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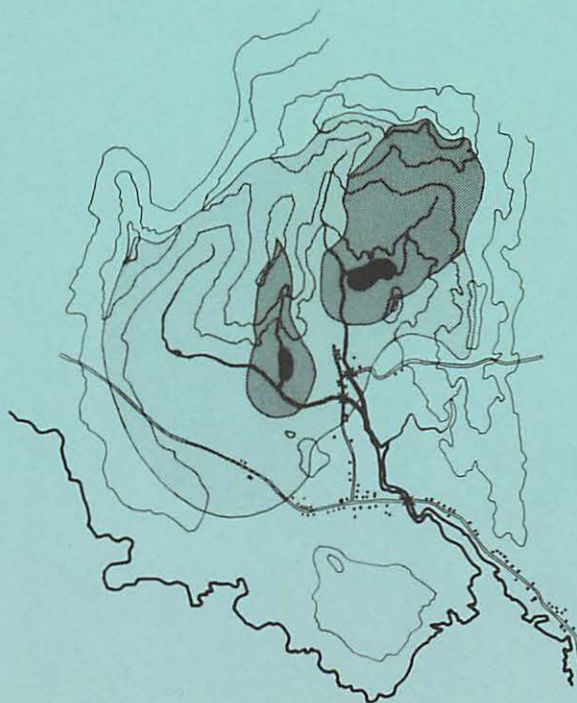
Nova Scotia Museum Complex

Curatorial Report Number 56

Planning for Ecological Reserves in Nova Scotia

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Nova Scotia Museum

Curatorial Reports

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ABSTRACT

A method is described for selecting sites as candidates for designation under the Special Places Protection Act and for planning ecological reserves in Nova Scotia. Designation implies protection: hunting, forestry, and other activities are forbidden. The method is applied to select sites that contain unique ecological features. Either an ecological feature or a particular site may be proposed for designation. The method introduces an enhanced concept of ecological reserve in order to implement conservation. This concept integrates Designated Ecological Sites (with management plans), buffer zones, and a surrounding greater management area.

The method has two stages. 1. The priority for protection of the ecological feature or proposed site is determined early to avoid delay and unnecessary expense. 2. All sites in which the ecological feature may occur or all sites similar to the proposed site are identified. The degree to which the pattern of suitability and land-use at each site can fulfill the four conservation functions of an ecological site and can satisfy management requirements determines which sites are selected as candidates for designation. The ecological reserve is planned in order to fulfill all the conservation functions.

The proposed method is compared with the methods of Gehlbach (1975) and Wright (1977). Approaches to public participation in the establishment and management of ecological reserves are suggested.

To develop, test, and illustrate the method, the Tusket River system in southwest Nova Scotia was chosen as an appropriate study area: it contains species of the coastal-plain floral element of Nova Scotia, some of which are considered as rare or endangered in Canada.

KEY WORDS

Coastal-plain flora
Designated Ecological Site
Ecological reserve
Ellenwood Lake
Gillfillan Lake
Landscape ecology

Nature conservation
Planning - ecological
Special Places Protection Act
Terrestrial ecology
Tusket River
Wilsons Lake

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Planning for Ecological Reserves in Nova Scotia

INTRODUCTION

The Special Places Protection Act, proclaimed in Nova Scotia in 1981, has the goal of protecting sites of significant ecological value. This paper describes a method for selecting candidate sites for designation, or protection under the Act. The method is designed to ensure that the candidate sites fulfill the functions that embody conservation. The method is called the "Integrating Site Selection" or ISIS Method. It presents a comprehensive, step-by-step approach to site selection.

A site of significant ecological value may contain a unique ecological feature or it may be representative of one of Nova Scotia's Theme Regions. An ecological feature is any distinct element of the natural environment: for example, a particular species, community, habitat, or ecological process. The ISIS Method described in this paper is a method to select sites containing unique ecological features. The method may be adapted for selection of representative sites as well.

In Nova Scotia, many significant ecological features have been identified; more may yet be discovered. The Nova Scotia Museum maintains a list of 80 sites which have been proposed for designation.

The ISIS Method is applied in response to a proposal to protect either a unique ecological feature or a particular site containing a unique ecological feature under the Special Places Protection Act. The method includes two stages. In the first stage of the method, the compliance of the proposal with the Act and the degree of threat bearing on the ecological feature in question are evaluated. Evaluating compliance of a proposal with the Act at an early stage can reduce the time and resources that could be spent if a detailed evaluation were carried out immediately. The degree of threat defines the priority of attention with which each feature will be addressed.

In the second stage of the ISIS Method, all sites that may contain the ecological feature in question are evaluated in order to determine which may be designated for protection under the Act. The process of evaluation integrates factors of both the natural and human environments: hence, the "Integrating Site Selection" Method. Natural factors are assessed together to indicate suitability of sites for nature conservation. Human factors are represented on a land-use map. Suitability and land-use, combined in a comprehensive map and descriptive matrix, define areas of homogeneous character. These areas are evaluated for their ability to fulfill conservation functions and to support the corresponding management requirements. The result of the evaluation process is candidate sites for designation. Buffer zones and a greater management area are planned around the candidate sites. This system constitutes an enhanced concept of the ecological reserve.

An ecological reserve - a constellation of candidate sites with buffer zones within a greater management area, accompanied by management plans - ensures that both the letter and the spirit of the Special Places Protection Act are achieved. Since human activities and natural processes outside the Designated Ecological Sites may directly or indirectly affect the ecological feature protected within, conservation of an ecological site can be successful only with appropriate management of the surrounding landscape.

This is the second reason for naming the method the Integrating Site Selection Method; application of the method yields both a landscape plan and management plans which integrate three levels of landscape management.

It is recognized that few planning efforts today are successful without public participation. In this paper, therefore, considerable attention is given to ways in which Nova Scotians could be involved in planning and managing ecological reserves.

The ISIS Method originates from traditional environmental planning methods. In this paper, the traditional methods are adapted to plan for nature conservation, a non-traditional land-use.

This paper proceeds as follows: Section 1 provides the context for the development of the ISIS Method. It reviews recent thinking and programs that are important in the establishment of ecological reserves in Nova Scotia. Section 2 surveys the class of environmental planning methods that form the basis of the ISIS Method and reviews recent contributions to the environmental planning literature that are concerned with nature conservation. Section 3 develops the rationale for ecological reserves and clarifies the values underlying the ISIS Method. Section 4 describes the method. It presents the landscape plan of an ecological reserve and both a conceptual and detailed description of the ISIS Method; it compares the ISIS Method with other methods and considers aspects of the application of the ISIS Method. Section 5 presents an example of the application of the ISIS Method in a specific test case. Section 6 explores the establishment of ecological reserves in Nova Scotia, especially public participation in the planning and management of ecological reserves. Section 7 concludes the discussion of planning. Section 8 recapitulates the highlights of the ISIS Method. The appendixes provide technical details.

1 THE CONTEXT OF PLANNING FOR ECOLOGICAL RESERVES IN NOVA SCOTIA

The Integrating Site Selection, or ISIS, Method is a method of selecting sites for, and planning, *ecological reserves** in Nova Scotia. It was developed to conform with the Special Places Protection Act on these bases: environmental planning methods, and the International Biological Programme in Nova Scotia.

1.1 Developments In Environmental Planning Methods

Environmental planning methods are applied in planning "traditional" land-uses, for example, residential, industrial, and agricultural. Environmental planning methods are responsive to the natural landscape and natural processes; that is, while planning for optimal human use of the landscape, they accommodate *environmental factors* such as slope and drainage - frequently resulting in significant savings in construction and maintenance costs. Environmental planning methods have developed over the past 40 years and have become more comprehensive. McHarg (1971) has been a prime contributor to the development.

Recently, because of increased recognition that *ecological features* are under pressure and in some cases are threatened with extinction as a result of human activities, nature *conservation* is being accepted more readily as a valid land-use. Thus, a current development is the application of environmental planning methods to nature conservation.

1.2 The International Biological Programme in Nova Scotia

The International Biological Programme (IBP) of UNESCO was "a programme adopted by 58 nations to study the biological productivity of the earth and relate this to human adaptability and welfare." (Taschereau 1974, iv). It lasted from 1964 to 1974 and was, in part, succeeded by the UNESCO Man and the Biosphere (MAB) Program. (See Taschereau 1985, 11). A major effort of the IBP was the "Conservation of Terrestrial Communities" section (IBP-CT), to "locate examples of all major ecosystems and work toward their protection as Ecological Reserves." (Taschereau 1974, Summary). In Nova Scotia, 69 sites of significant ecological value were proposed for "Ecological Reserves" between 1964 and 1974; subsequently, 11 were added to the list at the Nova Scotia Museum.

* In this paper, the first use of every term defined in the Glossary is in *bold italics*.

1.3 The Special Places Protection Act

In Canada, nine provinces have introduced legislation to *protect* sites of significant ecological value.

In Nova Scotia, the Special Places Protection Act was assented to in 1980 and proclaimed in 1981. The Act "provides for the preservation, protection, regulation, acquisition and study of ecological sites..." (S.N.S. 1980, ch. 17, s. 3b). The term *designated* is used to indicate a site that is protected under this Act. The Nova Scotia Museum is the provincial agency empowered to administer the Act. The Special Places Protection Act resulted directly, although not uniquely, from the International Biological Programme in Nova Scotia.

2 LITERATURE REVIEW

Land suitability analysis is one class of environmental planning methods. In this section, six theoretical methods of land suitability analysis are summarized. Subsequently, two published methods for assessing and selecting sites for ecological reserves are summarized and discussed in the context of the six theoretical methods.

The concept of the biosphere reserve is also relevant to ecological reserves. This concept is an approach to nature conservation introduced by UNESCO's Man and the Biosphere programme in 1971. Certain aspects of biosphere reserves are reviewed.

