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GUIDELINES FOR THE SELECTION OF PROTECTED ECOLOGICAL AREAS

1989

T.J. Beechey

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FOREWORD

This paper presents provisional guidelines for the selection of protected ecological areas developed by the Canadian Council on Ecological Areas (CCEA). These guidelines are the product of extensive consultation and dialogue among members of CCEA culminating in a workshop on the topic at Council's 1985 annual meeting in Saskatoon, and the subsequent review of draft guidelines through its 1986 annual meeting in Montreal. The content is current to 1987, when the last revisions were made to accommodate reviewer's comments on the 1986 draft.

Many individuals assisted in the preparation of this paper. The following contacts provided information on selection guidelines in use in their jurisdiction in 1985: K. Curnew (Nfld.), D. Davis (N.S.), A. Godfrey (P.E.I.), J.M. Fitton (N.B.), M.L. Gaudreau (Que.), T.J. Beechey (Ont.), P. Gray (N.W.T.), T. Lash (D.O.E) and D. Pollard (C.F.S.). The format, scope and content of the paper developed out of the 1985 workshop in Saskatoon involving the following participants: T.J. Beechey (convenor), C. Bugslag, N. Courtemanche, C. Curnew, D. Elsaesser, D. Griffin, V.L. Harms, T. Lash, G. Ledingham, B. Ogilvie, D. Pollard and S. Rowe. The following individuals are acknowledged for their review comments on the initial draft presented at the 1986 annual meeting in Montreal: G. Argus, C. Bugslag, D. Elsaesser, H. Epp, G. Francis, L. Goulet, P. Gray, M. Hummel, J. Katz, P. Keddy, D. Pollard, H. Roemer, J. Theberge and R. Thomasson. The Ontario Ministry of Natural Resources is acknowledged for its support in the completion of the report. D. Powell, while in the employ of the Ministry, assisted on the bibliographic review and manuscript preparation.

Concepts and ideas dealing with the selection and evaluation of protected ecological areas is a dynamic field of conservation biology that Council intends to review from time to time. In the interim, the existing guidelines should continue to provide a relevant focus for Council and its members, in their collective efforts to create a comprehensive network of protected ecological areas in Canada.

T.J. Beechey
Coordinator, Management and Administration
Canadian Council on Ecological Areas
May, 1989

CONTENTS

GUIDELINES FOR THE SELECTION OF PROTECTED ECOLOGICAL AREAS

Management and Administration
Canadian Council on Ecological Areas

> In selecting areas for conservation purposes it is essential to secure a distribution of areas which will cover the ecological characteristics imposed by differences in geography and soil variation. Great importance attaches to any pristine and primitive vegetation and its associated fauna which persist in places least altered by man. However, a fair balance must be struck between the preservation of representative ecological types and the protection of populations, aggregates of species and individual species.
>
> (Nature Reserves Investigation Committee, 1945)

INTRODUCTION

In support of its aim to facilitate the creation of a comprehensive network of ecological reserves in Canada, the Canadian Council on Ecological Areas initiated investigations in 1982 to determine the design requirements for such a system. Early in this review, it became apparent that a national blueprint for a system of protected ecological areas, with the capability to assign representation targets within a natural regional context, was an essential component in designing a comprehensive system of reserves. Such a plan would serve as a yardstick against which existing representation could be measured, and critical gaps in representation could be determined.

In reviewing existing approaches for selecting ecological areas, Council found that a number of different frameworks were in use across Canada. Although a number of provincial jurisdictions have adopted a systematic approach for selecting ecological areas, these varied considerably in design, with little coordination in their implementation. Consequently, while some provide conceptual models for a national "systems plan," their provincial scope limits their ready extrapolation to the national scene. Parks Canada also has developed a national framework, independent of provincial plans, for selecting national parks. While this scheme also provides a rationale basis for its intended purpose, the framework of natural regions, which it utilizes, may be too coarse a filter to satisfy the requirements for comprehensive ecological representation.

