Toward a global network of mountain protected areas

C. J. Martinka[1], J. D. Peine[2] and D. L. Peterson[3]

Glacier National Park, West Glacier, MT 59936[1]

National Park Service, University of Tennessee, Knoxville, TN 37901[2]

National Park Service, University of Washington, Seattle, WA 98195[3]

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Abstract:

Examples of mountain landscapes are protected on hundreds of sites throughout the world. Conservation organizations and the scientific community recognize values for mountain protected areas that include contributions to strategies for addressing global change. To establish a functional network of protected areas, an informational framework that describes and communicates the important attributes of participating sites is proposed. Benefits include a means for evaluating system status, a mechanism for marketing values and opportunities, a foundation for ecological and cultural research, a system for exchanging knowledge of common interest, a focus for creating educational programs, and standards for new additions to the network.

Representative examples of mountain landscapes receive some form of legal protection in many countries throughout the world. A recent tabulation of 442 prominent sites, those 10,000 ha or greater in size with 1500 m or more relief, reveals global protection for more than 243 million ha of mountainous terrain (Thorsell and Harrison 1992). These protected areas represent nature reserves, national parks, natural landmarks, and managed sanctuaries in each of the eight global biogeographic realms described by Udvardy (1975). Distribution of the 442 sites is skewed with more than half the number and nearly two-thirds the land area located in the Nearctic and Palearctic Realms. When numerous smaller sites are considered, mountains appear to receive more extensive protection than most other biomes (Poore 1992).

Mountain protected areas (MPA) sample a topographically complex environment that is important for the economic and spiritual sustenance of many human cultures. And as human populations continue to grow, use of this biologically diverse resource has accelerated, highlighting a strategic role for MPA that includes both conservation and scientific interests. From a global conservation perspective, protecting representative examples of mountain resources is a high priority goal. At the same time, scientists are more frequently using protected areas as controls for land use research and as sites for long term environmental monitoring. The prospect of global climate change has heightened the value of MPA as scientific resources (Bailey 1991).

Mountains are biologically rich landscapes with complex regimes of climate and weather. Topographic gradients and atmospheric extremes are features that further enhance their usefulness for measuring climate change. We propose that protected sites represent a global sample of mountain environments that holds potential for enhancing the design of climate change research. To evaluate this idea and advance other values of MPA, we further propose that important site attributes be assembled as the informational foundation for a functional network of protected sites.

THE NETWORK CONCEPT

The possible causes and predicted effects of global climate change have precipitated an intense interest in the conservation of species and their habitats. Strategies to address conservation at the global scale require innovative approaches to the acquisition and use of knowledge. While the challenge includes the production of new knowledge, there is also unrealized opportunity in the extensive inventories of raw data provided by contemporary remote sensing technology.

During recent decades, the task of assembling information about species and their habitats has been undertaken by a variety of individuals and institutions. At the international level, inventories being developed by organizational coalitions are critical data sources for strategic conservation planning. The most comprehensive relating to protected areas is maintained by the World Conservation Monitoring Centre (WCMC) as a library of computer maps supported by structured databases and paper files (WCMC 1992). It represents a global overview of biological diversity that includes protected sites, threatened plant and animal species, and other areas of conservation concern. In this volume, P. N. Halpin provides a useful example of how these data can be used to understand the potential effects of climate change on nature reserves.

A geographically more limited endeavor is BRIM, the Euromab Biosphere Reserves Integrated Monitoring Programme (Gregg et al 1993). Its focus is a survey of biological attributes, current knowledge and science capabilities of biosphere reserves in Europe and North America. Strategically, the program is designed to facilitate the collection, reporting and access of various resource data among biosphere reserves, sites designated by the United Nations Educational, Scientific and Cultural Organization for their conservation, education, and scientific values. However, it also serves as useful model for other protected areas where research and monitoring are important functions.

For MPA, a functional network requires the comprehensive global foundation provided by the WCMC as well as the kinds of resource data being assembled by BRIM. The objective would be documentation of attributes that foster a credible ecological evaluation of MPA at the global scale. In general, the requisite descriptors for each site would include direct or scaled measurements capable of supporting classification, comparison, selection, assessment, and other technical analyses of MPA. A hierarchal design provides the flexibility required for the information to be part of meta-database networks now being considered by some organizations. Additionally, a hierarchy fosters maintenance of active files, data search procedures, and logical links to related databases that include more comprehensive site data at individual MPA.

To begin the network construction process, a catalog of information relating to the global network of MPA would serve an especially useful purpose. As a mechanism for marketing protected area values and identifying opportunities associated with their presence, its potential contributions would include a foundation for evaluating system status, identifying threats to its integrity, and developing standards for additional MPA. Moreover, an especially timely contribution would be elements of a framework for global research such as that described by Comanor and Gregg (1992) for the U. S. National Park Service Global Change Research Program. And finally, a catalog serves an educational purpose by defining a communication network and presenting knowledge of interest.