2.1 Environmental Planning Methods

The variety of natural and social situations in which people work and play requires the planner to address planning "problems" with flexibility - and select the most appropriate planning methods. However, "methods do not have to be used in their totality. (Planners) can draw on the strong features of each in conducting their work, leaving out the less desirable characteristics" (McAllister 1980, 261).

Evaluation methods are a class of environmental planning methods which permit the planner to select among alternative designs for a proposed project. Some evaluation methods are well known including cost-benefit analysis, energy analysis, the planning balance sheet, and environmental impact assessment.

Land suitability analysis is a class of environmental planning methods which permit the planner to identify alternative sites for a proposed project while the design process is in an early stage, and subsequently, to define the boundaries and zones of the site or the precise locations of any construction. The initial objective of the ISIS Method is to identify all possible sites for designation. Thus, land suitability analysis would be the class of methods on which to draw.

2.2 Six Theoretical Methods of Land Suitability Analysis

2.2.1 Purpose of a land suitability analysis

The purpose of a land suitability analysis is "to delineate the relative suitability of each location in the planning jurisdiction for various types of urban development and subsequent urban activity, based on the environmental implications of their occurrence in conjunction with the environmental characteristics existing at that location. The central assumption is that a location's natural environmental characteristics render the site inherently more suitable for some land uses than for others." (Chapin and Kaiser 1979, 291). A land suitability analysis can equally be used to delineate the relative suitability of a location for rural development or for purely ecological goals (eg. nature conservation).

2.2.2 General description of methods of land suitability analysis

The methods "all identify polygons of land that are homogenous in the relevant environmental attributes and then employ some procedure to rate the suitability of these polygons for one or more land uses based on one or more environmental considerations" (Chapin and Kaiser 1979, 306).

2.2.3 Six theoretical methods of land suitability analysis

The methods are as follows (after Hopkins 1977 and Chapin and Kaiser 1979, 308-314):

(a) Ordinal Combination

Procedure: In grid or irregular polygons, map the location and extent of each *category* of each environmental factor (use a standard base map and one copy of it for each factor). Assign a value - either a shade of grey or a number - that "indicates the relative suitability of each category of each environmental factor for each...land use" under consideration (Chapin and Kaiser 1979, 310). Combine the values by overlaying the factor maps or summing the numbers.

Result: A suitability map with polygons having a range of values 0 to N indicating the preferred location for the land use.

Advantages of this Method: The hand operation of overlaying maps (or the arithmetical equivalent of summing numbers) is a technique that is simple and inexpensive.

Disadvantages of this Method: 1. Assigning values requires expert judgement. 2. The values assigned are developed on an ordinal scale. "While the (algebraic) operation (of addition of ordinal numbers) is not mathematically valid, it seems to yield reasonable results" (J. Zuck *in litt.* 3/86). 3. Independence of factors is assumed.

(b) Linear Combination

Procedure: As in 2.2.3(a), except that the raw values are assigned on an interval scale. They are then weighted in an attempt to convert them all to the same scale.

Result: As in 2.2.3(a).

Advantages of this Method: This method requires one more operation than ordinal combination, but it is still fairly simple and inexpensive. In theory, weighting the various interval scales allows a valid addition operation.

Disadvantages of this Method: 1. Assigning values requires expert judgement. 2. Linear combination "assumes that 'raw values' are found on an interval scale and that appropriate weights convert the various value sets to the same scale. (This is) rarely, if ever, the case" (J. Zuck *ibid.*). 3. Independence of factors is assumed. 4. "Ordinal combination and linear combination yield grand scores - numbers that convey little of the rich meaning of analysis" (*ibid.*).

(c) Non-linear Combination

Procedure: As in ordinal combination but non-linear mathematical functions are used instead of addition to generate suitability values.

Result: As in 2.2.3(a).

Advantages of this Method: This method responds to the interrelationships among environmental factors.

Disadvantages of this Method: In general, interaction among factors "is rarely sufficiently understood or simple enough to be represented confidently by a mathematical function" (Chapin and Kaiser 1979, 312). As a result, such modelling is at present limited to natural processes like runoff or erosion.

(d) Factor Combination

Procedure: Map the location and extent of each category of each environmental factor (as in ordinal combination). Draw "a code sheet...by placing a piece of tracing paper on each of the factor maps in succession, outlining areas bounding each (category), and identifying them with a sequential code of letters or numbers" (Hopkins 1977, 395). Describe and evaluate (by assigning a numerical or narrative value) each area or polygon to indicate its suitability for the land use under consideration.

Result: As in 2.2.3(a).

Advantages of this Method: 1. "The final synthesis need not be a 'grand score' but a list of characteristics that is easier to understand and communicate" (J. Zuck *ibid.*). 2. This method may respond to the interrelationships among factors.

Disadvantages of this Method: 1. Descriptions of, and values assigned to, the polygons require expert judgement. 2. "It is unfeasible when more than a very few factors and categories are involved" (Chapin and Kaiser 1979, 313).

(e) **Rules of Combination**
(see Figure 2.1)

Procedure: Map the location and extent of each category of each environmental factor (as in ordinal combination). Draw "a code sheet...by placing a piece of tracing paper on each of the factor maps in succession, outlining areas bounding each (category), and identifying them with a sequential code of letters or numbers...This paint-by-number sheet is then printed as a base map for drawing suitability maps for various land use activities. However, instead of developing suitabilities through implicit judgement of each of the combinations at this stage, as in the factor combination method, a set of explicit rules of combination is now developed" (Hopkins 1977, 395). An example of a rule may be "Wherever factor A is in category 1 and factor B is in category 3, the land is rated good for agriculture."

Result: A suitability map with polygons having the values indicated by the rules.

Advantages of this Method: 1. "The rules assign suitabilities to sets of combinations of (categories) rather than to single combinations...; it is then not necessary to evaluate each combination separately as in the factor combination method. (2. The rules) are expressed in terms of verbal logic rather than in terms of numbers and arithmetic; (it is then not) necessary to find a precise mathematical statement of the relationships among factors as in the non-linear combination method. (3.) The rules are explicit and thus subject to scrutiny. (Statements of logic are often more easily understood than mathematical formulations.) (4.) The rules, if carefully devised, can also handle interdependence among factors" (Hopkins 1977, 395).

Disadvantages of this Method: Rules must be devised with care. This may require several revisions of the original rules statements: this may be quite time-consuming.

(f) **Combined Approach**

Procedure: Combine those basic environmental factors which can be combined by linear combination or non-linear combination to yield derived factors (for example, erosion may result from the combination of wind speed and soil type). Combine derived and other factors by rules of combination.

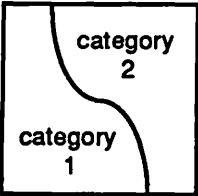
Result: As in 2.2.3(e).

Advantages of this Method: This method has the advantages of linear combination, non-linear combination, and rules of combination.

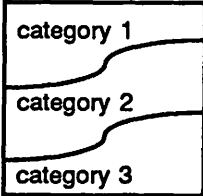
Figure 2.1: Rules of combination method of land suitability analysis (after Hopkins 1977 and Chapin and Kaiser 1979. see 2.2.3.e)

STEP 1
Map the location and extent of each category of each environmental factor

Factor A

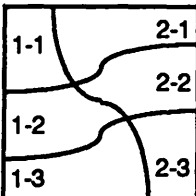


Factor B



STEP 2
Draw a code sheet by placing a piece of tracing paper on each of the factor maps in succession, outlining areas bounding each category, and identifying them with a sequential code of numbers.

Code Sheet



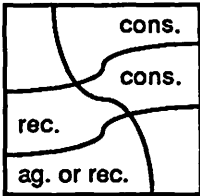
STEP 3
Develop rules to identify suitabilities.

| | Factor A | B |
|--------------|--|-------------------------------------|
| Land-use | | |
| Agriculture | suitable in category 1 only | suitable in category 3 only |
| Recreation | suitable in category 1 suitable with restrictions in category 2 | suitable in categories 2 and 3 only |
| Conservation | suitable in category 2 | suitable in categories 1 and 2 only |

STEP 4
Identify the suitabilities of each area or "polygon" for each land-use.

| | Land-use Ag. | Rec. | Cons. |
|-------|--------------|-------|-------|
| Areas | | | |
| 1-1 | no | no | no |
| 1-2 | no | yes | no |
| 1-3 | yes | yes | no |
| 2-1 | no | no | yes |
| 2-2 | no | maybe | yes |
| 2-3 | no | maybe | no |

STEP 5
Map suitabilities.



Disadvantages of this Method: This method is a sophisticated modelling technique and hence may be difficult to use in all situations.

2.3 Two Published Methods for Selecting Sites for Ecological Reserves

2.3.1 "Investigation, Evaluation and Priority Ranking of Natural Areas" (Gehlbach 1975)

Summary of Gehlbach method:

- (a) A method to provide standardized quantitative data on the *physiognomy* of an area:
"With a guide to community-type identification in hand, ...transect counts or measurements of individuals per species or lineal coverage per species...are easily accomplished by amateurs without special equipment" (Gehlbach 1974, 80).
- (b) A method to identify community-types:
The survey (transect) data are interpreted as follows: "a community-type is determined from the tallest and most abundant plants tallied...Species or genera represented by 20% or more of transect individuals or lineal coverage...further describe a natural area" (Gehlbach 1975, 81).
- (c) A scheme for the evaluation and priority ranking of a site for acquisition by a conservation organization:
The scheme "considers the pervasive influence of man together with the features of natural communities...Commonness and diversity...are interrelated and hence joined under community representation...

Numerical values are given to five features of natural areas in order of their importance to natural area preservation (see Table 2.1). Under each feature, categories of that feature are ranked from least to most important and given values accordingly. A natural area score is obtained by multiplying each feature value by its appropriate category value and adding the products.