Mindful of the inherent limitations of existing schemes, Council has been following with interest, the development of eco-region mapping for Canada being undertaken by the Lands Directorate. This mapping, in combination with parallel initiatives of the Canadian Committee on Ecological Land Classification to classify and describe Canadian ecosystems, could provide the necessary basis for rationalizing, describing and selecting a complete network of protected ecological areas in Canada.

However, despite the considerable progress being made on describing Canadian ecosystems, it has become apparent that the completion of a national plan based on this work is a long term undertaking. This situation, along with the ongoing need to identify and to protect ecological areas, has prompted the development of guidelines for the selection of ecological areas. This paper is the initial response of Council to that need.

The present paper takes its direction from Council's notion of protected ecological areas, which it defines as formally protected areas established to maintain viable examples of Canadian ecosystems, flora and fauna to preserve natural diversity and to provide opportunities for scientific research, environmental education and

appreciation. So defined, protected ecological areas include legally defined ecological reserves as well as conforming categories of parks, zones and other protected areas having equivalent status and purpose. This direction is consistent with a number of jurisdictional approaches and it conforms closely with categories 1 (Strict Natural Areas) and 4 (Managed Natural Areas) of the IUCN classification for protected areas (Commission on National Parks and Protected Areas, 1978), which Council has adopted to frame its primary interest.

With this backdrop, an effort was made to consolidate and to review existing selection criteria and planning processes from Canadian jurisdictions and beyond. This information was summarized and was the subject of a workshop on "Model Guidelines for Selecting Ecological Areas" staged at the 1985 general meeting of Council in Saskatoon. That workshop confirmed the purpose, scope and format of this paper. Arising out of that workshop, it was felt that the initial selection guidelines should emphasize natural ecosystems because of their inherent fragility and irreplaceable nature. As well, it was agreed that these guidelines should concentrate on terrestrial ecosystems, since aquatic ecosystems present sufficiently different management implications to warrant separate treatment through a special task force of Council.

PERSPECTIVE ON GUIDELINES FOR SELECTING ECOLOGICAL AREAS

Current approaches for the selection of ecological areas in many Canadian jurisdictions originated out of Canada's participation in Section CT of the International Biological Programme (IBP/CT), which concerned itself with the conservation of terrestrial communities. The selection of areas for consideration by Section CT was governed by six criteria:

(a) the areas should, taken together, contain adequate and manageable samples of the entire range of major ecological formations or ecosystems in the world and illustrate the degree of variation within each;

(b) the series should include sites which, although they do not qualify for inclusion under the first criterion, support species of plants and animals of outstanding interest or great rarity;

(c) the series should include sites which are of scientific interest because of the human management to which they have been subjected, even if this has in some cases led to more or less far-reaching modification of the biota;

(d) the series should include sites which are important because they have been the scene of detailed and well documented research;

(e) the series should include sites which contain for example, deposits of peat, lignite or sediment from which past vegetational and climatic changes can be determined, and also sites which are of special palaeontological importance;

(f) the series should include sites which are of special physiographic or geomorphological interest and which represent unusual habitats.

(Nicholson, 1968)

In reviewing current efforts to protect ecological areas across Canada, it is evident that the foregoing perspective has shaped selection efforts in many jurisdictions. Moreover, while formulated some 20 years ago, the criteria remain relevant, and they continue to reflect current needs and priorities.

Building on this perspective, some jurisdictions in Canada have refined their approaches to the selection and evaluation of ecological areas through "systems plans", which provide further definition of the range of communities and other ecological features for representation in ecological areas. This has led to the development of some fairly sophisticated programmes for selecting ecological areas for nature conservation.

However, as previously noted, all such schemes lack a national perspective, and without such uniformity, they cannot be adopted readily. Thus, the following material, which has been distilled from existing programmes, is put forward as general principles and guidelines for consideration in selecting and evaluating ecological areas, rather than a rigid scheme for exclusive application in any regimented fashion.

CONCEPTS AND PRINCIPLES FOR SELECTING ECOLOGICAL AREAS

The present paper segregates considerations for selecting ecological areas into four categories: representational concepts; functional principles; utilitarian values and administrative considerations. Representational concepts deal with thematic representation, specifically defining categories of ecological features for inclusion in a network of protected areas. Functional principles address design considerations pertaining to quality, viability and sensitivity of ecological areas. Utilitarian values cover considerations related to the value of ecological areas for scientific research, environmental education and appreciation. And administrative considerations focus on aspects dealing with ownership, management and competing uses.

