One focus for the conservation of biodiversity can be the knowledge of the indigenous mountain people, who should be given a vested interest in safeguarding biodiversity and keeping alive traditional knowledge perhaps through the registration of intellectual property rights.
5. The size and characteristics of the areas protected in mountains should be related to the needs of the plant and animal communities that they are intended to protect. In the case of large reserves, areas should be chosen to include as much internal variation as possible (aspect, altitude, soils, snow cover, etc.)

6. Wherever possible areas set aside to safeguard samples of natural ecosystems should be surrounded by buffer zones, taking advantage of physiographic and other natural protective features. These should be maintained under natural vegetation but can be used for any form of economic land use which does not interfere with the integrity of the protected area.

7. The objectives of management for such mountain protected areas should be carefully defined and adhered to. They should include maintaining part of the area completely undisturbed as a standard for comparison; but, in the remainder, use for scientific study, education and recreation should be encouraged, provided that these uses do not conflict with the primary purpose of protection.

8. Consideration must be given to the management of biological diversity in each protected area, and the course of management should be monitored to assess whether the original objectives were reasonable and the management has been successful.

9. The general policy in protected areas should be to favour natural processes; care should be taken to avoid interfering with them by introducing any major physical disturbances. Artificial fires should only be started, or natural fires put out, if there are good reasons for doing so.

10. There should be no introduction of alien species and any recently introduced species should be eliminated as soon as possible. If any alien species are already well established, their effects on biodiversity should be assessed, and eradication or control concentrated on those whose effects are significant or on areas of particular importance for their biodiversity or ecological characteristics.

11. If habitat preservation and appropriate management are not possible, genotypes and species should be preserved by cultivation or captive breeding. These methods should have the ultimate aim of reintroduction after the habitat has been restored. There should be firm linkages with botanical and zoological gardens which are experienced in the maintenance of well documented collections of indigenous mountain species.

*The conservation of biodiversity in a country should, of course, be treated as a comprehensive whole. In planning the overall development of any mountain area, provision should be made for the migration of animals and dispersal of plants between protected areas. The maintenance of biodiversity transcends the boundaries of any protected area; many species within it depend upon resources outside, and, conversely, the existence of a protected area has effects outside it.*

## Guidelines

12. When the land surrounding mountain protected areas becomes intensively used, these are left as "islands" and are very vulnerable to such external changes as fluctuations in climate. The danger of losing species can be lessened by making reserves larger and more varied, crossing a number of altitudinal belts, or by regulating land use in the areas between reserves so that migration is possible in natural corridors.

13. The management of lands within protected landscapes (Category V) which are used by local communities (for cultivation, grazing, collection of fuelwood, hunting, etc.) should be carried out in such a way that reasonable populations of wild plants and animals are maintained in them.

*The selection and continued management of areas for the preservation of biodiversity can only be effective if supported by adequate data on the distribution and status of species and ecosystems, on changes in these, and on the social and economic conditions of the people resident in protected areas. Such work is essential in order to identify gaps in coverage, new management problems and opportunities for cooperative management.*

## Guidelines

14. International, national, and local databanks should be assembled and analysed in order to identify gaps, problems, and possibilities for cooperation. These databanks should include biological, physical, ecological, and socio-economic inventories. Scientific effort should be concentrated first on those areas of survey, monitoring and management which are critical for protection.

15. Threats to biodiversity should be identified in each protected area and research that addresses these threats should be designed and implemented. Special attention should be directed to the ecology of species that have a key role in the structure and function of ecosystems.

16. The palaeoecology of protected areas should be investigated in order to determine the likely direction of future change and to identify any management action that may prove necessary.

17. Educational programmes should be developed to inform local people, the general population and decision makers of the importance of biodiversity. There should be cross-fertilisation of ideas scientists in communication with decision makers, interpreters with the public, and managers with local people. Museums and interpretation centres often provide an effective focus. These should share the story between different parks in a region and should link highlands and lowlands.

## V. TRANSFRONTIER MOUNTAIN PROTECTED AREAS

Mountain ranges have often been chosen to form the boundaries between countries or other large administrative entities. At the same time, the ecological values of mountains have also provided opportunities for the establishment of parks and other protected areas. It is not surprising, therefore, that there are now 25 transfrontier mountain parks established throughout the world by 33 countries (Thorsell and Harrison, op. cit.)

It is obvious that it is advantageous to manage such parks jointly by cross border-cooperation. The conservation benefits to be derived from border parks are reinforced by such cooperative agreements, for these also reflect the commitment of the governments concerned, functional relationships between their agencies and a degree of cultural sensitivity.

*A cooperative arrangement for the management of crossborder protected areas is essential to ensure the conservation of the continuum of natural and cultural heritage that transcends administrative boundaries.*

### Guidelines

18. Each country or state should already have, or should develop, an inventory of mountain protected areas on its borders which are matched in a neighbouring country or state. This inventory should give guidance on the circumstances where cooperative management practices would be advantageous. Shared concerns might cover, for example: the migration paths of species; water catchment protection; the management of pest species; the management of recreation; search and rescue; and nomadic human populations who regularly cross frontiers.

19. Where the boundaries of contiguous protected areas do not match, or do not include, all key physical and biological elements, boundary adjustments should be considered.

*In establishing cooperative management agreements, a fundamental principle is respect for the sovereignty of the individual countries or states in achieving mutually beneficial endeavours. Cooperative agreements now in use in several countries transcend politics and are designed so that they are voluntary and may be terminated by either party at will.*

### Guidelines

20. Transfrontier management in mountain protected areas should receive the endorsement of the highest authority in the land.

21. As soon as shared mountain border parks are recognised as areas of special importance by governments, a cooperative management agreement should be prepared. Elements of such an agreement should include:

- enhanced conservation of the natural and cultural heritage of the Transborder
- mountain protected areas;
- respect for the sovereignty of the individual governments involved;
- enhancement of cooperative research and the development of comparable
- methodologies; and
- Cooperation which is equitable, mutually beneficial and responsible.

22. The commitment to joint management may be achieved by: initial discussions between the appropriate authorities; a brief agreement on protocol (34 pages) and a more detailed, comprehensive operational statement.

23. The cooperative management agreement should identify: the management groups responsible for the agreement and their key objectives; the principles governing the allocation of resources; and arrangements for monitoring performance.

*Cooperative management will be effective where there is active and sustained management on the ground which leads to an improvement in the conservation status of the natural and cultural heritage.*

### **Guidelines**

24. Once the administrative group responsible for implementing the cooperative management agreement has been established, one of its first tasks is to prepare a work plan. This could

Include:

- joint consultation by the respective agencies on planning for the protected area;
- Transborder law enforcement (including the potential for cooperatively developed legal agreements to assist in anti-poaching);

- Joint arrangements for water catchment management, pest species control, search and rescue, fire management, wildlife disease prevention, species management and other operational matters.

25. There should be joint consideration of the provision of facilities and information to visitors, in public education programmes and in marketing.

26. Scientific research and monitoring of mountain protected areas are essential prerequisites for the improved management of those protected areas.

27. The effectiveness of conservation can be increased by making cooperative arrangements for research and by the sharing of research skills, facilities and data.

28. Public support for the concept of Transborder mountain protected areas can be fostered by providing information to the public and by the appropriate involvement of politicians, advisory groups, local authorities, and those with an economic interest in the areas in question.

*The international cooperation evidenced by the setting up of Transborder mountain protected areas should be extended, in appropriate instances, by associating these with the World Heritage Convention and the Biosphere Reserve Programme.*

### **Guideline**

29. Countries are encouraged to propose suitable mountain protected areas for nomination to the World Heritage List or as Biosphere Reserves and, especially, to consider joint nominations with other countries.

## **VI. THE RELIGIOUS AND CULTURAL SIGNIFICANCE OF MOUNTAINS**

*Many mountains have a metaphysical significance which involves sacredness, fear, ceremony and mystique. This already gives them some degree of protection. The managers, planners and interpreters of mountain protected areas should take account of the opportunities and problems presented by this special spiritual and cultural aura.*

Many areas can be chosen as illustrations:

- From two to four per cent of the Yunnan prefecture of Xishuanbanna in China lies in "holy hills" where the spirits of ancestors of the Dai people dwell, and these mountain forests are largely intact because of the reverence in which they are held.