The major innovations of the...scheme are (1) its brevity, and hence utility; (2) that in part it derives from a standard inventory; and (3) that it contributes to a priority ranking scheme that can use additive or multiplicative scoring of weighted or non-weighted features" (Gehlbach 1975, 83-84).

Table 2.1: Gehlbach's table of environmental factors ("features") and categories "to be considered in evaluating natural areas, listed from least [numeric value = 1] to most [5] important." (after Gehlbach 1975, 84)

| | <i>Features and categories (Numerical value)</i> | <i>Considerations</i> |
|------|---|--|
| I. | HERITAGE VALUE (1) A. Late seral stage (1) B. Climax condition (2) | Presettlement landscape; either approximating the climax or in virgin condition. |
| II. | EDUCATIONAL UTILITY(2) A. One special feature (1) B. Two special features (2) C. Three or more special features (3) | Size sufficient for protection (includes buffer zones) or manipulation; history of study; present study, accessibility, demonstration value, etc. |
| III. | SPECIES SIGNIFICANCE (3) A. Peripheral species, hybrid zones (1) B. Rare, relict, or endemic species (2) C. Endangered species (3) | Status in world, North America, and Texas, in this order, for evaluating rarity and endangerment; Texas alone for evaluating other categories. |
| IV. | COMMUNITY REPRESENTATION (4) A. Two or more community-types (1) B. Community or dominance-types novel to preservation system (2) C. Localised or relict, novel types (3) | Diversity with attention to localised or relict situations; geographic variants of a type, and coverage of existing preservation system. |
| V. | HUMAN IMPACT (5) A. Possible but not imminent (1) B. Imminent ie. planned (2) C. In progress but features salvageable through succession with management (3) | Degree of damage; nature of succession based on relative stress of physical environment; and suitability of restorative processes, either natural or cultural, if protection afforded. |

2.3.2 "A Site Evaluation Scheme for Use in the Assessment of Potential Natural Reserves" (Wright 1977)

Summary of Wright method:

(a) A method for systematic site survey:
"The collection of site information and the scoring for evaluation are made on standardized cards." (Wright 1977, 297). Each card has places to enter data on site location and land tenure, geology, soils, topography, habitats present, flora, fauna, human disturbance, and management. The back of the card is to be used for sketch maps and additional notes. Extensive explanatory notes are provided for use with the survey card. Wright does not favour, as Gehlbach does, any one particular technique to collect data as long as it is "as comprehensive as possible within the time available" (ibid.).

(b) A site evaluation scheme:
Environmental factors ("evaluation criteria") are grouped under four main headings, as follows (see Table 2.2):

Scientific Appraisal: For example, information on ecosystems, and habitats.

Management Appraisal: For example, access to site, and availability for purchase.

Assessment of Educational Use: Suitability for use by various levels of education.

Assessment of Amenity Use: Public enjoyment potential (partly duplicates management appraisal).

Each evaluation criterion is assigned a score from 1 (low value) to 3 (high value). The scores are summed under each heading, yielding four total scores.

Management criteria, potential educational use, and potential amenity use are assessed separately because:

1. (Management) "Conservation organizations with limited money, manpower, and other management resources are frequently faced with a problem of selecting sites of approximately equal scientific value".
2. (Education) "As educational use...and scientific value may conflict it appears inappropriate to include both in the same total".

Table 2.2: Wright's table of environmental factors ("evaluation criteria") and its scoring system (after Wright 1977, 300)

| | | | |
|--|--|-------------------------|------------------|
| <i>Name of site:</i> | | <i>Grid ref:</i> | |
| Scoring system. Score 1 for low value; 2 for moderate value; 3 for very high value (see also explanation notes). Mark 'X' if factor does not apply or if no information available. | | | |
| DO NOT LEAVE BLANK | | | |
| | | | SCORE |
| I. SCIENTIFIC APPRAISAL | | | |
| 01 | Representativeness of ecosystem | | |
| 02 | Representativeness of geological region | | |
| 03 | Habitat diversity | | |
| 04 | Community diversity | | |
| 05 | Species diversity | | |
| 06 | Species rarity | | |
| 07 | Landscape category | | |
| 08 | Sensitivity to disturbance | | |
| 09 | Recorded history | | |
| 10 | | TOTAL (max. 27): | Per cent: |
| II. MANAGEMENT APPRAISAL | | | |
| 11 | Access to site | | |
| 12 | Boundaries | | |
| 13 | Availability | | |
| 14 | Security of tenure | | |
| 15 | Liabilities | | |
| 16 | Manpower | | |
| 17 | Cost | | |
| 18 | Special | | |
| 19 | | TOTAL (max. 24): | Per cent: |
| 20 | ASSESSMENT OF EDUCATIONAL USE | | |
| 21 | ASSESSMENT OF AMENITY USE | | |
| 22 | ASSESSMENT BY CO-ORDINATOR | | |
| 23 | ACTION: Defer: Immediate (purchase/lease/agreement) | | |

3. (Amenity) "Many nature reserves serve an important amenity function since they are places where the public can enjoy scenery and wildlife" (Wright 1977, 296).

The overall site assessment (a fifth heading) is an "assessment by (the) coordinator": on the bases of the scores from each of the four main headings, by expert judgement, a score from 1 to 3 is assigned to the site:

- "1. Low priority site. Low scientific value. Management problems likely. Possible conflict of use.
2. Medium priority site. Good scientific value. One or two management problems possible. Conflict of use unlikely.
3. Top priority site. High scientific value. Attractive site. No major management problems. Available for selection or alternative protection" (Wright 1977, 303).

The final assessment (a sixth heading) is a decision on action about the site.

2.3.3 Discussion

- (a) Data collected for the environmental factors are ordinal; each scheme is an ordinal combination method of land suitability analysis. A site proposed for acquisition is assigned a rank on the basis of the degree to which it meets each of the criteria (factors) in the ranking scheme.
- (b) Category values and factor weights are assigned by expert judgement; in Gehlbach's scheme, the reasoning is made explicit.
- (c) The application of each scheme yields results that are suggestive rather than definitive for the following reasons:
 1. Ordinal combination is unable to evaluate effectively the interrelationships among factors. In other words, ordinal combination poorly represents interactions in an ecosystem.
 2. The addition of ordinal numbers in the ordinal combination method of land suitability analysis is not mathematically valid.

Gehlbach considers various ways of manipulating his numbers. This is in an effort, it seems, to achieve the results which Gehlbach's appraisal of the territory tells him to be the correct results.

- (d) Each scheme can be applied to compare sites containing the same ecological feature. If only one site is evaluated in isolation, sites of equal or higher quality may be missed.
- (e) For each ecological feature and in every biogeographic region (for example, a Theme Region), a different category weighting system may be necessary. Wright acknowledges that the "basic weakness of any non-objective system including the one presented (is) manipulation (of) weightings given to the criteria (ie. the environmental factors) and the gradings (ie. the categories)" (Wright 1977, 305).
- (f) There appears to be an inherent conflict in Gehlbach's ranking scheme; for example, if damage is in progress, would not community representation or number of species present be reduced, resulting in a lower site ranking? In other words, Gehlbach's goal is to create a concise scheme for ranking the site for priority for acquisition, but the scheme described includes, effectively, both high site quality and low site quality as reasons for acquisition.

2.4 Biosphere Reserves - Relevant Aspects

2.4.1 Biosphere reserve - definition

A biosphere reserve is a "well-defined territorial unit" established "to ensure the conservation of (a) site representative of (one of) the world's principle ecosystems" (Maldague 1981, 8,5). However, "matters relating to human populations are an integral part of biosphere reserve stewardship" (ibid). A world-wide network of biosphere reserves was recommended by The International Coordinating Council of the Man and Biosphere Programme (itself launched by UNESCO in November 1970) at its first meeting in November 1971.

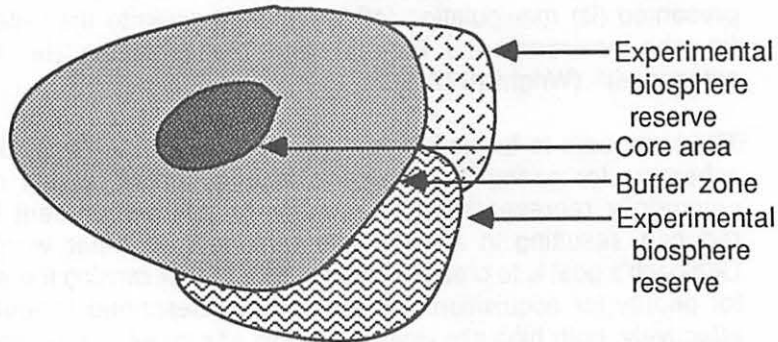
2.4.2 Difference between a biosphere reserve and an ecological reserve

A biosphere reserve is not an ecological reserve. Taschereau remarks that "the emphasis (in biosphere reserves) is on active use of the reserves for monitoring and research, education and training. Representative ecosystems are preferred to those which are rare or unique. This facilitates the extrapolation of research results to broadly comparable sites in other parts of the world...This use of a reserve is in sharp contrast to that of an Ecological Reserve where human influence is kept to a minimum and only non-manipulative research is permitted" (Taschereau 1985, 10).

2.4.3 The landscape plan ("layout") of biosphere reserves

(a) "Typical layout" (see Figure 2.2)

Figure 2.2: "Typical layout" of a biosphere reserve (after Maldague 1981, 23)



Core area of the biosphere reserve: "... a protected area, kept in as natural a state as possible, which is representative of a natural ecosystem,...if possible in its climax state..., and where animal and plant species can continuously evolve. It should be arranged in such a way that human intervention is reduced to a minimum... Consequently, research, education and training activities conducted in the core area must be strictly regulated" (Maldague 1981, 17).

Buffer zone: Serves "to isolate the core area from external influences" (ibid.,18).