Representational Concepts

Seven representational categories cover the range of features for inclusion within a network of ecological areas: natural terrestrial ecosystems, natural aquatic ecosystems, floristic/faunistic sites, special habitats, palaeoecological sites, physiographic and geological sites, and modified ecosystems. Of these categories, in Council's view, those dealing with natural ecosystems, flora and fauna, special habitats and palaeoecological sites are of primary importance owing to their comparative sensitivity and increasingly limited opportunities for representation. In line with this focus, CCEA endorses the development and use of regional or thematic frameworks which define specific representation targets for each category, and which assign priority for their protection.

Natural terrestrial ecosystems comprise specific biotic communities and their support environments, and characteristic patterns of these units typical of the natural regions and the major ecosystems throughout Canada. The representation of this category, with particular emphasis on the representation of patterns of communities, is viewed by Council as the highest priority. This category, together with natural aquatic ecosystems, should form the core of a system of protected areas.

Natural aquatic ecosystems include freshwater, brackish and saltwater communities and their support environments. This category also is viewed by Council as a very high priority for representation within protected ecological areas. Because of the too limited consideration for and the special management needs of aquatic ecosystems, Council has chosen to assign a Task Force to deal with developing guidelines for their selection and management.

Floristic/faunistic sites include sites which may be important for genetic and evolutionary conservation, but which may be overlooked by the previous categories owing to similarities among the habitats shared by them. In particular, this category will concentrate on rare, threatened and endangered species, endemics, or species of exceptional biogeographical interest. Areas such as refugia, which contain concentrations of relictual species, and significant peripheral habitats supporting species at the limit of their range, should assume priority.

Special habitats include areas of exceptional importance for both rare and common species, such as hibernacula, calving grounds and significant denning and feeding sites of either seasonal or year round importance. Such sites need to be considered on an exceptional basis as they are discovered.

Palaeoecological sites include important fossil localities and other sites, such as pollen banks, which contain evidence of prehistoric ecological succession and evolutionary change. Sites that are sensitive and vulnerable to destruction should receive priority.

Physiographical and geological sites of special ecological interest and vulnerable to destruction need to be considered on an exceptional basis as they are described and reported.

Modified ecosystems may include sites within any of the foregoing categories, which due to former alteration or management, have assumed special scientific, research and/or educational value. Only where such sites offer unique opportunities for scientific study should they be considered ahead of other categories. Otherwise, modified and disturbed sites assume lower priority than natural areas due do to the more extensive opportunities to re-create and to represent them.

Functional Principles

Functional principles constitute the series of factors that govern the significance, quality, viability and sensitivity of representative ecological areas. Ten principles are covered under this category: diversity, rarity, size, integrity, condition, endangerment, fragility, distribution, replication and significance.

Diversity is used in its literal sense to convey variety of ecological features and species diversity. Diversity within an area may be expressed as ecological variation within a particular thematic category, for example, to indicate the variety of aquatic or terrestrial communities within an area. Or, diversity may be used more broadly to express the variety of different thematic categories within an area.

Ecological diversity in the broadest sense usually correlates with physiographic diversity. In practical terms, areas with dramatic relief, varied exposures and heterogeneous substrates usually exhibit greater ecological diversity than areas of comparable size that are more homogeneous in nature and possess narrower environmental gradients.

In general, ecological areas offering the greatest range of environmental, community and species diversity, and which are presently unrepresented within protected ecological areas, should assume priority for protection.

Rarity is a measure to express the relative scarcity of an ecological feature. In the extreme, rarity may equate with unique, where it concerns the singular occurrence of a phenomenon.

While any natural rare feature is of interest, complex, rare ecological phenomenon, such as a unique community or environment, or an assemblage of rare species, are usually more important than an isolated feature or individual species. Species restricted to relictual or peripheral habitats, also should receive priority consideration because of their possible evolutionary significance.