- Part of the central range of mountains of Venezuela is "la Sorte de Maria Lionza" or the sacred place of the Queen Maria Lionza, goddess of nature, who will enhance the welfare of the people provided that they do not enter the "Sorte", in which case they will first become lost and later die. (It was easy to afford this protected area status.)
- Highland dwellers in Tibet dispose of dead bodies by feeding the body to vultures in a "sky burial" at special sites. If this were not done, cremation would require large amounts of fuel resulting either in depletion of scarce resources of wood or in the use of fragile cushion plants dug from the steep slopes.
- The volcanic fire of Tongariro (New Zealand) was lit by the gods to warm Ngatoroirangi, ancestor of the present day Ngati Tuwharetoa tribe. The mountain in turn was itself regarded as an ancestor. Recognition of these special values has limited the expansion of facilities on the upper mountain slopes of the park.
- Tarns like Suraj Khundin the Kumaon Himalaya and many of the Bhadeli Guars (the highest alpine pastures) are regarded as sacred gardens of the gods; shepherds believe that trespassing in these holy places would have dire consequences to them, and hence never graze their sheep in these areas.
- Gauri Shanker peak in Nepal depicts the lord Shankar and his consort Gauri in Hindu religion; this peak is sacred and no mountaineering is permitted. This has resulted in a mountain and adjoining valleys which are clean and free of refuse.
- In Hawaii, the volcano goddess Pele, creator and destroyer by her lava flows, is both feared and loved. Now, within Hawaii Volcanoes National Park, fear of Pele's bad luck reduces the removal of lava for souvenirs and the desecration of natural or cultural sites.
- "The Sacred Valley" between Cuzco and Ollantai Tambo in Peru was once devoted to the crops used to feed the Inca warriors, while the cliffs were used for burial crypts for those of high rank in the Inca king's court. The place gave, and still gives, some protection to the soils, wild flora, and Andean crops.

In addition, there is an aura of spirituality in many mountain physical features rocks, caves, summits, flora, springs, and celestial conditions.

This special significance provides an opportunity for some form of protected area designation including that of protected landscape or biosphere reserve, taking advantage of the protection already afforded by these values. In such

instances, the paramount responsibility should be to protect and respect the "spirit of place". This may require special management measures.

The people whose spiritual and cultural values are at stake must have complete confidence in those responsible for stewardship of the protected area. This sense of trust must be carefully fostered and maintained. Those responsible for management should seek guidance from the people who hold the belief system before acting.

The landscapes in areas of cultural and spiritual significance have usually evolved through long interaction between people and nature. Because any alteration of the landscape may change the "spirit of place", great care should be taken to preserve the authentic landscape setting.

Areas of cultural and spiritual significance are much more complex than other protected areas, because their qualities are not only physical and biological, but also include the metaphysical. As their management requires skills in dealing not only with the natural environment but also with the cultural and spiritual aspects of the area, there is a strong case for selecting management staff primarily from the local people and giving them the necessary training to deal with the usual aspects of management.

*Where mountain areas are of special religious and cultural significance, they should be included in protected areas wherever possible, and precedence in protection and management should be given to the sacred or ceremonial values. Management should be based on full consultation and collaboration with the people to whom the area is sacred, and a proportion of the benefit of any visitor income should return to them.*

### **Guideline**

30. Mountain managers should consult with the people of the place and establish consultative mechanisms with them to ensure a cooperative approach to handling the opportunities and possible conflicts resulting from the presence of sacred sites in mountain protected areas. Management plans should be developed in collaboration with local people.

*Many of these sacred areas are also places of pilgrimage. Everything must be done to maintain their sacred character and to avoid detracting from the spiritual experience of those on pilgrimage to them.*

### **Guidelines**

31. Places of cultural and spiritual significance, especially sites of pilgrimage, usually require development of some infrastructure. Any new structures must

be carefully designed to integrate harmoniously with the natural and cultural environment.

32. These places attract many users, often including tour operators who may make profits from visitors. Arrangements should be made to ensure that a reasonable proportion of the profits return to the local population through local spending or through investment in, for example, health and education.

33. Special measures may be needed at sites of pilgrimage to reconcile the number of visitors with the quality of their experience and to provide for sightseeing by tourists without upsetting the pilgrims.

34. Where there are great numbers of pilgrims, as, for example, at Kedarnath in the Indian Himalaya, the carrying capacity of the site should be assessed in terms of possible pollution, site deterioration and overloading of existing facilities. An attempt should be made to predict future numbers, in order that adequate, environmentally sound facilities may be provided in good time.

35. If there is a danger of overuse, it may be necessary to design an equitable system to limit access, such as areas in which visitors are strictly controlled or from which tourists are excluded.

36. Sites of metaphysical importance are often also of great significance for their natural features, both physical and biological. Excessive use (for example, of trails or ceremonial plants) often leads to damage to physical or biological features. The same measures should be applied in sacred places as are recommended for the conservation of nature in other protected areas (see Sections IV and X).

37. To enhance the natural values and to avoid conflicts with cultural values, it may be necessary to establish sets of both ethical and practical rules to be followed equally by users and managers. Protected area managers and the tourism industry should, therefore, develop culturally sensitive codes of conduct for visitors and make them available through publications and display boards.

*Mountains with cultural and spiritual significance are often the roots of indigenous cultures and contain monuments and artifacts of great importance. While there is a legitimate desire among scholars to study these, there should be an absolute prohibition on the unauthorized disturbance of sites, the removal of artifacts or any vandalism.*

## **Guidelines**

38. There should on no account be any desecration of sites through destruction or unauthorized removal of sacred artifacts. Regulations should be promulgated

and enforced, and codes of behaviour drawn up, governing all research. These would clearly define the general prohibition on the disturbance of artifacts and the special conditions under which licences might be granted for the collection of specimens.

39. Stringent conditions should also govern the trading and taking as souvenirs of artifacts or scientific specimens. The managers of mountain parks should keep an inventory of archaeological, historical and sacred objects and provide adequate control to ensure that they are not removed, damaged or defaced.

40. Any display and promotional sales of souvenirs depicting sacred qualities of the site should be done with discretion and sensitivity.

*The interpretation of sacred sites must be particularly sensitive. For many of the world's people, religions are based on nature gods and goddesses that provide an overriding system of order a cosmos which includes all environments from mountains to the seas: "spirituality" is considered to be inherent in all natural things. Such an approach may provide a broad framework in which may fit the specifics of particular sites.*

### **Guidelines**

41. Interpretive policies and programmes should be designed to present metaphysical and cultural values in mountain protected areas in a manner that respects local beliefs, and also informs visitors by encouraging them to act in a sensitive manner towards the beliefs of others.

42. Interpretation in such sites should be carried out by custodians who are repositories of the local values and beliefs.

43. Myth must be interpreted with great care to avoid the extremes either of glorification or belittlement.

## **VII. MOUNTAIN PROTECTED AREAS AND THE CULTURAL AND ECONOMIC LIFE OF THE COMMUNITIES IN THEM**

Many present or proposed protected areas in the mountains contain people, few in some, many in others. The communities range from self-sufficient tribal peoples with a subsistence economy, through those that are to some extent reliant on resources from outside, to groups which are more or less fully integrated into the market economy and the broader national society.

Very few, if any, of these communities are not influenced to some extent by the world outside and this influence is bound to increase, through improved access and communications, health care, education, new technology, visitors from outside, and the return of local people who have seen other places. The

issue is, rather, how should they change in what ways and how fast. The improved communications which are an essential element of development can in time lead to out migration (especially of the young) and a break down of the social fabric. Mountain protected areas can provide a legal and administrative framework within which communities may develop in an appropriate and controlled manner, while maintaining essential elements of their special cultures.

At the same time, mountain protected areas can provide a framework for the enjoyment of nature and landscape which, in many countries, is an important factor in attracting public and government

*Mountain protected areas which contain people may aim to protect not only natural features but also the essential elements of the cultural landscape, archaeological and historical monuments and vernacular buildings. It should provide a framework in which this can be done by encouraging sympathetic economic development which preserves the cultural identity of the resident communities living in or near the protected area.*

### **Guidelines**

44. Protected areas in the mountains should be planned and managed in accordance with the above principles and with full participation by local communities.

45. There should be a full recognition of the right of any mountain community to define its own identity and cultural values. The community should be assisted in its efforts to maintain cultural practices which are threatened by migration, tourism, resource exploitation and any culturally insensitive development.

46. The community should, equally, be provided with assistance in social and economic development within the framework of the overall objectives of the protected area. The management of the protected area should play an active part in supporting local development.

47. Communities should be assisted in their attempts to cope with any disruption to their culture and identities originating from outside influences. This may be done by providing support in ways that are consistent with the above principles.

Grazing is allowed in a portion of the Lanin National Park and Reserve, Argentina.

48. Policies and programmes should be developed for mountain tourism which encourage mutual understanding, respect and cultural sensitivity between

mountain people and their guests, and which recognise the rights of local communities to have a voice in regulating the scale and nature of tourism in their homelands.

49. There should be an analysis of potential harm that might be caused to the culture or economy by the establishment of the protected area, and measures should be included in the management plan to mitigate these.

50. There is need for a mechanism whereby local communities continue to be involved in both planning and management.

51. The management plan for any mountain protected area should include (in addition to the normal conservation component) the following:

Provision for a co-management structure which enables the representation of the community in decision-making bodies;

- a mechanism for monitoring, review and updating;
- a mechanism for continuing participation of the community in this process;
- a formal mechanism for integrating policy coordination and decision-making;
- a plan for the protection of all elements of the local culture, its documentation and appropriate interpretation;
- a mechanism for discussion and exchange of information between the protected area staff and the community on any matters affecting either of them, including cultural changes, the effects of tourism and ways to incorporate traditional knowledge in the management of the protected area; and
- a plan which provides for appropriate benefits to the community from the establishment of the protected area(5);
- A plan for financing and support.