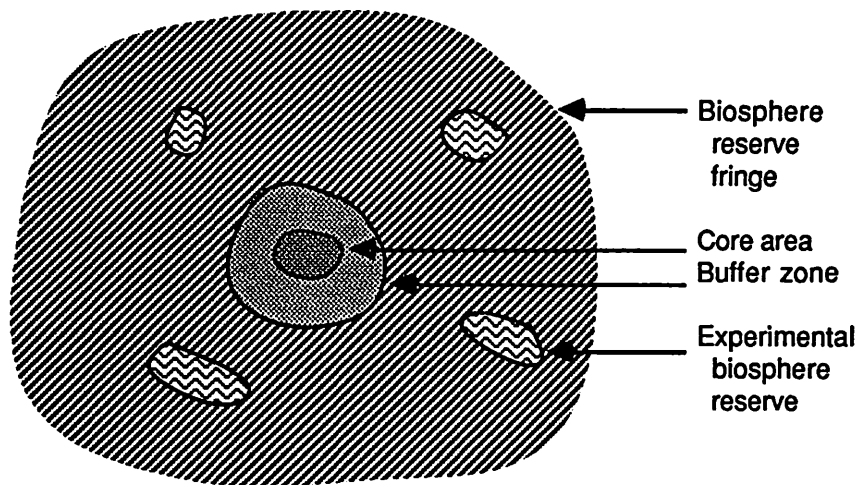
Experimental biosphere reserve: "Experimental biosphere reserves (EBR) can be regarded as field laboratories where a great variety of research can be carried out on the overall environment and the different activities involved there. Comparative studies of different disturbances caused by man may be conducted. A carefully established EBR network could provide a means of ascertaining the rate of both quantitative and qualitative modifications, revealing, by reference to the conditions existing in the natural ecosystem, the correlation between the pressure exercised upon a particular environment and the resulting deteriorations, together with the factors - resistance of the biophysical environment, human intervention, etc. - affecting it" (ibid., 21).

Research and experiments might be passive and observational or they might be interventionist and manipulative.

"Inhabited zones: Some biosphere reserves contain inhabitants while others are located near heavily populated areas. In all such cases, it is not only important, but essential that the population concerned be consulted about any decision relating to the management of the biosphere reserve. The participation of the population is a *sine qua non* for the success of biosphere reserves" (ibid., 20).

(b) The "cluster of biosphere reserves" (see Figure 2.3)

Figure 2.3: The "cluster of biosphere reserves" (after Maldague 1981, 23)



"Cases may arise where the context - i.e. the geographical situation, land use patterns, habitat distribution, etc., - does not allow experiment areas to be included in the buffer zone of a biosphere reserve... In such circumstances experimental biosphere reserves have to be established in the vicinity of the biosphere reserve proper" (ibid.).

Biosphere reserve fringe: "Between the core area surrounded by its buffer zone and the experimental reserves is an area known as the biosphere reserve fringe" (Maldague 1981, 22).

"The cluster of biosphere reserves is often the most suitable system for ensuring that the various functions of the biosphere reserve are fulfilled. . . (and) provides the most faithful reflection of regional ecological variability" (ibid.).

2.4.4 Size of a biosphere reserve

"A biosphere reserve should be extensive enough to form a conservation unit that can maintain itself in a state of self-regulating dynamic equilibrium. Different types of land use should also be able to coexist without conflict" (ibid., 11).

2.4.5 Discussion

- (a) The "typical layout" addresses the fact that habitats shift geographically over time. However, this layout may not respond adequately to infectious diseases or fire which can sweep through a contiguous area.
- (b) A biosphere reserve with the typical layout would need to be very large to be accepted by international UNESCO standards; however, a modified form, similar to the reserve at Mont. St.-Hilaire in Quebec, might be quite successful in Nova Scotia.
- (c) The location of an inhabited zone with respect to the core area, buffer zone, or experimental area of a biosphere reserve is not indicated. One possibility is that an inhabited zone would occupy a position similar to that of the experimental biosphere reserves.
- (d) In the "cluster of biosphere reserves", Maldague proposes a "biosphere reserve fringe" but does not describe its purposes: it appears only as the area between core reserve and experimental reserves. However, this territory may have a very important function: broad protection of the core area...Perhaps Maldague recognized this implicitly.

2.5 Conclusions

- (a) In the combined approach method of land suitability analysis, Hopkins (1977) and Chapin and Kaiser (1979) introduce the use of the rules of combination method in conjunction with linear or non-linear combination but not factor combination. This is probably because of the apparent unreliability of the factor combination method. However, if the factor combination synthesis is carefully carried out, it can complement rules of combination in the combined approach.

Because of its advantages, the combined approach appears to be the most appropriate method for selecting candidate ecological sites in Nova Scotia.

- (b) Both Gehlbach and Wright manipulate natural factors and human factors - including "threat" - in their methods for selecting sites for ecological reserves. Whereas some of the factors are relevant in the selection of ecological sites and the planning of ecological reserves in Nova Scotia, the methods as a whole are unsatisfactory in that they are unable to meet all the requirements of identifying candidate sites.

- (c) **The biosphere reserve concept introduces the idea that individuals can carry on their daily business within a territory specifically devoted to conservation. The biosphere reserve concept also illustrates a landscape plan ("layout") of a reserve containing various zones. Both of these ideas may be readily applied in planning ecological reserves in Nova Scotia.**



3 RATIONALE FOR ECOLOGICAL RESERVES IN NOVA SCOTIA

Conservation, in all of its physical, social, and legal aspects, must respond to change in the natural and human environments. At present, a common but misleading notion of landscape conservation considers it as a process of restriction. Landscape conservation is understood to isolate territory in some way from local human settlements; the territory might even be fenced off. However, a policy of territory isolation to implement conservation goals cannot be successful over an extended period of time. For example, natural pressures may cause the ecological feature originally inside the territory to shift beyond the legal fence; or implementation of an altered system of land tenure may lead to vandalism. The ISIS Method proposes an enhanced concept of an ecological reserve as an effective method to ensure the success of conservation efforts.

3.1 The Natural and Human Landscape

3.1.1 The natural landscape and human activity

The natural landscape is defined as "the surface of the earth with all its phenomena" (Vink 1984, 13), including lands and waters, flora and fauna. In most places in the world, the natural landscape has been modified by human activities to a greater or lesser degree.

3.1.2 Changing character of the natural landscape and of human communities

The natural landscape is in a state of flux. Change may be perceived as gradual; for example, the course of a river might shift. In contrast, change may be perceived as sudden; for example, "shocks" such as earthquakes.

Human communities are in a state of flux. Change may be perceived as gradual; for example, settlements may grow or decline. Alternatively, change may be perceived as sudden; for example, "shocks" such as result from the construction of a causeway.

As a result of natural and human changes, the geographic location and extent of an ecological feature may shift with time.

3.2 Conservation

3.2.1 Definition

According to Webster, the term *conservation* implies "official maintenance and supervision, as of natural resources", while *preservation* implies "to keep up and reserve for personal or special use; as to preserve a stream for

fishing". In this regard, the Special Places Protection Act uses *preservation*, not *conservation*. However, organizations such as the International Union for the Conservation of Nature participate in programs that encompass both sorts of activities; and certainly the *World Conservation Strategy* encompasses both.

In this paper, conservation should be understood to refer to non-intrusive reservation of sites as well as more active management programs. Conservation also implies activities such as education and research which may enhance awareness and appreciation of the Nova Scotia landscape.

3.2.2 Social value of conservation

It is of value to conserve and protect the natural landscape for the following reasons:

- (a) "Our continued existence depends on the workings of these complex (eco-)systems" (Taschereau 1985, 105). For example, the natural landscape supports agriculture.
- (b) The natural landscape provides us with the environment for health and well-being (see for example McHarg 1971, 4-5).
- (c) The natural landscape is our heritage and provides us, in part, with our identity as Nova Scotians and as Canadians.
- (d) The natural landscape provides us with important opportunity for recreation.
- (e) "We are beginning to treat the earth as a sort of household pet, living in an environment invented by us, part kitchen-garden, part park, part zoo. It is an idea we must rid ourselves of soon, for it is not so, it is the other way round. We are not separate beings. We are a living part of the earth's life, owned and operated by the earth, probably specialized for functions on its behalf that we have not yet glimpsed. Conceivably, and this is the best thought I have about us, we might turn out to be a sort of sense-organ for the whole creature, a set of eyes, even a storage place for thought...We may be the greatest and brainiest of all biological opportunists on the planet, but we owe debts of long standing to the beings that came before us, and to those that now surround us and will help us along into the future" (Thomas 1984).

3.2.3 Effective conservation of the natural landscape in Nova Scotia

- (a) Nova Scotians' attitudes, reflected in their activities, in general have more widespread and longer-lasting impacts on the natural landscape than do large industrial projects: the impacts of such "megaprojects" may be acute but they are usually localized and of relatively short duration. Thus, only the commitment of each

Nova Scotian to conserve and protect the natural landscape of Nova Scotia will ensure its prosperity.

- (b) To enhance Nova Scotians' awareness of the natural landscape, ecological reserves, wilderness parks, and wildlife sanctuaries may:
1. provide information to the public,
 2. demonstrate alternative approaches to conservation,
 3. conserve specific territories or ecological features.
- However, only ecological reserves have the goals of conserving and protecting ecosystems.

3.3 Ecological Reserves

The Special Places Protection Act provides both for the designation of particular sites of significant ecological value and generally for the conservation of ecosystems. This paper proposes that an enhanced concept of an ecological reserve may be an effective vehicle for achieving both these purposes, even though the term *ecological reserve* is not specified in the legislation.