Distributional context is obviously required to assess rarity, and phenomenon of national importance should assume priority over those of regional or local interest. The ability to assess rarity and its significance is constantly being improved through surveys of natural areas and surveys of organisms. Knowledge of rarity is regularly extended through initiatives such as status reports by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and other organizations, museum projects such as the catalogue of rare plants being compiled by the National Museum of Natural Sciences, and various initiatives involved in atlasing breeding birds and other species.

Size is concerned with considerations pertaining to the area of specific sites, and it is important from several perspectives.

Ideally, ecological reserves should incorporate representative patterns of biotic communities rather than isolated examples of specific communities and environments. Emphasis on patterns which incorporate systems of communities insures that transitional habitats between discrete types, and entire environmental gradients, are incorporated into reserves. Reserve size often dictates the extent to which this approach is possible, and consequently large areas are favoured over small ones where size is the deciding factor.
Comparatively large reserves are also important for wide ranging animals, and with careful design, single areas

can accommodate populations of large herbivores and carnivores in remote regions, at least during critical periods of their life cycles.

The likelihood of species being extirpated may be reduced in relatively large reserves, especially in developed regions where opportunities for the survival of some species may be reduced outside of reserves. Large reserves may enhance the survival of some species by providing necessary isolation and by mitigating against losses due to chance occurrences. Similarly, large areas may provide better opportunities for re-colonization and re-introduction of locally extirpated species.

Large size, in combination with careful boundary design, can also minimize the proportionate "edge effect" between natural communities and intensively managed systems such as croplands. This can be an important consideration in near-urban and agricultural settings where non-native biota may invade modified habitats. In general, edge effect of similarly shaped areas diminishes with reserve size due to the inverse area/edge relationship.

Finally, large reserves also afford a greater range of stewardship options than can be accommodated in small ones. Carefully planned large reserves can include strictly protected zones, managed zones, buffer zones and access zones to provide a wider range of research and educational opportunities while insuring that preservation objectives are met.

Environmental integrity relates to functions such as ecological homeostasis, dynamic equilibrium and self regulation. In practice, environmental integrity is concerned with incorporating whole viable systems into protected ecological areas, and thereby minimizing extrinsic biophysical processes.

One aspect of environmental integrity pertains to the inclusion of critical physical processes that are necessary for maintaining communities and species within a reserve. This is especially important to consider in dynamic systems, such as riparian environments, coastlines, dune fields and mountainous terrain, where dramatic physical processes dictate the structure, composition and succession of constituent communities. In practice, it is essential to understand these processes, and to insure that critical processes either are incorporated into the reserve, or are otherwise maintained on its periphery.

Another aspect of environmental integrity pertains to surrounding land use and its influence on natural ecological areas. For example, agricultural and forestry practices may cause the transport of sediments, chemicals and nutrients through erosion and hydrological processes. In landscape settings where this is a concern, ecological areas positioned on topographic highs, ideally incorporating headwaters, are preferred over localities receiving discharge or catchment areas. This design consideration is especially important for wetland ecosystems, which function as catchments and facilitate nutrient transport; accordingly, wherever possible, natural forested buffers are recommended around wetland reserves.

Islands, by virtue of their isolation from mainland environmental processes, are sometimes ideal locations for protected ecological areas. Processes such as surface drainage and groundwater regimes are localized, making the control of nutrient transport by hydrological processes more manageable. Islands isolated from the mainland by relatively short distances should minimize problems of re-colonization should some catastrophic event eliminate any native biota.

Condition relates to the degree of disturbance by man, which is important to consider for ecological areas being selected as benchmarks to represent natural communities.

While certain kinds of anthropogenic impacts, such as pesticide traces and air borne contaminants are pervasive, many other disturbances are more localized. All disturbances are deserving of consideration in site selection.

Examples of disturbances that may disqualify a candidate ecological area from consideration are former forestry, aggregate or mineral extraction, agriculture conversion, grazing, alien biota, fire history, human habitation, mechanized use, hunting and trapping, pesticide or herbicide applications and pollution.

Endangerment is concerned with assessing threats to specific ecological areas as well as the type of ecosystems which they represent.