## **VIII. THE OWNERS OR USERS OF LAND WITHIN MOUNTAIN PROTECTED AREAS**

Mountains are regions of exceptional cultural diversity. They are the homes of numerous indigenous peoples and of local populations who have often lived there for generations. Their ways of life are often unique. Mountain peoples in many parts of the world have long lived in relative isolation from urban civilizations and lowland market economies. Their ways of life are distinctive

adaptations to the high risk environments of mountains. They are based on profound knowledge of the great micro environmental diversity which is unique to mountain regions, and typically exploit the seasonal resources of a range of different ecosystems. Mountain peoples are, moreover, the custodians of a rich storehouse of crop and livestock varieties which have been locally developed and maintained and which are now a vital world resource.

Today, however, mountain areas are undergoing rapid cultural, economic, and environmental change caused by better transport and communications, greater integration with lowland and international economies, growth of population and the development of tourism. Moreover, the structure of communities is often changing because, in some places, of out migration to lowland urban centres and, in others, from an influx of new residents.

The involvement of local people in the planning and management of natural resources is now widely recognised as critical to conservation and development. This recognition must be an integral part of the goals for mountain protected areas; without it, mountain protected areas will in most cases fail, for they may not be able to maintain the natural and aesthetic values which are the fundamental reasons for their existence.

Mountain protected areas are among the few places in the world where indigenous peoples continue to practice long-established ways of life and where later settlers continue to maintain generations old patterns of traditional land use. This local knowledge is an invaluable asset for the better planning and management of mountain protected areas.

Local peoples and their knowledge play a central role in the maintenance of valued landscapes which have been created and sustained by longstanding local land use and land management practices. The ways of life of mountain peoples living within and adjacent to mountain protected areas can thus offer models for the successful balancing of people and environment in mountain lands elsewhere.

Mountain protected areas and their local residents provide conservation benefits critical to promoting conservation for development both in the mountains themselves and at lower altitudes. They often establish a local constituency of great importance for the continued protection of the region.

The benefits of mountain protected areas for local peoples are diverse and fundamental. The protection they afford can maintain resource and subsistence rights, cultural integrity and environmental quality. The establishment of a protected area may also safeguard local communities from exploitation or insensitive treatment by outside interests. Such protected areas can support culturally and ecologically sound economic activity inside or outside their boundaries.

*Although the overriding goal for mountain protected areas should be nature and water conservation and the maintenance of landscapes, an essential and integral part of this goal must be recognition that the knowledge, rights, lifestyles and cultural values of people living in and near mountain protected areas, including identity grounded in places, must be integral to the goals of mountain protected areas.*

## **Guidelines**

52. Mountain protected area planning and management must include the perspectives and continuing involvement of local people in all phases. Those people most directly affected should share in the benefits flowing from the establishment and operation of mountain protected areas.

53. The plans for any protected area, and its establishment and management, should be set in a framework which includes:

- local participation in planning (initial discussion of concepts, the identification of
- objectives, the setting of management goals, decisions about the appropriate protected
- area designation, internal zoning and boundaries);
  
- a recognition of the key role of women in mountain societies and the need to ensure
- that they are involved;
  
- setting the mountain protected area and its buffer zones in the regional planning
- context;
  
- the encouragement of grassroots discussion and support;
  
- flexible mechanisms for continuing consultation and involvement; and
  
- Periodic review, evaluation and revision.

54. There should be an initial assessment of resources and their uses by local people, the rights of ownership and use of land, and kinds and effectiveness of local organizations.

55. Boundaries need to be demarcated in a way which provides for an equitable sharing of rights between those inside and outside of them.

1. Discussions should be held with local people using culturally acceptable channels of communication, while trying to ensure that all groups are heard. It is important to build an atmosphere of mutual confidence.

57. Park planners and staff should be trained in the skills of communication and in local languages to enable them to be more responsive to the needs, ways of life, and cultures of local peoples. Staff should contain some members recruited from local communities.

58. Training courses are needed for local people and staff, in order to share traditional knowledge, increase mutual understanding and profit from all possible linkages between local knowledge and western science.

59. Communication between managers, policy makers, planners and the media usually needs improvement; and all these people should be sensitised about local values, ways of life, and the need for local participation.

60. Encouragement should be given to local leaders, advocates, and those who can facilitate and implement the management of protected areas.

61. Obligatory arrangements for consultation and joint planning should be instituted. These may take account not only of the views of local communities but also of relevant and representative regional or national interest groups. Mutually acceptable mechanisms should be established for the resolution of any conflicts and disputes. Such cooperative and consultative mechanisms should include all interests.

## **IX. WATER AND SOIL CONSERVATION IN MOUNTAIN PROTECTED AREAS**

The provision and safeguarding of sufficient safe, high quality water in mountain protected areas is necessary to accommodate visitors as well as to sustain mountain inhabitants within the protected area. Sanitation measures are also necessary for visitors and residents alike in order to safeguard water supplies both within and downstream from the protected area.

The quality and total yield, and, to some extent, the timing of water delivered to the lowlands and its communities is influenced by land use in the mountain headwaters of the catchments. Undisturbed natural vegetation represents a status quo condition for delivery in quantity, timing and quality, to which the downstream environment and society have become adjusted. The alteration of vegetation through human activity and changed land use usually increases erosion and thus water transported sediment. Heavy sediment loads and deposition have a host of consequences, most of them causing harm to aquatic life and the human use of water, and causing flooding, changes in the stream and river regime, and ultimately the marine environment. Quantity and timing are also changed, and therefore environments and life, both human and wild,

must adjust; this often entails some cost, such as less total water, more total water, or seasonal changes in quality. Human use which adds fertilizers, pesticides or other wastes also creates problems and contributes to environmental change downstream.

The degree of adverse change downstream depends on the practices of the users of mountain land, on the size of the water catchment and its geomorphic characteristics. There will be substantial effects in small catchments (up to 5000 ha) which are close to the place where the land has been altered, less effect for larger catchments, and least in large river basins such as the Ganges caused by activities in its Himalayan headwaters. The effects will be more pronounced in smaller, more frequent storm events, and very much reduced in the case of infrequent major storms.

*Those mountain protected areas where human impacts are largely excluded, or are controlled both inside their core and in their buffer zones, represent the very best option for soil and water conservation. Mountain "cloud forests" are especially important for their capture of "occult" or horizontal precipitation which can provide a significant addition to the water budget of the catchment.*

## **Guidelines**

62. Protected area management must provide safe, high quality water to visitors. Source areas should be identified and protected from other developments that would impair the quantity or quality of the water. Particular attention should be paid to groundwater sources and to maintaining mountain springs for use in more remote areas or piping to lower elevations.

63. "Cloud forests" on mountains are valuable for their capture of occult water which is significant for water recharge and yield both locally and downstream. They are also a habitat for plants and animals that occur nowhere else. Because the clearing of these forests is increasing worldwide, especially on isolated mountains, these "water towers" and repositories of biodiversity are seriously threatened. Whenever found, they should command special attention, either for the possible establishment of a protected area or, if already within one, for special protective measures.

64. Where good water sources can be developed, those who are responsible for the planning and management of the protected area should consider the provision of water to inhabitants or bordering communities as part of a partnership in assigning benefits to local people (who have usually foregone some utilisation of resources in the protected areas).

*While the full direct and indirect effects of protection on downstream water are quite site specific and not yet clearly understood, this much is certain: protected areas provide the greatest hydrologic and erosional safety in these*

*steep lands. The inhabitants of the populous lowlands might well value them for this reason alone. Protection of the natural condition is effective in minimising erosion at lowest cost and with the maintenance of the highest scenic value. It thereby keeps sedimentation damage to a minimum and reduces impairment of water quality both very important downstream benefit is to aquatic life, reservoirs, turbines and people.*

65. In all IUCN categories of protected areas, steep lands should be examined to see what part they play as hazards for landslips or surface erosion, in water collection or as sources of overland flow. These should be zoned in management plans so that use is strictly prohibited or, if allowed, is associated with strong conservation measures.

66. Mountain protected area managers should emphasise the protective role of their areas for soil and water conservation benefits to those downstream within and outside the reserve. On the other hand, managers should refrain from making large claims for flood disaster control in the distant lowlands of major rivers. Nevertheless, benefit can be substantial in reducing damage caused by those frequent small storms close to the protected area which can still harm many people.

67. Where forests are being harvested within mountain protected areas, logging guidelines that have been developed to minimise adverse soil and water consequences should be rigorously applied.