An ecological reserve in Nova Scotia, as proposed in this paper, is constituted by a constellation of Designated Ecological Sites, each with a surrounding buffer zone, and all within a greater management area. An ecological reserve offers the following advantages:

- (a) An ecological reserve ensures that all the functions that embody conservation will be fulfilled. Each Site in an ecological reserve has a particular pattern of suitability and land-use characteristics and therefore may fulfill a function different than each of the other Sites; but together, all the Sites may fulfill all the functions.
- (b) An ecological reserve ensures that the natural processes which are optimum for the ecological feature of concern in the Designated Ecological sites are conserved in the greater management area. An ecological reserve ensures that settlement, resource development, and agriculture can carry on in the vicinity of the Sites.
- (c) An ecological reserve ensures long-term conservation of the Nova Scotian landscape. Nova Scotians, especially local residents, are encouraged to participate in the planning and management of an ecological reserve. Corporations whose resource development lies within an ecological reserve may benefit from positive public relations arising from involvement or support in the planning and management of an ecological reserve.
- (d) In general, the advantages of an ecological reserve include stability (resistance to shocks) and flexibility (responsiveness to long-term stresses).



4 THE ISIS METHOD OF SITE SELECTION AND ECOLOGICAL RESERVE PLANNING

The first part of this section illustrates the landscape plan of an ecological reserve. Then a conceptual description of the ISIS Method precedes a detailed, operation-by-operation description. In summary and conclusion, the ISIS Method is compared with the methods of Gehlbach and Wright. Finally, aspects of the application of the ISIS Method are considered.

4.1 Landscape Plan of an Ecological Reserve

4.1.1 Landscape plan of an ecological reserve (see Figure 4.1)

An ecological reserve in Nova Scotia should consist of the following:

- (a) a "constellation" of several Designated Ecological Sites (which may or may not be contiguous) in which the protected ecological feature is located; a constellation because:
 - 1. the highest quality sites may not be contiguous, and
 - 2. a local event which disturbs one site may not disturb a relatively distant site.

- (b) a buffer zone of varying width that surrounds each Designated Ecological Site to:
 - 1. permit the natural shifting of the ecological feature, and
 - 2. protect the ecological feature from "mechanical" damage eg. from trampling, all-terrain vehicles (ATVs), tree felling.

- (c) a greater management area in which the Designated Ecological Sites are located. In the greater management area, environmental performance standards protect the ecological feature from "invisible" damage while permitting resource and building development. Invisible damage may result from, for example, sprayed pesticides and chemical fertilizers.

4.1.2 Types of Designated Ecological Sites

Two types of ecological sites are recommended for Nova Scotia. The first type is intended to conserve and protect areas representative of Nova Scotia's Natural History *Theme Regions*. The second type is intended to conserve and protect unique ecological features. To select sites of the first type, *representative sites*, a method may be devised to study systematically the territory of each Natural History Theme Region in Nova

Scotia and then to select "best" or highest *quality* sites within that territory. To select sites of the second type, *feature sites*, this paper proposes a method to assess both the unique character of, and threat to, any ecological feature or any site already proposed for designation.

4.2 Summary Description of the ISIS Method

The ISIS Method has two stages. The first stage identifies the urgency of a proposal. The second stage develops the procedures of site selection and ecological reserve planning.

4.2.1 Stage I

Stage I is a method to:

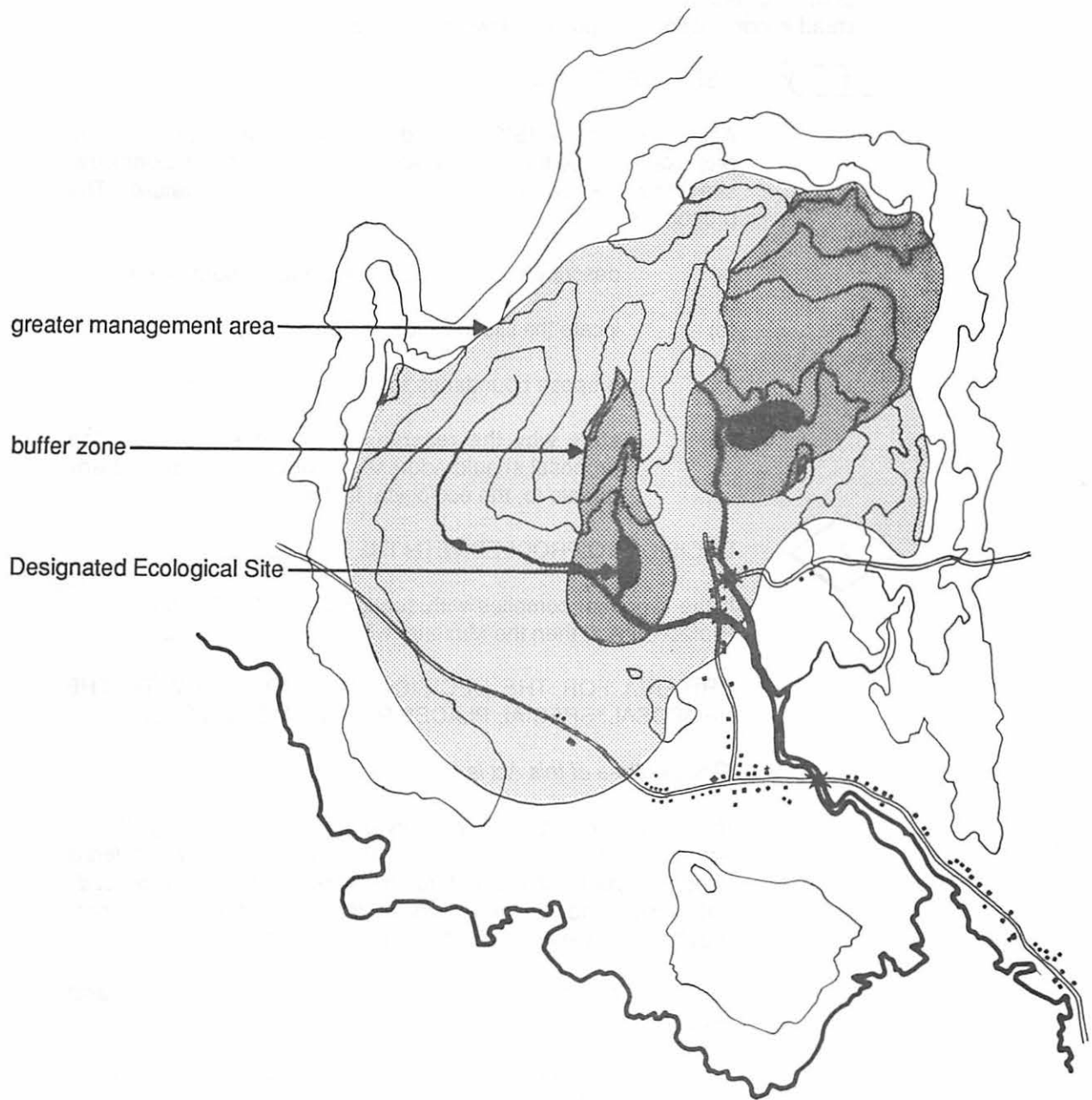
- (a) evaluate an ecological feature or proposed site for compliance with the Special Places Protection Act prior to a significant expenditure of resources and time.
- (b) determine the priority which the ecological feature or proposed site should have for conservation and protection.

4.2.2 Stage II

Stage II is a method to:

- (a) identify all sites in which the ecological feature may occur or to identify all sites similar to the proposed site (*possible sites*). Possible sites are identified by overlaying maps according to the combined approach method of land suitability analysis.
- (b) carry out field studies of each of these sites and identify suitable sites. The site is called a *suitable site* if the ecological feature is found in the predicted location.
- (c) select *candidate sites*, assign the *functions*, and outline preliminary management plans for each. Candidate sites are identified according to the factor combination method of land suitability analysis including a second map overlaying and the development of a factor combination matrix. Because only two environmental factors are involved, this method of land suitability analysis can be successful.
- (d) complete the plan of the ecological reserve by delimiting a buffer zone for each candidate site and by outlining a *greater management area* with *environmental performance standards* for human activities within it. The greater management area is identified by outlining the area which

Figure 4.1: Schematic landscape plan of an ecological reserve in Nova Scotia
Scale: approximately 1:50,000 or 1cm.~1km.



includes all the territories in which the environmental factors closely or uniquely associated with the ecological feature operate.

4.3 Detailed Description of the ISIS Method

- 4.3.1 Stage I - to determine compliance with the Special Places Protection Act and priority for protection
(read in conjunction with pull-out flowchart Figure A.1 in Appendix 5)

1

RESERVE PROPOSAL

Application of the ISIS Method begins with a proposal. The proposal could be for a unique ecological feature or for a particular site which is known to contain a unique ecological feature. The proposal should:

- (a) describe the ecological feature to be conserved;
- (b) locate the site in words and on a map;
- (c) propose boundaries for the ecological site;
- (d) state why the reserve should be established: the proposal should address the uniqueness of, and any threats to, the ecological feature.

2

DECISION TO PROCEED WITH THE PROPOSAL

If the proposal complies with section 3b of the Special Places Protection Act, then the Museum will proceed with the proposal.

CRITERIA FOR THE DECISION TO PROCEED WITH THE PROPOSAL: SPECIAL PLACES PROTECTION ACT s.3b

"The purpose of this Act is...

(b) to provide for the preservation, protection, regulation, acquisition and study of ecological sites which are considered important parts of the natural heritage of the Province and, notwithstanding the generality of the foregoing, to preserve, regulate, acquire and study those ecological sites

(i) that are suitable for scientific research and educational purposes,

(ii) that are representative examples of natural ecosystems within the Province,

(iii) that serve as examples of ecosystems that have been modified by man and that offer an opportunity to study the natural recovery of ecosystems from such modification,

(iv) that contain rare or endangered native plants or animals in their natural habitats,

(v) that provide educational or research field areas for the long-term study of natural changes and balancing forces in undisturbed ecosystems..." (S.N.S.1980, c.17, s. 3b).