While endangerment is related to rarity and fragility, consideration of it should not be confined to areas sharing these attributes. Some types of ecosystems, seemingly widespread and secure, may be vulnerable over time to incremental conversion, modification and use. Extensive wetland and forest conversion for agricultural development in some regions of Canada illustrate this trend too well, and care must be taken to guard against complacency over what now appears to be commonplace.

The kinds of land use threats that endanger particular areas and habitats may include wholesale destruction for industrial and urban development, conversion for agriculture, intensive management for forestry and wildlife production, or development for access and recreation. In general, already uncommon ecosystems under pressure for conversion to other uses should receive priority for protection.

As applied to species, the evaluation of endangerment can be distilled from status reports, and sometimes from other published sources, museum records and knowledgeable individuals.

Fragility is concerned with assessing the inherent environmental sensitivity of an ecological area or feature, and the types of ecosystems that it represents.

Fragility is obviously related to threat, but is distinguished from it in being an intrinsic or inherent attribute as distinct from the threat itself. Fragility is concerned with the ability of an area to tolerate use, and specific ecosystems may exhibit different thresholds to the same use. For example, dune communities are classic examples of environmentally sensitive ecosystems that may sustain long term damage through even low levels of pedestrian use. In contrast, sugar maple-beech forest may be comparatively resilient to the same kinds and levels of use.

Distribution is concerned with the geographic location of ecological areas within a given region.

In general, distribution of sites is dictated by opportunities to achieve representation, and is determined mainly by selecting the most significant areas on the basis of their inherent natural values. In some cases, accessibility and use may influence the selection of sites.

Replication is concerned with the inclusion of more than one example of a community or species within a system of ecological reserves. Replication is desirable from several standpoints.

With respect to communities, specific types may exhibit geographic variation in productivity, composition, structure or other attributes, and the inclusion of two or more examples from different localities can broaden research and management opportunities. Replicates could afford opportunities to investigate similarities and differences, and to determine the environmental factors causing any variation.

With respect to organisms, individual species, and often separate populations, may exhibit clinal variation. Again two or more examples of such phenomena broaden opportunities for protecting the variation and studying the causative factors.

Normally, considerable replication of species will be included in any series of reserves selected to represent the environmental and community diversity of a region, without having to concentrate specifically on this aspect. The same holds to a lesser degree with communities. Specific efforts to replicate features should be confined to the most significant and the rarest elements and, in general, they should not take priority until overall biotic representation is fairly complete.

Significance is a cumulative measure of the importance of an area as determined through considerations of the foregoing representational concepts and functional principles.

It is advisable to attempt to rank areas on the basis of the foregoing considerations to determine their overall significance, in order to insure that protection efforts are concentrated on the most important sites.

Utilitarian Values

The assessment of utilitarian values includes those aspects related to the uses for which protected ecological areas are created: research, education and nature appreciation. Normally, these aspects are secondary considerations, with the first priority being assigned to representational and functional considerations.

Scientific value relates to the importance of the area for study and research. Established research use with published results, enhances the value of a site for future investigations and environmental monitoring. In particular, baseline studies, past ecological research having application for ongoing monitoring, and long term time-trend investigations are especially important.

Apart from established historical use for research, it is often difficult to determine the future scientific value of an area because of the indeterminate path of scientific enquiry. Consequently, it is best to insure that ecological diversity is represented completely to provide the fullest range of opportunities for future study.

Educational value is also ancillary to ecological representation. Thus the range of features within a particular site largely determines its potential for educational use.

Nature appreciation is a passive use permissible in some reserves. The value of areas from this perspective is also a function of the ecological values being protected. Seldom should areas be established exclusively to satisfy this need, which is accommodated widely in other categories of protected areas.

Accessibility can become a consideration in relation to utilitarian value of an area where candidate sites comparable in other aspects are being considered. Where use pressures are high, inaccessibility might be favoured to discourage visitations. In contrast, in remote areas the most accessible sites might be favoured to facilitate research.

Administrative Considerations

Administrative considerations deal with legal and institutional aspects of creating and stewarding ecological areas, including the assessment of non-conforming competing land uses. These considerations may be wide ranging, and they often include concerns about ownership and deposition of land, land use conflicts, management costs, enforcement needs and other custodial arrangements.