68. Where agriculture or grazing are carried out within mountain protected areas, measures should be taken to prevent the breakdown of traditional farming systems which have often been, by necessity and long adaptation, very conservative of soil and water. Where pressures have already led to a breakdown and the site has deteriorated, every effort should be made to rehabilitate the land and to encourage, by education, incentives or even sanctions, the reinstatement of well-known soil and water conservation practices. Assistance with water supply can be a positive inducement.

69. There are many techniques, using both vegetation and structures, for stabilising already eroded areas, and persistent sediment sources must be treated as part of protected area management.

70. All bridges, ditches, culverts and fords associated with roads need to be carefully designed, installed and maintained, based on the best available hydrologic information, with the addition of a safety factor made necessary because of the general inadequacy of data on rainfall and runoff from these remote areas.

71. Microhydroelectric development is often looked upon as a solution to the energy problem in mountain protected areas. Such developments must be very

carefully planned, sited and maintained, not only from a hydrological standpoint but also from an aesthetic one.

72. Waste disposal of any sort must be kept away from surface water supplies, whether used in the protected area or further downstream. Groundwater contamination must also be avoided by the proper disposal of waste.

## **X. MANAGEMENT TO MINIMISE PHYSICAL AND BIOLOGICAL DAMAGE**

The uses of mountain areas by residents and by visitors are bound to change the direction and intensity of natural processes. Those responsible for the management of a protected area must decide how far such changes are consistent with the defined objectives of protection; in fact, what the limits are of acceptable change.

Research may be needed to determine these limits. Some of the limits will be related to physical "carrying capacity" how much the environment can bear without irreversible damage. Others will be concerned with what is socially acceptable, either to the residents or to the visitors. Research may, therefore, have to encompass not only the natural history and ecology of the area but also the attitudes, preferences and perceptions of people.

Alternatively, management itself may be used as a tool of research, the effects of any decision being monitored and correction being applied if the changes appear to be going too far.

All (residents, visitors and managers) will benefit from the better understanding of the systems with which they are working. Those responsible for management have a vital role to play in interpreting and explaining what they are doing, and why, to local people and visitors alike. Their training must fit them for this.

The guidelines which follow deal in turn with: fire; trampling and other physical damage to vegetation and soils; pollution and waste disposal; alien organisms; the dispersal of plant and animal pathogens; the use of fuelwood; hunting; construction; grazing; and traditional uses of resources.

### **FIRE**

Mountains tend to have higher concentrations of fire sensitive ecosystems than adjacent lowlands. Nevertheless, mountain ecosystems vary enormously in their fire sensitivity, from the sensitive coniferous heaths of Tasmania that can be destroyed forever by a single burn, to the tussock grasslands of New Zealand which require burning for maintenance. Some mountains have a high natural fire incidence (e.g. the San Bernadino Mountains, USA), while in others (e.g. the mountains of Taiwan) it is low. Some mountains may have frequent natural

sources of ignition but nonflammable vegetation. If mountain vegetation is both flammable and fire sensitive, tourists and residents may alter the fire regime to an extent that imperils biodiversity.

Because of the influence of topography on local climate and on the behaviour of fires, it can be very difficult to predict the intensity and rate of spread of fires in mountains; thus both prescribed burning and the suppression of wild fires may be very hazardous and difficult. Under extreme weather conditions entire protected areas may be burnt by wildfires in a matter of hours (e.g. 140,000 ha in 810 hours in South Western Australia).

Where mountain protected areas are totally surrounded by cleared land recolonisation by native plants and animals from outside the burn area may not be possible.

The ideal fire regime is one that allows the maintenance of all elements of biodiversity in a mountain area. This may require planned fires in some areas and regular fire suppression in others. High winds in mountain and steep slope updrafts present great difficulties for fire suppression.

#### Guidelines (6)

73. The following actions should be taken in relation to fire:

- Open fires should be totally excluded or only permitted in periods when there is no fire danger and then confined to constructed fireplaces.
- In remote areas fuel stoves alone should be used.
- In high danger periods remote areas should be closed or there should be a total ban on fires.
- The highest priority for the suppression of wildfires will depend upon local conditions, fire laws, predicted weather and resources available. Human life has the highest priority. As a general principle, biological priorities should, wherever possible, protect special habitats and particularly fire sensitive ecosystems.
- In protected areas which include fire sensitive ecosystems, fire management plans are essential. These should specify areas that should or should not be burnt, identified by knowledge about the ecology and dynamics of the ecosystems in Lion
- There should be adequate training, equipment and funding to provide for the management and suppression of fires.

## TRAMPLING AND OTHER PHYSICAL DAMAGE TO VEGETATION AND SOILS

Walking, trekking and mountaineering are major uses of mountain protected areas. There are many fragile ecosystems on mountains, some containing rare species, which can readily be damaged by trampling; natural recovery is usually very slow. Some mountain soils, too, such as peats and volcanic ash, are highly susceptible to damage caused by trampling. This may lead to a serious alteration of the natural drainage with resulting soil erosion. The effects are often irreversible.

Management to reduce trampling is usually difficult to enforce, while maintenance or repair is labour intensive and costly, especially in remote areas and at high altitudes.

Some protected areas contain ski resorts. Developments associated with these can cause serious harm by the disturbance of habitats, unsightly structures, pollution of streams and soil erosion. The disturbance of soil may provide an opportunity for invasion by alien species.

Peaks which are famous in mountaineering circles are a great attraction to climbers and the summits and trails or routes to them are especially vulnerable.

*As it is impossible to prevent all damage, it must be decided whether to disperse use or to concentrate it along defined corridors such as footpaths, bridle trails, roads or designated ski runs. Prevention is better than cure.*

### Guidelines

74. The impacts of trampling, climbing and similar damage should be monitored and quick action taken to intervene when necessary.

75. Data derived from research and monitoring should be used to decide on the relative value of dispersed versus concentrated use.

76. Durable natural surfaces should be used wherever possible.

77. A conscious effort should be made to locate and eradicate any alien species becoming established in areas disturbed by trampling or rehabilitation works.

78. As a general principle, the use of off-road vehicles (including motorised trail bikes and mountain push bikes) should be discouraged in protected areas in the mountains unless specifically provided for in approved management plans.

79. Downhill ski facilities require careful management based on a thorough knowledge of the physical and biological values of the area, clear and tough guidelines on the limits of acceptable change, and supervision of developments to minimise visual and physical impacts.

## **POLLUTION AND WASTE DISPOSAL**

Visitors and residents generate wastes, rubbish and excrete. Mountain areas vary enormously in their capacity to absorb these but, in general, their capacity is lower than most other environments. On fertile and warm mountains decomposition and oxidation are rapid, while on cold and infertile mountains plastics and cans may become almost permanent. Some well-known summits have major refuse problems. The nitrogen in urine and food waste may encourage the invasion of alien plants. Burial of waste may pollute groundwater and streams. The ideal would be to export all solid wastes and to deal with all liquids in ways that cause least harm. Summits of famous mountains and the routes to them are particular problem areas for litter.

### **Guidelines**

80. "Pack it in, pack it out" rule should be implemented by education and enforcement.

81. The disposal of rubbish outside the protected area should be encouraged in all possible ways; such as the establishment of designated dumping sites at road heads outside the protected area, or the levying of a deposit refundable on leaving the area.

82. Toilets should be provided in areas where people are concentrated. Waste should be removed or treated so that it is environmentally safe.

83. Rules about human wastes should be instituted and enforced in remote areas in order to minimise environmental damage and the risk of disease.

84. Careful thought should be given to methods for the safe disposal of waste which are appropriate to each set of local conditions. The public needs to be educated in the importance of adhering to these.

## **ALIEN ORGANISMS**

Because mountains are essentially island habitats, they are often highly susceptible to harm from introduced organisms. The risk is enhanced because of the high proportion of disturbed ground (from both natural and human causes) and the low growth rates of plant communities, at least within the sub-alpine and alpine zones. Some mountains appear to be more susceptible than others; mountains on oceanic islands are particularly so.

There are a number of sources: tourists may unwittingly introduce species on their boots, clothes, person, vehicles or packs; visitors often wish to bring pets into mountain protected areas; and local people may wish to introduce new animals, crops or ornamentals.

*The ideal would be the outlawing of all further introductions of alien species, and the elimination (or at least stringent control) of any newly introduced species.*

### **Guidelines**

85. Visitor education about impacts of alien species is critical.

86. There should be an insistence on visitor hygiene in relation to introduced species, including the cleaning of boots, clothes and equipment.

87. There may need to be restrictions on the use of potential vectors such as horses and vehicles.

88. The introduction of any plant and animal species or cultivars that might become invasive should, in general, be prohibited. Any proposed introduction should be subject to strict screening, even where private land is involved, in protected areas or their buffer zones.

89. There should be control or, if possible, eradication of introduced taxa that significantly threaten the values of protected areas in the mountains.