3

DECISION TO FORWARD THE PROPOSAL TO ANOTHER AGENCY

If the ecological feature or proposed site does not comply with the requirements of the Special Places Protection Act but is of sufficient interest for another land tenure system (eg. a Provincial Park), then the proposal and its related information should be forwarded to the appropriate agency or organization for their consideration.



4

SOME AGENCIES INTERESTED IN SIGNIFICANT SITES

Appropriate agencies might include the Parks and Recreation Division, Nova Scotia Department of Lands and Forests; the local municipality; Parks Canada; the Nature Conservancy of Canada or other private organizations.



5

TERMINATE CONSIDERATION OF THE PROPOSAL

If the ecological feature or proposed site does not comply with the requirements of the Special Places Protection Act and if it is not of sufficient interest for consideration by another agency or organization, consideration of the proposal by the Museum should be terminated and its related documents should be kept for later decision-making needs.



6

DETERMINE THE PRIORITY FOR PROTECTION OF THE ECOLOGICAL FEATURE OR PROPOSED SITE

An ecological feature or site which complies with the Special Places Protection Act and which faces a high degree of threat will have a high priority for conservation and protection action. Gehlbach (1975, 84) identifies three levels of threat: possible, imminent (ie. planned), or in progress. However, the existence of ecological reserves, provincial parks, or other land tenures which protect similar ecological features and/or the existence of major land-use or other conflicts may modify this priority (after Quebec 1981, 6).

If a proposal is determined to have a high priority, then planning of the ecological reserve proceeds in Stage II. An ecological feature or site which complies with the Act but which is relatively secure (unthreatened) may be considered at a later date.

By considering threat early in the assessment of a proposal, the Nova Scotia Museum can move quickly to protect a significant ecological feature or site.

7

DEFER CONSIDERATION OF THE PROPOSAL

If the ecological feature or proposed site does comply with the requirements of section 3b of the Special Places Protection Act but is determined to have a low priority for conservation and protection action, the proposal should be deferred for consideration at a later date.

4.3.2 Stage II - to select candidate sites
(read in conjunction with pull-out flowchart Figure A.2 in Appendix 5)

4.3.2 Substage 1 - to identify possible sites

8

BIOPHYSICAL INVENTORY: MAPPING THE ECOLOGICAL FEATURE AND ITS ASSOCIATED THEME UNITS AND NATURAL FACTORS

At a scale of 1:50,000,

- (a) map the known occurrences of the ecological feature or map the proposed site.
- (b) map the Theme Unit(s) in which the ecological feature or proposed site occurs. A Theme Unit is an area of landscape with a homogeneous character. A Theme Unit is the smallest division of the Nova Scotia Theme Regions ecological land classification system. The Theme Units may be revised from time to time as new data is incorporated into the classification system.
- (c) map the location and extent of any natural factor closely or uniquely associated with the ecological feature. Natural factors characterize the natural landscape. They include, for example, slope condition, temperature range, or water regime. Map only the area that is relevant to the

ecological feature being considered.

On these bases, map an appropriate study area in which to identify all the possible sites. In general, this study area includes only those territories which are both included in the Theme Units and specified by the natural factors. The map of the study area corresponds to the code sheet described in 2.2.3.e.

Note: Maps and other published information used to identify the possible sites are probably produced for purposes other than identifying ecological sites; in addition, the scales of such maps may be different than needed. As a result, the available information may not be in readily useable form.

9

DEFINE THE RULE TO IDENTIFY POSSIBLE SITES

The identification of possible sites proceeds by the application of a rule to the map of the study area (see 2.2.3.e). A rule is a statement of criteria which guides the identification of sites. The rule takes the following general form: A possible site is identified at any location where the natural factors closely or uniquely associated with the ecological feature occur within the same Theme Units as a known occurrence of the ecological feature. In each case, the rule must be specified according to the natural factors and Theme Units associated with the ecological feature in question.

10

IDENTIFY POSSIBLE SITES

Apply the rule to the map of the study area in order to identify and map all possible sites.

4.3.2 Substage 2 - to identify suitable sites

11

FIELD STUDIES

Initially, ecologists, botanists, wildlife biologists or other specialists examine each possible site to confirm that the ecological feature exists in the location as identified in substage 1. If it does, studies are carried out to determine the extent, quality of, and threat to, the ecological feature at each site. To facilitate comparison of all the possible sites, the field report has a standardized format. See Appendix 1 for a detailed discussion of field studies.

12

RANK POSSIBLE SITES?

Ranking the possible sites is useful to quickly suggest those sites which may be suitable for designation. *Ranking possible sites is optional: ranking is not required to either identify suitable sites or to select candidate sites.* Since ranking is essentially an ordinal combination method of land suitability analysis, the results should be treated as indicative only.

13

RANK POSSIBLE SITES

To rank possible sites, follow directions in Appendix 2.

The site ranking scheme includes the following environmental factors:

1. Seral stage
2. Community status
3. Site diversity
4. Uniqueness
5. Degree of disturbance

14

IDENTIFY AND MAP SUITABLE SITES

Any possible site in which the ecological feature is found to exist is a suitable site. Since a variety of functions can be assigned to different sites, even sites of low quality may be considered for designation.

Map the location and extent of all suitable sites on one map. Enter a brief description of the quality of each site on the map. This map will be used in the application of the factor combination method of land suitability analysis to select candidate sites.

15

DECISION TO FORWARD THE PROPOSAL TO AN ALTERNATIVE AGENCY

Possible sites that clearly do not comply with the requirements of the Special Places Protection Act for designation as an ecological site may be of sufficient interest for an alternative form of conservation and protection, for example, a provincial park. In such a case, the information about these sites including the field study reports may be forwarded to the appropriate agency for their consideration.

16

AGENCIES INTERESTED IN SIGNIFICANT SITES

Appropriate agencies: See operation 4.

17**TERMINATE CONSIDERATION OF THE PROPOSAL**

If none of the possible sites is found to be suitable for designation as an ecological site, and if none is of sufficient interest for an alternative form of conservation and protection, then consideration of the proposal should be terminated and field reports and related information kept for later reference.

4.3.2 Substage 3 - to select candidate sites and plan the ecological reserve**18****MAP CURRENT AND FUTURE LAND-USE**

Map land-use in the study area outlined in operation 8. Current land-use and future land-use are mapped separately because each may imply different land management.

Map land-uses in four classifications of intensity of land-use: urban, rural, wild and undisturbed (see Appendix 3).

Future land-use may be known from current mining or forestry leases and from municipal land-use plans.

19**MAP THE PATTERN OF SUITABILITY AND LAND-USE**

Draw a pattern map or code sheet by placing a piece of tracing paper on both the suitability map and the land-use map in succession and outlining the areas of each suitable site and land-use class. Enter a brief description of each area or polygon thus outlined on the map. Any area that is within a suitable site may be selected as a candidate site.

20**COMBINE SUITABILITY AND LAND-USE INFORMATION IN A FACTOR COMBINATION MATRIX**

Enter all available information in a matrix such as in Appendix 4.

21**SELECT CANDIDATE SITES**

Select each candidate site on the bases of its ability to fulfill one or more conservation functions and its ability to support the corresponding management requirements (Functions and management requirements are described in the paragraphs below).

To determine the ability of each area to fulfill any function and the corresponding management requirements, compare the description of each area to the descriptions of the functions and subsequently to the descriptions of the management requirements. On the basis of this evaluation, establish which if any conservation functions can be fulfilled in each area. Subsequently, outline the preliminary management plans: preliminary management plans describe activities that will ensure that the areas can fulfill the established function(s). For convenience, these established functions and their corresponding management plans can be entered below the descriptions on the factor combination matrix. Areas which can fulfill both one or more conservation functions and the corresponding management requirements qualify as candidate sites.

FUNCTIONS OF AN ECOLOGICAL SITE (after the "Purposes and functions of an ecological reserve" according to the IBP, in Taschereau 1974, xv - xviii)

1. **Conservation of the gene pool:** Conserve genetic resources in situ, where the natural habitat supports each "member" of the habitat.
2. **Control:** Provide base data and control (or reference) areas against which human- and natural-caused changes in the environment can be measured.
3. **Research:** Provide areas in which the "complex structure and function of ecosystems" and other natural processes can be studied.
4. **Education:** Serve as outdoor classrooms "for the training of foresters, wildlife biologists, and resource managers." Reserves may also serve as outdoor classrooms for the general public.

MANAGEMENT REQUIREMENTS

1. **Availability:** Land which is Crown-owned or available for purchase can be readily transferred to the Nova Scotia Museum for management for conservation.

A private owner may not wish to have his or her land designated as an ecological site. However, where a cooperative private owner does agree to have his or her land designated, the ecological feature might have satisfactory protection.

2. Education/interpretation potential includes adaptability of the land for 'nature' trails, opportunity for interpretive displays, and existence of, or opportunity for, visitor reception facilities. A Park (Provincial, National, or municipal) which already has visitor reception facilities and which is found to contain the ecological feature, could have education and interpretation added to its recreation functions.
3. Research potential of each ecological site consists of:
 - (a) the need for site monitoring, and
 - (b) the characteristics of the site which would support special ecological research.
4. Accessibility: Sites which are close to human centres of population may be used for public education because of accessibility.

Note: 1 to 4 do not represent an exhaustive nor exclusive description of the management requirements.

22

PLAN THE BUFFER ZONE AROUND EACH CANDIDATE SITE

A buffer zone protects the candidate site from mechanical damage, for example, trampling. Buffer zone boundaries may be delimited on two bases as follows:

- (a) The buffer zone should extend to the local watershed. This is the first peak or height of land in any direction around the Designated Ecological Site. Activities within the local watershed will likely have a direct impact on the Designated Site.

- (b) The buffer zone should have a minimum width. If the local watershed is very small or if the Designated Ecological Site is close to one side, activities beyond the watershed may have a direct impact on the Designated Site. The minimum width of a buffer is the distance needed to ensure that any activity on its edge will not affect the Designated Ecological Site; that for example, substances cannot migrate through the soil, or passersby will not inadvertently enter the Designated Ecological Site.