As administrative considerations are imposed through the institutional framework guiding the designation of ecological areas, they are often complex, and they may vary considerably within or among different jurisdictions. Thus it is not easy to distil widely applied administrative principles concerning the selection of ecological areas.

Depending on the legal and institutional framework governing the selection of ecological areas within a particular jurisdiction, administrative considerations may be introduced at various stages in the selection process. In order that the widest range of sites are considered in selecting ecological areas, Council advocates that administrative considerations come into play at a site specific level after preferred candidate areas have been selected on an ecological basis. If introduced earlier in the planning process, administrative considerations could adversely prejudice the selection and ranking of areas to exclude significant sites deserving of consideration. This could result in inappropriate land allocation, and it could prematurely close off options from future consideration. To advert this concern, the selection of ecological areas should precede or be integrated with strategic land use planning.

PROCEDURAL CONSIDERATIONS FOR SELECTING ECOLOGICAL AREAS

Through cumulative experiences gained in assessing ecological areas in Canada and beyond, planning principles

are emerging which have proven useful in selecting and evaluating sites. These principles relate to the identification and documentation of areas, procedures for evaluating sites, and information storage and retrieval.

Area Identification and Documentation

In order that ecological areas may be evaluated and selected as objectively as possible, it is important that consistent documentation be available for each.

Beginning with the IBP/CT survey, and subsequent to its completion, some Canadian jurisdictions have found it advantageous to continue field surveys to identify and describe ecological areas for conservation purposes. With limited financial resources, assessments of necessity often are carried out on an area specific basis. Where this is the case, it is important to realize that each such study adds to the existing knowledge of the ecosystems and species' occurrence within a particular region. Consequently, it is advisable to adopt content and format standards for such studies to insure consistency and objectivity in reporting on and evaluating areas.

The information to be included in area specific status reports may vary in detail, with the minimum amount of information being dictated by the concepts and principles used in the evaluation of sites. In this regard, the considerations set out in the previous section provide a useful guide in determining the kind of information and the level of detail that ideally should be collected for each site.

As a minimum, area survey reports should include the following: adequate boundary mapping of the site; basic administrative and geographical information; a brief overview of the major biophysical features emphasizing the regional context of the area; brief descriptions of the communities within the area; preliminary mapping of communities and significant features at a suitable scale; an evaluation of the area's significance based on considerations outlined in the previous section; observations on management needs; a list of vascular plants and other groups of species; and a list of reference material including air photos, maps, technical reports and personal communications.

Regional reconnaissance surveys have proven valuable in initial area selection. Generally speaking, these are extensive surveys conducted on a regional or a thematic basis with the aim of describing the range of ecological features being sought for representation, and identifying one or more candidate sites to represent the required elements. The documentation of candidate areas is similar to that for area specific studies, although sometimes less demanding in detail because of the regional overview provided by such studies. Results of such studies should be issued as technical reports, which include a description of the region under study and a compendium of check-sheets that describe specific sites.

In completing such reports, it is advisable to adopt some widely used survey procedures, which enhance coverage and efficiency in field studies. For convenience, these procedures may be grouped into pre-field, field and post-field procedures.

Pre-field procedures include those activities necessary to prepare for field survey work and they include the following tasks: consolidation of existing published and file information, such as IBP reports, previous surveys, scientific papers and maps; review and interpretation of maps and air photos; consultation with individuals knowledgeable about the area; regional mapping of documented areas; fixed-wing aerial reconnaissance; and development of a field survey programme.

Field procedures include those activities necessary to describe and map the communities and other important ecological features within an area. The range of activities include: conducting field transects through representative areas; surveying specific communities; collecting specimens, such as vouchers of vascular plants, for later determination or confirmation; photographing communities, species and other features; and compiling check-lists of vascular plants and faunal groups for the area.

Post-field procedures entail the following tasks: synthesizing field data; verifying and determining any field collections; investigating the significance of recorded features; finalizing mapping; and manuscript preparation.