### **DISPERSAL OF PLANT OR ANIMAL PATHOGENS**

*The establishment of pathogens in a mountain area may have serious wider implications because of their tendency to spread rapidly downhill. Some may cause permanent damage to plant and animal communities, irreversible changes to habitat and considerable human inconvenience; examples of organisms causing widespread damage are Giardia and Phytophthora cinnamomi. It is evident that different mountain regions are susceptible to damage by different pathogens and site-specific measures must be taken to counter them. Where there are established centres of infection within or close to the mountain protected area some stringent guidelines apply.*

### **Guidelines**

90. Hygiene is important at all times: cleaning of boots, brushing down of clothes and cleaning, of tools and machines.

91. It is important that people should move as little as possible in and out of infected areas. Entry to areas of high conservation value or uninfected catchment areas should be restricted.

92. Access routes and facilities (roads, tracks, paths, campsites, etc.) should be designed and maintained so as to minimise the risk of further spread (e.g. dry, free-drained surfaces for footpaths, campsites away from surface water, etc.)

93. Accurate monitoring and mapping of infections and spread is essential but may be complicated because of a "lag phase" in detection.

### **USE OF FUELWOOD**

The use of wood for cooking, heating or campfires is traditional for those who live in the mountains and can be an important part of the experience of visitors. It may be the only feasible source of fuel. In many places increased trekking and camping near the tree line has resulted in serious damage to woody vegetation.

*Fuelwood is renewable if cut and used carefully, thus ensuring the conservation of forest and shrub communities, the protection of mountain soils and the continued provision of fuel.*

#### **Guidelines**

94. Fuel should be taken only by the harvesting of dead wood; the cutting of green native trees and shrubs should be prohibited.

95. As a wood conservation measure, it is best to cut fuelwood by saw rather than by axe.

96. Plantations of indigenous species should be actively encouraged and a fuelwood tax should be levied, where appropriate, to provide funds for fuelwood plantations.

97. Alternative cooking or heating arrangements should be encouraged, such as kerosene stoves, solar heating or rural electrification. Where this is not feasible, use of more efficient wood stoves should be encouraged within of near mountain protected areas.

d areas.

### **HUNTING**

Mountainous protected areas often contain animals that are confined to them or provide refuges for others which were once common in the lowlands but are

now rare or endangered. Many of these animals still have great appeal to trophy hunters and can bring needed revenues to local communities. Hunting may be permissible if numbers killed can be sustained, but must be forbidden if they cannot be sustained. Resident traditional peoples may have long standing cultural harvesting rights.

In some mountainous countries (e.g. New Zealand, Hawaii) there are high populations of alien animals such as deer, chamois, thar, pigs, goats and hares which are a serious threat to the stability of protected areas because they have no natural predators and are destroying vegetation that has evolved in the absence of browsing mammals. Hunting by local people or by visitors can be an important method of control and may even generate revenue which may be used for further control. Even native wild animals, where their predators have been reduced, may require a hunting regime if they are to be prevented from damaging their habitat by exceeding its carrying capacity.

*The ideal would be to eliminate hunting of indigenous animals except for sustainable harvesting by resident mountain peoples and to encourage the hunting of alien wildlife pests to supplement control by the management agency.*

### **Guidelines**

98. The hunting of indigenous animals should be forbidden in most protected areas except where resident mountain people have traditional hunting rights. It should be subject to monitoring and licence, so that the level of culling remains sustainable. There may be rare instances where controlled hunting is needed to prevent habitat damage by species which have lost natural predators.

99. The hunting of alien animals which have become pests should be encouraged in protected areas where the management plan so stipulates.

### **CONSTRUCTION**

Some new construction may be required from time to time either to repair damage or to meet the objectives of the management plan. There is a high risk of causing harm in such ecologically fragile and highly aesthetic mountain environments.

*In general there should be as little new construction as possible and, where it is essential, the greatest possible use should be made of local material and "mountain" styles.*

## **Guidelines**

100. New construction should be avoided except where it is provided for in the management plan.

101. If any construction is approved, its design and structure should accord with an environmental statement presented as an integral part of the procedure for approval. It should blend as much as possible with the natural mountain environment and traditional structures.

102. Actions should be taken to mitigate any adverse effects of construction, both physical and aesthetic.

103. Any construction which is approved should be monitored by an environmental expert with the legal authority to provide appropriate environmental controls.

104. A contract for construction should be approved only if it includes a performance bond to correct and repair any works which do not conform to the design.

105. Any construction which is approved should be the least intrusive to achieve the desired result.

## **GRAZING**

Many mountain areas, such as Tibet, have been used for transhumant stock grazing for many centuries, while others, such as the Australian Alps, have experienced stock grazing for less than two centuries. Overgrazing may eliminate plant species and cause accelerated erosion. Trees and shrubs may be lopped to provide fodder. Stock may hybridise with local species. Domestic animals can bare the ground in places where they concentrate and drain bogs in their passage to water. They often disperse alien plants and provide suitable sites for their establishment. They may compete with wild indigenous grazing or browsing animals.

Conversely, stock grazing may, by reducing the biomass of the dominant plants, allow the survival of small herbs. There are many mountain ecosystems deserving perpetuation that have developed as a result of traditional grazing practices. Native grazing animals may cause environmental damage in situations where their numbers are kept artificially high by tourist activities. (For example, wallaby feeding at Cradle Mountain National Park in Tasmania may have contributed to the loss of several rare daisies in the natural grassland near their feeding area.)

*The ideal pattern of stock grazing would maintain biodiversity and soil quality, be restricted to the buffer or support zone of the protected area, and only involve long-established traditional practices of resident indigenes. The ideal, in the case of native grazing animals, would be to support population levels that most benefit the maintenance of natural ecosystems, hydrological security and biodiversity.*

### **Guidelines**

106. There should be no stock grazing in the core zones of large protected areas or in parts in which selective grazing and the introduction of aliens will damage biodiversity.

107. Stock grazing should be sustainable. It should generally be permitted to resident indigenes and to others if used as a tool of management to maintain either biodiversity or the character of cultural landscapes. Research and monitoring should be carried out to determine carrying capacity and biological effects.

108. Where possible, stock should be indigenous.

109. In many cases, stall feeding is preferable to free range grazing. These cases need to be sought out and encouraged.

110. There should be no feeding of native animals by or for tourists.

### **TRADITIONAL USE OF PLANT RESOURCES**

Mountains provide many resources that have been traditionally harvested and used by people. Examples include timber, fuelwood, bamboo, herbs, flowers, essential oils, and ceremonial, medicinal and edible plants. While many of these are thought to have been harvested for centuries without damage, increasing markets and hence overexploitation can rapidly lead to degradation.

*Considerable benefits can accrue to resident local communities through industries based on indigenous resources, provided that these are managed sustainably.*

### **Guidelines**

111. The traditional and sustainable use of resources should be permitted in protected areas with "sustainability" determined for each product by research supported by the administration of the protected area. Areas for harvesting should be controlled through the zonation determined in the management plan.

112. Local community development should be promoted and encouragement should be given to income generating work related to the traditional use of resources, such as crafts (e.g. baskets, furniture) and medicinal herbs. Assistance in marketing and access to credit should be provided.

113. Activities should be assessed which may cause degradation (such as slash and burn agriculture), and alternatives investigated. Assistance should be provided to improve productivity, but expansion into pristine areas should not be allowed.

114. The collection of wood for fuel, where this is allowed, should be from dead trees. The harvesting of living trees and shrubs should only be permitted if it is shown to be sustainable, and then only in designated areas.

## **SCENERY**

The effects of human activity in mountains (tracks, buildings, litter) are often highly visible and long lasting. The value of mountains as special places prized for their beauty, peace and solitude can be seriously compromised by uses or structures that are inappropriate, badly designed or poorly sited.

*Facilities should be blended harmoniously into the physical and cultural landscape.*

## **Guidelines**

115. Facilities should be appropriately designed and sited, built of natural materials and in harmony with indigenous mountain styles.

116. There is a need to assess the balance of advantage between techniques of protection (e.g. boardwalks) and the visual intrusion they cause.

117. Wherever possible, the placing of structures on skylines should be avoided, except where these are important for safety (e.g. mountain huts).

118. Wherever possible, accommodation should be provided below the treeline

119 The sides of new tracks and access roads should be planted with indigenous species.

120. If a structure is no longer required, it should be removed promptly.

121. The effectiveness of design, siting and construction should be assessed by asking the opinion of visitors.

## XI. MANAGEMENT FOR VISITORS' HEALTH, SAFETY AND ENJOYMENT

Visitors have long been attracted to mountains as places of natural wonder. Increasingly in urbanised societies people have need to escape to wild natural landscapes where solitude and freedom of action can be experienced and where there is opportunity for challenge and exposure to danger and, through this, self-development. Mountains are not the only environment where these recreational values can be enjoyed but they are preeminent among such places.

However, mountains are very vulnerable to the impacts of recreation. Habitats are often fragile and of high nature conservation value. Hence recreation in mountain protected areas needs to be managed so that the special values of these areas are not put at risk. There are many hazards in mountains and managers have a duty to see that human life is not needlessly endangered, although a careful balance has to be struck so as not to devalue the experience.