23

PLAN THE GREATER MANAGEMENT AREA

Specify environmental performance standards for the greater management area. This area will usually consist of the territory containing the natural processes closely or uniquely associated with the ecological feature of concern (see operation 8).

Specifying environmental performance standards in the greater management area and encoding them in municipal legislation ensures that invisible damage to the ecological feature - from pesticides, for example - will be minimized. Each environmental performance standard makes reference to a natural process closely or uniquely associated with the ecological feature in question. The environmental performance standard describes an aspect of the process which can be a measure or indicator of the operation of the natural process. The environmental performance standard specifies a level, rate, or standard at which the indicator must operate or exist. If the standards are not met, the natural processes (and hence the survival of the ecological feature) may be temporarily or irreversibly affected.

Environmental performance standards have distinct advantages over specification standards (zoning) for nature conservation (see 6.2.1.3). Further study on the implementation of environmental performance standards in Nova Scotia is recommended, including, for example, a review of enabling legislation.

24

COMPLETE THE PLAN OF THE ECOLOGICAL RESERVE

- (a) Ensure that candidate sites complement each other in the fulfillment of the conservation functions.
- (b) Ensure that the environmental performance standards in the greater management area complement the preliminary management plan of each candidate site. This will ensure that both mechanical and invisible damage are addressed.
- (c) Draw the landscape plan of the ecological reserve. Ensure that the buffer zones are contained completely within the greater management area.

The recommended ecological reserve consists of candidate ecological sites on Crown or on private land (with preliminary management plans), their buffer zones, and their greater management area. Each ecological site fulfills one or more of the four conservation functions in the following manners:

Core Sites conserve genetic stock; act as a control to monitor changes to surrounding lands;

Educational Sites may act as field schools for technical personnel (eg. foresters) or for public school, high school, or university students; they may act as an interpretation centre for the public. Secondary purposes would include conservation of genetic stock and research.

Research Sites are for scientific research - as a general rule, non-manipulative. Secondary purposes would include conservation of genetic stock and education.

Where it is ecologically appropriate, an educational site or a research site could be used as a sort of outdoor botanical (or zoological) garden: for the propagation of threatened or endangered species.

Sites designated on privately held land will generally be core sites; they may fulfill other functions that will reflect the attitude and preference of the owner, and

the recommendation of the Nova Scotia Museum.

4.3.3 Stages III and IV.

In Stage III, the site plans are developed and draft management plans are written. In Stage IV, the public is invited to participate in the final planning of the ecological reserve.

These stages are beyond the scope of this paper.

4.4 Comparison of Three Methods of Site Selection

The methods of Gehlbach and Wright and the ISIS Method have as a common goal to conserve ecological features.

4.4.1 Stage I

Gehlbach's (1975) site selection method identifies threat to the proposed site or ecological feature as a factor in the site ranking scheme. The ISIS Method identifies, at an earlier stage, threat to the ecological feature or to the proposed site as a criterion for determining the priority for conservation and protection action. Only factors concerned with site quality are included in the evaluation of site suitability (also in the draft ranking scheme, Appendix 2). As a result, in the ISIS Method,

1. a rapid evaluation of the priority of a feature or site for protection is possible;
2. quality of sites is clearly distinguished from threat to sites. An appropriate response is then possible. For example, high site quality and high threat: high priority site; high site quality and low threat: may be moderate priority site.

4.4.2 Stage II

Table 4.1 summarizes and compares the procedures of the methods (see 2.3.1, 2.3.2, and 4.3).

4.5 Aspects of the Application of the ISIS Method

4.5.1 Depth of investigation of a proposal

The ISIS Method offers the choice of a comprehensive investigation which may take much time or, using the site ranking scheme, of a more rapid but superficial review. The depth of the investigation is determined by the particular circumstances of a reserve proposal.

4.5.2 External influences in selection and designation of sites

The ISIS Method is a scientific approach to the selection and designation of ecological sites. However, the actual selection and designation of sites may be influenced by the donation of a property to the Nova Scotia Museum or by political weight.

4.5.3 Continuing evaluation of the ISIS Method

The Special Places Protection Act is in part a policy for the conservation and protection of significant ecological sites in Nova Scotia. *Planning for Ecological Reserves in Nova Scotia* is a proposal for implementation of this policy. In view of the fact that feedback is a necessary component of any successful system, the ISIS Method should be evaluated each time that it is applied. Evaluation may be neatly summarized in two questions, as follows:

- (a) In what ways is the ISIS Method effective as described?
- (b) In what ways may the ISIS Method be developed for greater precision and flexibility?

4.5.4 Application of the ISIS Method in the provinces and in Canada

The ISIS Method is based on the use of *The Natural History of Nova Scotia* which is an ecological land classification of Nova Scotia's natural landscape. Where the method is applied to other provinces, it could be based on the use of similar provincial ecological land classifications. For areas of Canada where a provincially-sponsored ecological land classification has not been prepared, application of the proposed method could be based on the use of ecological land classifications produced by the Lands Directorate of Environment Canada. *The Ecological Land Classification of Labrador* (Lopoukhine et al. 1978) is such a classification.

Where the method is applied to Canada as a whole, it could be based on the use of the Ecoclimatic Regions of Canada map (Lands Directorate, Environment Canada, in preparation).

Table 4.1 Comparison of three methods of site selection and ecological reserve planning to protect an ecological feature

| AUTHOR | IDENTIFY POSSIBLE SITES (Substage 1) | | IDENTIFY SUITABLE SITES (Substage 2) | |
|----------|--|---|--|---|
| | PROCEDURES | DISCUSSION | PROCEDURES | DISCUSSION |
| Gehlbach | Assumes site is available for evaluation. | Does not address the problem of identifying all possible sites. | a) Conduct field studies. b) Evaluate site data. c) Give the site an overall rank on the basis of five factors and their respective weights. | A site ranking scheme (ordinal combination) generates a rough approximation of site suitability due to shortcomings in mathematical procedures and ecological systems analysis. |
| Wright | Assumes site is available for evaluation. | Does not address the problem of identifying all possible sites. | a) Conduct field studies. b) Assign four ranks to the site corresponding to four factors. | A site ranking scheme is a fast way to suggest a site that may be suitable for nature conservation. |
| Katz | a) Map natural and derived environmental factors on the basis of published information. b) Apply rules of combination method of land suitability analysis to identify possible sites. | All possible (theoretically suitable) sites are identified for subsequent evaluation. | a) Conduct field studies. b) Confirm and evaluate the presence of the ecological feature according to field data in each of the possible sites. | All suitable sites are identified. |

Table 4.1 Continued

| AUTHOR | SELECT CANDIDATE SITES (Substage 3) | | PLAN THE ECOLOGICAL RESERVE (Substg. 3) | |
|----------|--|--|--|---|
| | PROCEDURES | DISCUSSION | PROCEDURES | DISCUSSION |
| Gehlbach | In general, a high-ranking site is accepted for protection. | Other sites not evaluated may have higher quality and thus more value for protection. | Does not plan the ecological reserve. | Site suitability, regardless of how it is generated, is not a land-use plan. |
| Wright | The four ranks are assessed by the coordinator to determine the appropriate action to take regarding the site. | The decision to acquire a site greatly depends on the experience of the coordinator. | Does not plan the ecological reserve. | Site suitability, regardless of how it is generated, is not a land-use plan. |
| Katz | <p>a) Combine suitability and land-use information for a comprehensive description of each site.</p> <p>b) On the bases of the ability of each site to fulfill any of the functions of an ecological site and to satisfy management requirements, select candidate sites. Candidate sites are the highest-quality sites among those evaluated.</p> | The selection of several highest-quality sites ensures that all of the four conservation functions of an ecological site are likely to be fulfilled. | <p>a) Plan buffer zones around candidate sites.</p> <p>b) Outline the greater management area and its performance standards.</p> <p>c) Develop a preliminary management plan for each candidate site as required by the Special Places Protection Act.</p> | An ecological reserve that is a constellation of Designated Sites with surrounding buffers and a greater management area has significant advantages over a single site ecological reserve. These include stability (resistance to shocks) and flexibility (responsiveness to long-term stresses). All the Designated Sites can be jointly managed as a single system. Environmental planning ensures that conservation functions and management requirements are fulfilled. |



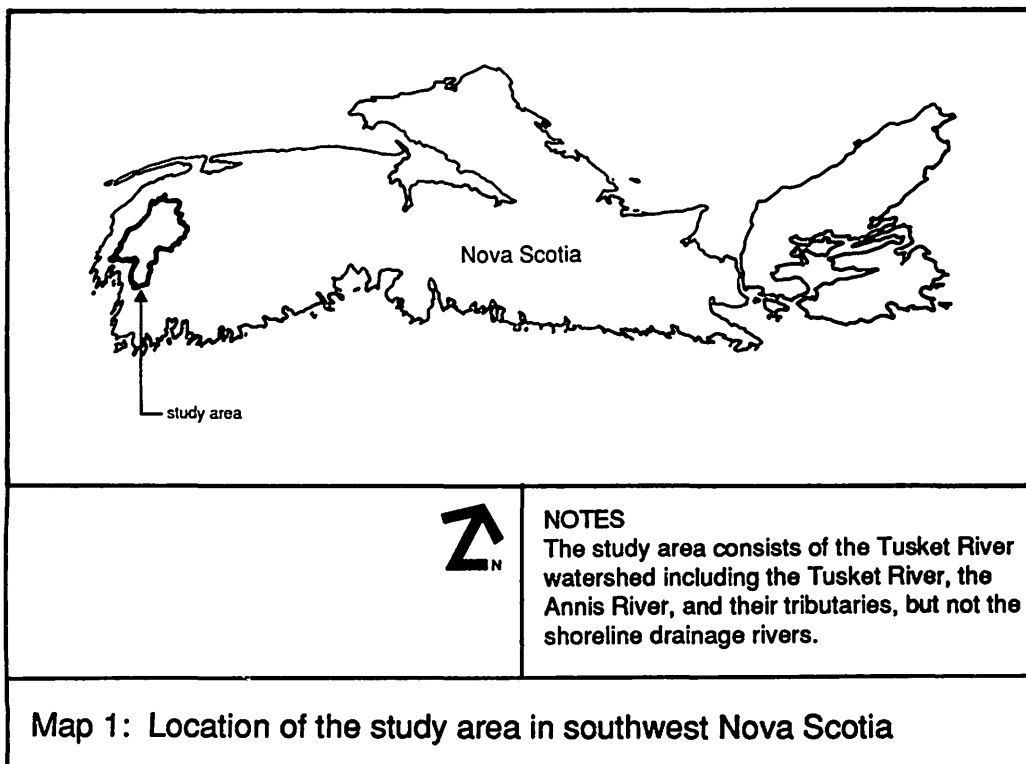
5 THE TUSKET RIVER TEST CASE

This section contains a narrative of the Tusket River test of the ISIS Method. Numbers in parentheses refer to the operation boxes of the flowchart (refer to 4.3 and see Figures A.1 and A.2 in Appendix 5). The narrative is followed by a review of some of the procedures in the application of the ISIS Method: the experience of the test suggested refinements in the method.