Area Evaluation

In the course of identifying and describing candidate ecological areas, various opportunities for comparable representation may arise. The range of opportunities may vary from region to region in relation to many factors: natural physiographic variation, land use practices and others. With the exception of undisputed unique features, managers are faced with having to select, preferably within a regional context, one or several areas from a pool of optional sites. Evaluation is the process involving the ranking or grading of sites for protection.

Evaluation is essential to insure that candidate areas receive a similar appraisal of their ecological significance. A common approach is especially important when areas are being documented and assessed by independent workers. Under these circumstances, objectivity is desirable to permit ongoing consideration and grading of sites in light of new information. In addition, a standardized approach provides a tool to priority rank areas so that protection efforts are concentrated on the most important sites.

Previous sections have set out the concepts and principles which can assist in assessing and selecting ecological areas. With good documentation, these constructs may be applied in several ways.

In selecting and evaluating ecological areas, it is always preferable to work from regional surveys rather than isolated site specific surveys. Regional surveys, completed to the foregoing standards, provide important context to determine to what extent representative features are incorporated into candidate areas. Moreover, regional studies should provide a firmer basis for the comparative evaluation of sites. This comparative approach allows for more confident assessments, and it also may identify optional areas where particular features may be represented.

The selection and comparative grading of areas may be carried out by individuals, solicited reviewers or advisory committees. Regardless of the approach taken, it is always desirable to involve personnel who conducted the original field studies, and any others who are intimately familiar with the areas under consideration.

Since no single individual is qualified to evaluate all the ecological, botanical, zoological and design considerations for an area, individual assessments are generally the least desirable. Wherever possible, individual perspectives and opinions should be augmented with those of others qualified to evaluate ecological areas. This can be accomplished by consulting outside experts in the course of carrying out regional or area specific investigations and through peer review of draft manuscripts reporting on such work.

Where they exist, ecological advisory committees should be involved directly in selecting and evaluating ecological areas when their members can provide a range of expertise, perspectives and continuity, which may be lacking through other approaches. Consensus-based evaluations by capable committees also may strengthen appraisals by individuals or isolated reviewers.

In evaluating sites, practitioners should be cautious of adopting rigid numerical or quantitative scoring systems based on qualitative field surveys. Numerical evaluations often provide only a false sense of objectivity, and they may not have sufficient flexibility to accommodate different regional circumstances and needs.

Information Storage and Retrieval

Systematic organization of information on ecological areas is important for long term documentation and evaluation of sites, and for sharing of information for conservation planning.

Conventional storage and retrieval of information has relied on manual file systems containing hard copy reports and mapping of areas. It is important that such information be centrally organized for archival purposes and for future reference in selecting and evaluating new sites. In addition to its direct application for these purposes, centralization can often facilitate access to the information for other land use planning and environmental

assessment work, such as corridor planning for utilities, subdivision planning, and sensitive resource allocation and development.

Manual file systems vary in their organization and may range from "shelved reports" to administratively, and preferably, geographically organized data bases. Some jurisdictions utilize the national topographical grid system as a means to organize area specific data, which can then be mapped in a complimentary atlas at various scales for ease of reference. Such a scheme is apolitical, universal in application and permanent in design. Each piece of information accessioned into such files adds to existing documentation for a region, and facilitates future application of it for site evaluations. Along with textual and map information, it is advisable to organize photographic documentation of the areas.

Voucher collections and original field notes may provide important information for evaluating areas. Wherever possible, field notes should be assembled with site files. Voucher collections of plants and other specimens should be verified or determined, and deposited in institutional collections to facilitate future reference. The National Museum of Natural Sciences, provincial museums and some universities are prepared to service such requests, and some will provide accession lists and specimen data for deposited material.

In addition to manual file data, some jurisdictions are now creating computer programmes to store and retrieve summary information on ecological areas. In order to standardize such efforts, Council encourages jurisdictions to adopt computer programmes and formats that will facilitate accession of information into its evolving national registry of ecological areas and jurisdictional reporting needs.

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FURTHER READINGS

The literature on the selection and evaluation of ecological areas for conservation is extensive and rapidly expanding. The following selected titles provide supplementary reading on a variety of perspectives, issues and approaches relating to the topic, which may be helpful to programme administrators and reserve managers.

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