*There can be much mutual support between the interests of those who appreciate mountains and take their recreation in them and those whose concern is conservation. Recreational users can be prime advocates and allies for conservation. In turn, visitors to mountain protected areas have a responsibility to exercise care in the way in which they behave, in the interests of both the protection of the resource and the sensitivity of local communities.*

*The managers of visitation in mountain protected areas can build on an alliance between users' interests and their own aims; the contribution made by visitors to rural economies is an important element. A sensitive approach to recreational values is required an approach which recognises the varied needs, aspirations and skills of visitors.*

*Depending on the values for which the area was dedicated, recreation may or may not be the dominant factor in management plans (e.g. where sacred sites are involved, as on Mount Fuji). On the other hand, markedly changed environmental or social factors may require new policies that put controls on recreation or visitation as a major use (e.g. in some areas of Western Australia where dieback disease of native plant species takes priority over recreation).*

### Guidelines

122. There should be management plans for all protected areas which include policies and prescriptions for recreation and sightseers; these to be prepared ideally before there is any preemptive use or management for recreation. In practice it will generally not be possible to have management plans in place before use or management begins. In such cases intervention should be

restricted to essential operations such as to ensure safety or for vital environmental protection; management should be conservative.

123. Policies and strategies should respect the special recreation values of mountains, including their wildlands quality and the opportunity for challenge, self-discovery and recreation in wild and dramatic landscapes. One important way of protecting these values is to control entry and access. In appropriate cases, it may be necessary to limit numbers.

124. Open access to special features is desirable, but exceptions might be made for strict nature reserves, sacred sites and places which are especially vulnerable to damage by recreational use.

125. Recreational activities which do not depend on the special qualities of the protected area (e.g. tennis courts or golf courses) should not be allowed and should be diverted to other more appropriate locations.

126. Footpaths should be durable and should be planned to assist or complement conservation needs and provide visitors with a safe and high quality experience. Generally, existing paths should be stabilized before new paths are opened up, unless the latter are absolutely essential (7).

127. Camping sites or trails which become degraded by use should be closed in rotation to recover.

128. There should be a range of opportunities to explore the area on foot, in different settings and seasons, and with different degrees of difficulty. (Some visitors will prefer well signposted and well surfaced routes in safe settings while others may be better pleased by little or no intervention such as signposting or trail marking.)

129. However, signposting generally should be used to warn visitors of unexpected dangers and to minimise risks.

130. Roads and other forms of access should be designed to provide safe travel consistent with acceptable levels of environmental impact (e.g. crash barriers should not be used unless absolutely essential).

131. There may be a need to maintain and clearly identify routes which may be used in the rapid evacuation of seriously injured persons.

132. Mountain protected areas should be shielded, as far as possible, from all kinds of nuisance associated with roads, military training and mechanized recreation, whether on the ground, on water or in the air. There should be strict controls on over-flying, whether civilian or military. Sudden noise (as

from low flying jet aircraft) can have a terrifying effect upon visitors, horses and pack animals, and has caused injury or even death to climbers.

1. If some over-flying cannot be avoided, consideration should be given to the designation of flight-free zones and military training should be redirected to alternative areas or permissible zones.

134. Activities such as ballooning, gliding and hang-gliding should be addressed in the management plan. It may be necessary to restrict them in time and location, or to prohibit them.

*Information that is of high quality and puts over a positive message to visitors is a key tool of management. Any information or interpretation should be provided with great sensitivity and in ways that are appropriate to the zone.*

### **Guidelines**

135. A site-specific code of conduct should be developed for visitors or one adopted that is applicable from another mountain area (e.g. the Kathmandu Declaration on Mountain Activities prepared by the International Union of Alpine Organisations).

136. Visitors should be introduced to the standards expected of them and be made aware of regulations before they enter the protected area. This introduction should be reinforced by information provided on entrance.

137. As a general rule, onsite interpretation is not appropriate in back country or wilderness zones. The provision of both information and interpretation should decrease rapidly with distance from points of entry.

138. Good, informative guidebooks and accurate maps add greatly to the pleasure and safety of visitors. Both should be provided.

*Accommodation should meet essential needs but should be as unobtrusive as possible.*

### **Guidelines**

139. Accommodation should generally be near the edge of protected areas, where it may also provide income to local communities. However, because of remoteness and altitude, it is customary to provide shelters, huts or tent sites on routes that are commonly used, even in core areas.

140. Where accommodation is provided, it must be located in such a way that damage and pollution are minimised and scenic quality maintained.

141. Where mountain huts or emergency shelters are provided, these should be left unlocked and should be subtly yet clearly marked to enable them to be found in bad weather. Discreet, reflective track markers may be necessary. Emergency shelters should be marked on all maps.

142. The inherent hazards and inconveniences which are part of a full experience of mountains should be recognised and preserved.

143. Managers should be fully aware of regular hazards (avalanches, rock-falls, mudslides, bush fires etc.) and special hazards (cyclones, severe weather conditions, earthquakes, lava flows, volcanic fumes, livestock, wildlife, flood, etc.), and be prepared with contingency plans.

144. Managers should also be fully aware of medical hazards (altitude sickness, contamination of food and water, hypothermia, exposure to heat or sunlight, plant and animal toxins), and possess some basic skills in dealing with these.

145. Mountain visitors should be informed without being patronized. Any special hazards, especially those that are not obvious, should be described.

146. Visitors need to be given advice and urged to be prepared with proper equipment, survival kit and basic first aid kit.

147. Where Search and Rescue (SAR) is available, saving human life should be the highest priority. SAR services should be available equally to management, support staff and visitors. These services should also be available to local residents. SAR should be considered an "act of mercy" without charge, unless adequate insurance is available.

148. "Convenience rescues" may be discouraged by imposing service fees.

149. SAR planning should emphasise training, adequate equipment, advance planning for evacuation and the judicious use of helicopters or motorised sleds.

150. The same provisions apply to planning for other emergencies (e.g. fires).

151. The training of users, managers and local interest groups is an essential component of visitor safety and impact reduction.

152. Effective training should be provided for staff and others involved in health and safety, aspiring to develop the highest standards, drawing from the best practice elsewhere, applying it sensitively, and being fully aware of local sensitivities and practices.

1. There should be a programme of monitoring and evaluation that is straightforward, inexpensive and repeatable, to enable the management

of the area to be modified, if necessary. The programme should cover all important elements affecting the health and safety of visitors and of the local community, including the views of visitors about the safety provisions.

## **XII. ISSUES ASSOCIATED WITH CLIMATIC CHANGES**

The prospect of global climate change presents an unprecedented challenge to those concerned with mountain protected areas. The present global network of protected areas already approximates to a representative sample of mountain landscapes. It affords, therefore, a unique opportunity for innovative conservation, which should include scientific and educational programmes.

Because of their steepness and relief, protected areas in mountains are exposed to a range of atmospheric and climatic conditions. This fact, combined with their distribution round the world, means that they provide unequalled opportunities to detect and monitor changes in climate and in air quality, and their effects (e.g. measurements on Mauna Loa in Hawaii Volcanoes National Park of carbon dioxide and acid rain). Innovative strategies will be essential to manage mountain protected areas against the background of likely climatic change.

In coming decades, climate changes resulting primarily from human activities are likely to be more rapid than any experienced in the development of present mountain ecosystems. Changes are likely not only in averages but also in seasonality and the frequency of those extreme events that are critical for both natural processes and human uses of mountain protected areas. While

While existing models agree to some extent on changes at the global scale, they are only just beginning to provide reliable predictions of probable climatic trends for regions, especially complex ones such as mountains.

Palaeoecological studies show that species may respond individually to climate change, forming assemblages that may not be the same as today's. The timing and magnitude of changes in species distribution may vary unpredictably. Particularly relevant are the different lifespans of different components of mountain ecosystems, from days to centuries.

Mountain landscapes contain many species and ecosystems that are highly sensitive to environmental change, and are refuges for populations of flora and fauna. They are also vital sources of water, have a rich cultural heritage, and are important locations for recreation and tourism. Future patterns of tourist use may be greatly affected by changes in weather conditions and air quality, and by increases in transport fuel prices that have been pushed upwards by controls on carbon release.

*Considerable data on climate, hydrology, biology, palaeoecology and culture have been amassed in some mountain protected areas. These data are frequently more detailed, and representative of longer time sequences, than data from other parts of the mountain regions in which they are situated. Such data are essential inputs to predictive models and actions to react and adapt to climate change at both regional and global levels.*

## **Guidelines**

154. In order to make full use of existing information, scientists and managers in mountain protected areas should:

- promote the use of mountain protected areas as leading centres for research and monitoring of climatic change by encouraging and contributing to regional, national and international programmes;
- foster the development of a network of mountain protected area research by establishing cooperative programmes that contribute to global conservation strategies for climate change;
- list and evaluate the practical uses of existing data, the nature and usefulness of present models, local knowledge of climate and its cultural implications, and gaps in the knowledge required for predicting and understanding regional climate change;
- Develop standards for the collection, analysis and storage of climatological, environmental and biological data in mountain protected areas.