Designing an extended information base for MPA requires objectives formulated in response to a series of questions based on the descriptive power of the database. What are the markets and uses for a catalog of MPA? Which attributes contribute to the current ecological status of a protected site? Can the attributes be expressed as measurements suitable for statistical analyses? Are the attributes held in common by all protected sites? What are the most productive communication pathways and when is further database development and management best handled at national, regional or site levels?

Formulation of objectives is strategic and thus an essential prelude for several routine steps in developing a prototype network. These steps are sequential and include a thorough review of existing information systems, construction of a database framework and designing a format for data collection. In turn, the results become the resources for creating a working model that addresses objectives. To evaluate the prototype, we suggest that initial design include three replicates from each of the eight biogeographic realms for a total of 24 MPA. Criteria for site selection would include substantive contributions to existing data systems and willingness to be an active participant in evaluating and advancing the network concept.

PROTECTED AREA ATTRIBUTES

Determining the nature and number of descriptive site attributes is a critical step in the network proposal. A recent analysis for Glacier National Park in northwestern Montana revealed the potential complexity of the issue (Martinka 1992). In that case, seven kinds of attributes that contributed to the conservation of biological diversity included enabling laws, economic factors, boundary characteristics, geographic location, management philosophy, environmental statutes, and public interest. Further analysis indicates that these attributes are conveniently grouped into three descriptive categories.

First are the primary physiographic features of a protected area, those which determine its basic potential for biological diversity. Geographic location, terrain characteristics, soil origin, and climatic features are especially important measures since they generally provide a basis for classifying MPA into various ecological categories. The usefulness of these basic attributes is illustrated by their role in regional ecosystem simulation models such as that described by Running et al (1989).

Next are the ecological expressions of the basic features including species counts, primary productivity, energy flux, and similar measures of biological activity within a protected area. While useful as indicators of ecological conditions, they are also more difficult to document and interpret than physical features. Nonetheless, expressive attributes add an essential dimension to the quantitative description of MPA.

A third category includes the legal and behavioral actions of humans that influence biological diversity in protected areas. Some with legal origins such as area size, boundary configuration, period of protection, and legislated mandates are relatively permanent and therefore important complements to physiographic features. Others such as regional setting, physical facilities, and organizational philosophy tend to modify the effects of physical and legal attributes; they too are important measures for a full description of MPA.

There are also a number of ancillary descriptors that are likely to enhance potential for a functional network. For example, the contents of a natural resources information system would provide for global research design based on existing knowledge. Or the presence of a library may provide local knowledge that is not available elsewhere. While these kinds of descriptors are important, they also add to the complexity of network design and should thus be selected with a clear view of the original objectives in mind.

NETWORK VALUES

Initially, the most important contribution of a network may be its ability to address questions about the nature of MPA. What are their global geographic attributes and how well do they represent major ecosystems? To what extent do MPA contribute to regional landscape conservation and the protection of biological diversity? Is size or replication sufficient to assure conservation of critical mountain resources? Do the system or representative components provide a sample for monitoring global environments?

In contrast to strategic analyses, there are also functional uses for the managers of protected sites. Are there sites with similar management philosophies elsewhere in the world that might provide information on an ecological issue? Can one design and implement an inventory or monitoring program that is exportable to other sites or be useful to global research design? How do various kinds of management potentially influence the ecological status of a new MPA? And in fact, the list of functional uses is limited chiefly by human imagination.

Strategic analyses and functional uses are valuable only to the extent that the data are accessible and accepted as credible knowledge. In turn, value is most effectively assured by applying current knowledge not just to new research, but also to education and management. With this in mind, climate change issues are likely to receive magnified benefits from a functional network of MPA. Poore (1992) suggests that mountain environments are sensitive indicators and that protected areas provide unequalled opportunities to detect and monitor changes in climate and air quality. He goes on to list a series of guidelines that stress their global role in understanding and conserving biological diversity.

CONCLUSIONS

When organized and presented in an appropriate form, knowledge improves the effectiveness of communications among scientific groups, conservation organizations and managers of natural resources. The potential for a functional network of MPA is therefore enhanced by the assembly, presentation and application of credible information about the hundreds of sites throughout the world. The concept is consistent with recent recommendations for new approaches to global environmental issues through the creation of international networks and centers (Carnegie Commission 1992).

The design of a global network requires that its markets be fully explored to determine the role, functions and applications of information to mountain environments. It seems reasonable to anticipate a diverse clientele, pointing to the need for relevant information that serves both the strategic and operational requirements of MPA. As such, the network becomes a contributor to the Sustainable Biosphere Initiative (Lubchenco et al 1991) through international cooperation in science, education, and conservation.

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Notes to readers

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The authors may be reached at:

C. J. Martinka
Glacier National Park
West Glacier, MT 59936
406-888-5441 (Telephone)
406-888-5581 (Telefax)