*The ability to detect climatic change and its effects requires baseline information on the present state and distribution of natural resources. The identification of key species which are likely to provide early indications of climatic change is crucial within each mountain area.*

## **Guideline**

155. Managers of protected areas and scientists should:

- identify key species and their distribution, and identify the climatic factors that limit their distribution;
- monitor the most sensitive components of ecosystems, especially alpine systems;
- monitor climatic and environmental variables at different altitudes, using standardised methods;

- Establish at least one long-term monitoring programme at a landscape scale (e.g. a research catchment area).

*Changes in the atmosphere will occur at a global scale and may have effects that can be measured only over long periods of time. Effective mountain research and monitoring of change at the global scale require long-term financial support. Research within developing countries requires adequate resources in order to develop indigenous expertise.*

### **Guidelines**

156. Establish a mechanism for supporting programmes with funding and assistance for at least ten years.

157. Encourage international collaboration, including the transfer of resources from developed countries to developing countries.

*The rivers flowing from mountain protected areas are vital sources of water for agricultural, industrial and domestic uses, and power for both mountain and lowland people. Since changes in regional precipitation are likely to result from climate change, this could lead to major, and perhaps rapid, changes in water flows. Both increases and decreases in total and seasonal flows are possible. Glacial melting rates are important components.*

### **Guideline**

158. Sensitivity analyses of water flows are warranted in order to design and implement flexible policies for the regional use of water.

*Uncertainty about the timing and magnitude of global environmental change forces the managers of mountain protected areas to make decisions with inadequate information. If dramatic changes in the physical environment occur, it will be impossible to maintain ecosystems in their present or desired state. There should be flexible plans for the spatial and temporal reorganization of ecosystems, which may include actions to ensure the survival of individual species.*

### **Guideline**

159. Managers of mountain protected areas must:

- prepare management plans that: protect as many physiographic features (landforms) as possible within a contiguous area; consider resources and issues outside their boundaries; periodically evaluate plans to determine whether adjustments are needed, and revise them if necessary;

- cooperate with individuals and institutions responsible for adjacent lands to maximise the effective size of the mountain protected area;
- Consider climatic change and its effects when selecting and defining boundaries of new protected areas.

*Mountain protected areas have great cultural and aesthetic value, and their ecosystems are likely to respond more rapidly to climate change than those in which most of their many visitors live. Thus these areas provide important opportunities for education relating to climate change.*

### **Guideline**

160. Agencies and individuals responsible for mountain protected areas should:

- provide leadership in developing educational programmes in response to climatic change the programmes to be designed to benefit these areas, surrounding landscapes and their inhabitants, and the global community;
- encourage timely communication of important facts arising from research and monitoring to the media and to those responsible for education;
- Develop interpretive programmes that demonstrate the various options for responding to global climate change.

*Because air pollutants are transported long distances, protected areas in mountains, even though remote, are atmospherically linked with upwind urban and industrial areas, and can suffer damage. Pollutants tend to concentrate in deep valleys and in cloud belts on mountains. Visibility is often reduced, affecting scenic quality. Mountains may provide suitable sites for monitoring regional pollution, and sensitive species in them (e.g. certain lichens) can be used as an early warning system.*

### **Guideline**

161. Monitoring should be instituted in the following fields:

- Visibility and the deposition of wet, dry and gaseous pollutants using standard methods.
- Identification and monitoring of species sensitive to those pollutants that may threaten any particular protected area.
- The biological and physical effects of those air pollutants which are known or suspected to cause harm.

## XIIL EPILOGUE

Every mountain area is different from every other in geology and climate, in its plants, animals and ecosystems, in its human cultures, and the pressures for change to which it is subject. Any general guidelines, such as these, can only give an indication of the kinds of action that are needed; the details must always be tailored to fit local circumstances.

These guidelines are offered, by 40 scientists and managers with special knowledge of mountain protected areas in over 30 countries, as a sharing of their experience. It is hoped that they will be useful as a general guide wherever they are applied; but in addition, they need to be adapted to fit different mountain regions. In some areas it may be possible to use them as a check list against which the completeness of local guidelines may be evaluated.

Also, many of the principles will be found to apply with equal force to the management of areas outside those formally protected. They should, therefore, be applied as widely as possible to cover whole catchments or mountain regions.

The golden rules when designing any local application are:

- understand the ecology of the region;
- understand the culture of its people; and
- Understand the nature of the changes physical, biological, cultural and socioeconomic that affect it.

Since these guidelines were articulated, IUCN has initiated a Mountain Protected Area Programme. The nucleus of the 40 scientists and managers from the Hawaii consultation which gave birth to the guidelines has been more than doubled to form a network of individuals who are willing to work on behalf of mountain conservation through IUCN channels. A Vice Chair for Mountains has been appointed within the Commission on National Parks and Protected Areas. The Commission on Ecology is adding its strength, and individual members of other Commissions with an interest in mountains (especially the Species Survival Commission) are also contributing to the Programme.

This activity will be plugged into the existing effort in sustainable mountain development being spearheaded by the World Mountains Network through its supporting organizations the International Mountain Society, the UN University, the University of Berne, the University of California (Davis), the East West Centre, the International Centre for Integrated Mountain Development, and the Russia MAB 6 Project of UNESCO. Through the initiative of these organizations, The State of the World's Mountains: A Global Report was

prepared in time for the "Earth Summit" (UNCED) in Rio de Janeiro in June, 1992 (8). It contains a section on Mountain Protected Areas. Mountain protected areas also figure largely as one of the solutions in a second document prepared for UNCED, An Appeal for the Mountains: Mountain Agenda (9). Agenda 21, which sets out the actions for economic and environmental conduct for the nations of the world in the 21st century, was produced at Rio. Section II, Chapter 5, is a text on sustainable mountain development, including the role of protected areas.

It would appear, in view of these and other developments such as the emergence of African and Andean Mountain Associations, the existence of several regional mountain centres in Europe and in the Himalayas, and a potential association for East Asia and the Pacific, that there will soon be much greater potential for the establishment and better management of mountain protected areas.

---

(1)Thorsell, J. and J. Harrison, (1992). National parks and nature reserves in mountain environments and development. *Geojournal*127(1): 113126.

(2)A schedule of the different IUCN Categories of Protected Areas is given in Appendix 1.

(3)Because of its general applicability, the material arising from discussions devoted to the design and management of mountain protected areas has been widely incorporated in the other sections.

(4) The Unesco Biosphere Reserve provides for this kind of graded protection, but includes also the requirement to carry out research and monitoring as part of an international network. The system of protection which is suggested here is comparable to a biosphere reserve without the obligation for coordinated research and monitoring (although, of course, a coordinated programme of research and monitoring is highly desirable, if resources are available for it. Indeed mountain areas provide special opportunities in relation to scientific studies in relation to climatic change). A comparable idea (an Environmentally Critical Areas Network) has been developed for the island of Palawan in the Philippines (Collins, N. Mark, Jeffrey A. Sayer and Timothy C. Whitmore, 1991).

(5)This might include elements of direct support such as preferential treatment in relation to employment, purchasing and procurement, local businesses and traditional occupations: there might be appropriate incentives or subsidies. Indirect support might take the form of education and health services, training and employment associated with the protected area, the encouragement of alternative opportunities for employment or, in the last resort, compensation for unavoidable harm.

(6) These guidelines do not apply to mountain areas where the vegetation is not flammable.

(7) Similar principles apply where the use of horses, llamas or other riding or pack animals is permitted. If possible, horses and walkers should not share the same path. This is both safer and more pleasant.

(8) *The State of the World's Mountains: A Global Report*. Zed Books, London, 1992.

(9) *An Appeal for the Mountains: Mountain Agenda*. Prepared on the occasion of the United Nations Conference on Environment and Development (UNCED), Rio de Janeiro, June 1992. University of Berne, 1992.

## **APPENDIX 1**

### Categories and management objectives of protected areas

#### **I. Strict Nature Reserve**

To protect nature and maintain natural processes in an undisturbed state in order to have ecologically representative examples of the natural environment available for scientific study, environmental monitoring, education, and for the maintenance of genetic resources in a dynamic and evolutionary state.

#### **II. National Park**

To protect outstanding natural and scenic areas of national or international significance for scientific, educational and recreational use, these are relatively large natural areas not materially altered by human activity where extractive resource uses are not allowed.

#### **III. Natural Monument/Natural Landmark**

To protect and preserve nationally significant natural features because of their special interest or unique characteristics. These are relatively small areas focused on protection of specific features.

#### **IV. Managed Nature Reserve/Wildlife Sanctuary**

To assure the natural conditions necessary to protect nationally significant species, groups of species, biotic communities, or physical features of the environment where these may require specific human manipulation for their perpetuation. Controlled harvesting of some resources can be permitted.

## **V. Protected Landscapes and Seascapes**

To maintain nationally significant natural landscapes which are characteristic of the harmonious interaction of humans and land while providing opportunities for public enjoyment through recreation and tourism within the normal life style and economic activity of these areas. These are mixed cultural/natural landscapes of high scenic value where traditional land uses are maintained.

## **VI. Resource Reserve**

To protect the natural resources of the area for future use and prevent or contain development activities that could affect the resource pending the establishment of objectives which are based upon appropriate knowledge and planning. This is a "holding" category used until a permanent classification can be determined.

## **VII. Anthropological Reserve/Natural Biotic Area**

To allow the way of life of societies living in harmony with the environment to continue undisturbed by modern technology, this category is appropriate where resource extraction by indigenous people is conducted in a traditional manner.

## **VIII. Multiple Use Management Area/Managed Resource Area**

To provide for the sustained production of water, timber, wildlife, pasture and tourism, with the conservation of nature primarily oriented to the support of the economic activities (although specific zones may also be designated within these areas to achieve specific conservation objectives).

*Two additional categories are international labels which overlay protected areas in the above eight categories:*

## **IX. Biosphere Reserve**

To conserve for present and future use the diversity and integrity of biotic communities of plants and animals within natural ecosystems, and to safeguard the genetic diversity of species on which their continuing evolution depends. These are internationally designated sites managed for research, education and training.

## **X. World Heritage Site**

To protect the natural features for which the area is considered to be of outstanding universal significance. This is a select list of the world's unique natural and cultural sites nominated by countries that are Party to the World Heritage Convention.

## APPENDIX 2

### Participants in Parks, Peaks and People consultation

Dr Nigel Allan, Associate Professor, Department of Geography University of California, Davis, CA 95616, USA

Dr Yuri P. Badenkov, USSR Academy of Sciences, Institute of Geography, USSR Headquarters for MAB 6, Staromonetny 29, Moscow 109017, Russia

Dr Anvar Buzurkov, Senior Specialist, Coordinator of Pamir National Park Project, Department of Protected Areas and Tourism, ul. Abaya 4/1, Dushanbe 734033, Republic of Tajikistan

Dr Alton Byers, Environmental Adviser, Woodlands Mountain Institute, Main and Dogwood Streets, Franklin, WV 26807, USA

Mr Steve Cunha, Chair, Earth Sciences, Cosumnes River College, 8401 Center Parkway, Sacramento, CA 95823, USA

Ms Jeannette Denholm, Mountain Farming Systems, International Centre for Integrated Mountain Development, PO Box 3226, Kathmandu, Nepal

Dr Patrick Devlin, Senior Lecturer in Parks, Recreation and Tourism, Lincoln College, Canterbury, New Zealand

Mr Hamish Ensor, Chairman, Aoraki Conservation Board, Glenaan, Methven, New Zealand

Mr Stephan Fuller, Director, Policy and Planning, Yukon Renewable Resources, Box 2703, Whitehorse, Yukon, Canada, Y1A 2C6

Dr Chandra Gurung, Annapurna Conservation Area Project, King Mahendra Trust for Nature Conservation, PO Box 3712, Sakya Kunj, Kathmandu, Nepal

Dr Lawrence Hamilton, Research Associate, EAPI, East West Center, 1777 East-West Road, Honolulu, HI 96848, USA

Dr Vineeta Hoon, M.S. Swaminathan Research Foundation, 14,11 Main Road, Kottur Gardens, Kotturpuram, Madras 600 085, India (Currently at EAPI, East West Center)

Dr Hsu KuoShi, Superintendent, Taroko National Park, 291, FuShi, ShowLin Shian, HwaLein, Taiwan, Republic of China

Mr Hugo Huntzinger, Superintendent, Hawaii Volcanoes National Park, PO Box 52, Volcano, HI 967180052, USA

Dr James Juvik, Associate Professor, Department of Geography, University of Hawaii, Hilo, HI 96720, USA

Dr Jamie Kirkpatrick, Professor and Head, Department of Geography and Environmental Studies, University of Tasmania, GPO Box 2526, Hobart, Tasmania, 7001 Australia

Mr Kanehiro Kitayama, Department of Botany, 3190 Maile Way #101, University of Hawaii Manoa, Honolulu, HI 96822, USA

Mr Wayne Lamphier, Lamphier and Associates, Box 61213 Brentwood Station, 3630 Brentwood Road NW, Calgary, Alberta, Canada, T2L 2K6

Mr P.H.C. (Bing) Lucas, Chairman, CNPPA, IUCN, 1/208 Main Road, Tawa, Wellington, New Zealand

Mr John Mackay, Senior Planning Officer, Countryside Commission for Scotland, Battleby Redgorton, Perth, PH1 3EW, Scotland, UK

Dr Clifford J. Martinka, Senior Scientist, NPS, Glacier National Park, West Glacier, MT 59936, USA

Dr Les Molloy, Coordinator, Interpretation, Department of Conservation, PO Box 10420, Wellington, New Zealand

Dr John Peine, Research Administrator, NPS, Uplands Field Research Laboratory, Great Smoky Mountains National Park, Route 2, Box 260, Gatlinburg, TN 37738, USA

Dr David L. Peterson, Associate Professor (Research Biologist, NPS), College of Forest Resources, University of Washington, Seattle, WA 98195, USA

Dr Duncan Poore, Balnacarn, Glenmoriston, Inverness, IV3 6YJ, Scotland, UK

Dr Martin Price, 9 Chemin de Notre Dame des Neiges, 73100 Mouxy, France

Dr Pedro Salinas, Centro de Estudios de Postgrado, Facultad de Ciencias Forestales, Universidad de los Andes, Merida, Venezuela

Mr Lhakpa Sherpa, Park Management Specialist, c/o College of Forest Resources, University of Washington, Seattle, WA 98195, USA

Dr Tirtha Shrestha, Task Force Coordinator, MakaluBarun Conservation Project, GPO Box 2785, Kathmandu, Nepal

Mr Paul G. Sneed, PPP Consultation Assistant, EAPI, East West Center, 1777 EastWest Road, Honolulu, HI 96648, USA

Dr Stan Stevens, Assistant Professor, Department of Geography and Anthropology, Louisiana State University, Baton Rouge, Louisiana 708035710, USA

Mr Dan Taylor, Resources Manager, Hawaii Volcanoes National Park, PO Box 52, Volcano, HI967180052, USA

Dr James Thorsell, Senior Adviser, Natural I IUCN, The World Conservation Union, Rue Mauverney 28, CH1196 Gland, Switzerland

Ms Miriam Torres, Fundación Peruana para la Naturaleza, Amador Medina Reyna (San Isidro Aptdo.181393 Lima, Peru)

Mr Tim Tunison, Resources Management, Hawaii Volcanoes National Park, PO Box 52, Volcano, HI 967180052, USA

Mr John Watson, Regional Manager, South Coast Region, Department of Conservation and Land Management, 44 Serpentine Road, Albany, Western Australia 6330.

Mr Carlos A. Weber, Projects Coordinator, Corporación Nacional Forestal, Depto. de Patrimonio Silvestri Avda. Bulnes 259Of.604, Santiago, Chile

Dr James Thorsell, Senior Adviser, Natural Heritage, IUCN, The World Conservation Union, Rue Mauverney 28, CH1196Gland, Switzerland

Ms Miriam Torres, Fundacioón Peruana pare la Conservación de la Naturaleza, Amador Medina Reyna (Ex los Rosales), San IsidroAptdo. 181393, Lima, Peru

Mr Tim Tunison, Resources Management, Hawaii Volcanoes National Park, PO Box 52, Volcano, HI967180052, USA

Mr John Watson, Regional Manager, South Coast Region, Department of Conservation and Land Management, 44 Serpentine Road, Albany, Western Australia 6330, Australia

Mr Carlos A. Weber, Projects Coordinator, Corporación Nacional Forestal, Depto. de Patrimonio Silvestre, Avda. Bulnes 259Of.604, Santiago, Chile

Mr Graeme Worboys, Regional Manager, South Eastern Region, NSW National Parks and Wildlife Service, Level 1,34 Lowe Street, Queanbeyon, New South Wales 2620, Australia

Mr Yeh ShihWen, Superintendent, YuShan National Park, 112 MingShen Road, ShueiLi Shian, NanTou, Taiwan, Republic of China

Professor Zhang Rongzu, Institute of Geography and Commission for Integrated Survey of Natural Resources, Academia Sinica, Building 917, Datung Road, Beijing 100101, China

Dr Zhao Shidong, Deputy Director, Institute of Applied Ecology, Academia Sinica, PO Box 417, Shenyang, China

---

### **Notes to readers**

The mountain Forum would like to thank the publishers for permission to include this document in the Mountain Forum Online Library.