5.1 Stage I - Determining Compliance of the Ecological Feature with the Special Places Protection Act and Priority for Protection

(1) The Tusket River is in southwest Nova Scotia (see Map 1). In the lower watershed of this river, disjunct communities of coastal-plain flora are located (Keddy 1985, 309). The coastal-plain flora is one of Nova Scotia's floral elements. It is so named due to its widespread distribution on the coastal plain of the eastern United States. In Canada, the coastal-plain flora has a distribution restricted to southwest Nova Scotia (Roland and Smith 1983, 304 - 7) and includes species which are considered as rare, threatened, or endangered (Keddy *ibid.*, Maher et al. 1978, 11). These species include the following:

- (a) *Hydrocotyle umbellata* Linnaeus
- (b) *Sabatia kennedyana* (Fernald 1916)
- (c) *Coreopsis rosea* (Nuttall 1818)



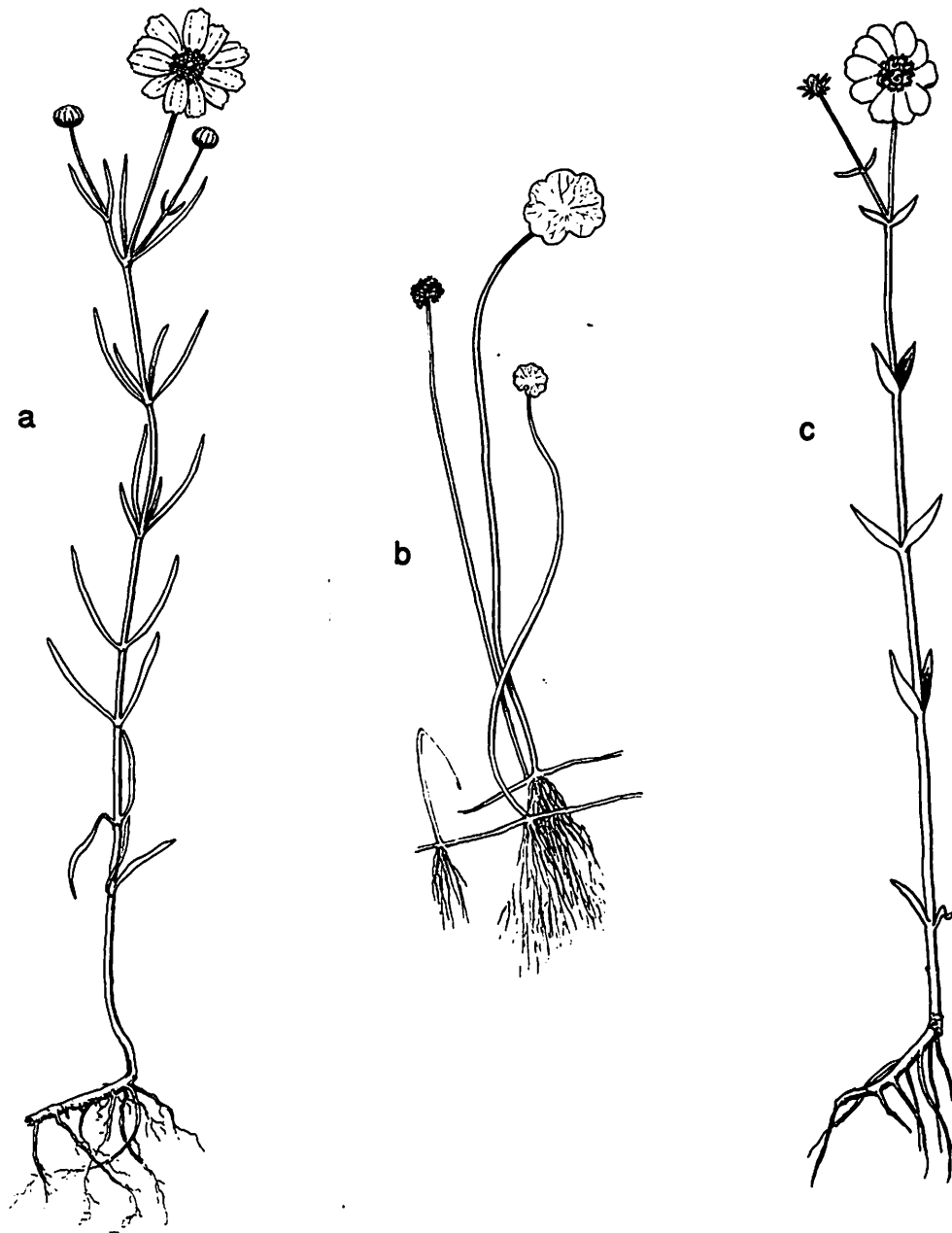


Figure 5.1: Some threatened and endangered species of coastal-plain flora (x 1/3. Drawn by: A. Vienneau, N. S. M.)

- (a) *Coreopsis rosea* N. (threatened)
- (b) *Hydrocotyle umbellata* L. (endangered)
- (c) *Sabatia kennedyana* F. (endangered)

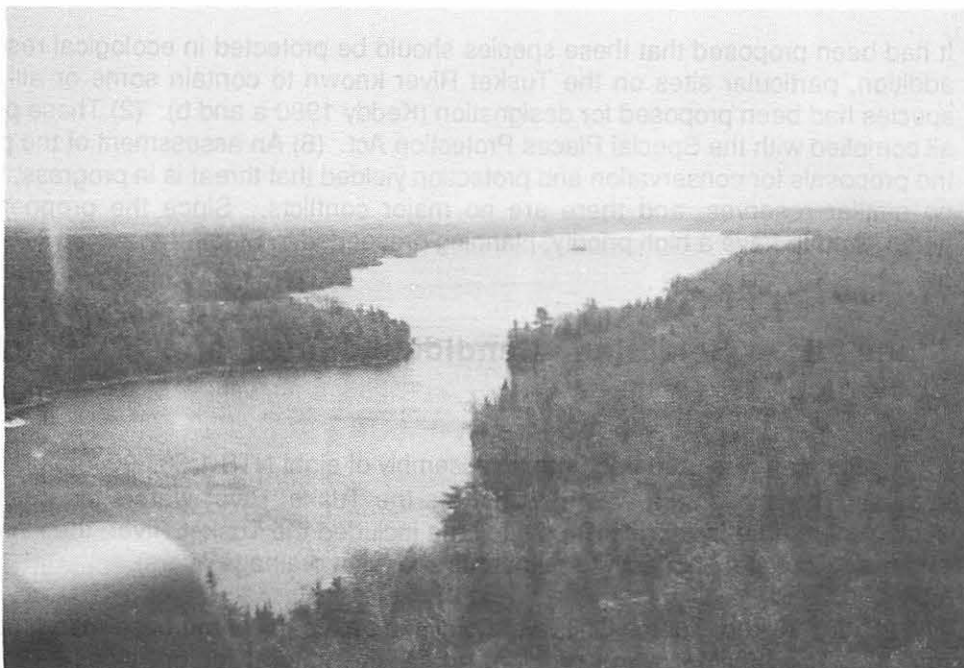


Figure 5.2: Gillfillan Lake: aerial view looking southeast in March.
Note the low relief topography, the indented shoreline, and the maturing second growth mixed forest (photo: author, 1985).



Figure 5.3: Gillfillan Lake: eastern shore looking northwest in July.
Note the population of *Sabatia kennedyana* occupying the midzone of the gently sloping, seasonally-emergent shoreline (photo: A. Wilson, 1984).

It had been proposed that these species should be protected in ecological reserves; in addition, particular sites on the Tusket River known to contain some or all of these species had been proposed for designation (Keddy 1980 a and b). (2) These proposals all complied with the Special Places Protection Act. (6) An assessment of the priority of the proposals for conservation and protection yielded that threat is in progress, there are no similar reserves, and there are no major conflicts. Since the proposals were determined to have a high priority, planning proceeded in Stage II.

5.2 Stage II - Selecting Candidate Sites and Planning the Ecological Reserve

(8) A base map was prepared from an assembly of eight NTS 1:50,000 topographic map sheets. The study area was identified as the Tusket River watershed because the ecological feature is littoral (The study area included the Tusket River, the Annis River, and their tributaries, but not the numerous shoreline drainage rivers).

The Natural History Theme Units were outlined on a copy of the base map (see Maps 2 and 3). Then the following problem arose: the natural factors closely or uniquely associated with the coastal-plain community were not known with certainty. It was hypothesized that the following natural conditions were relevant:

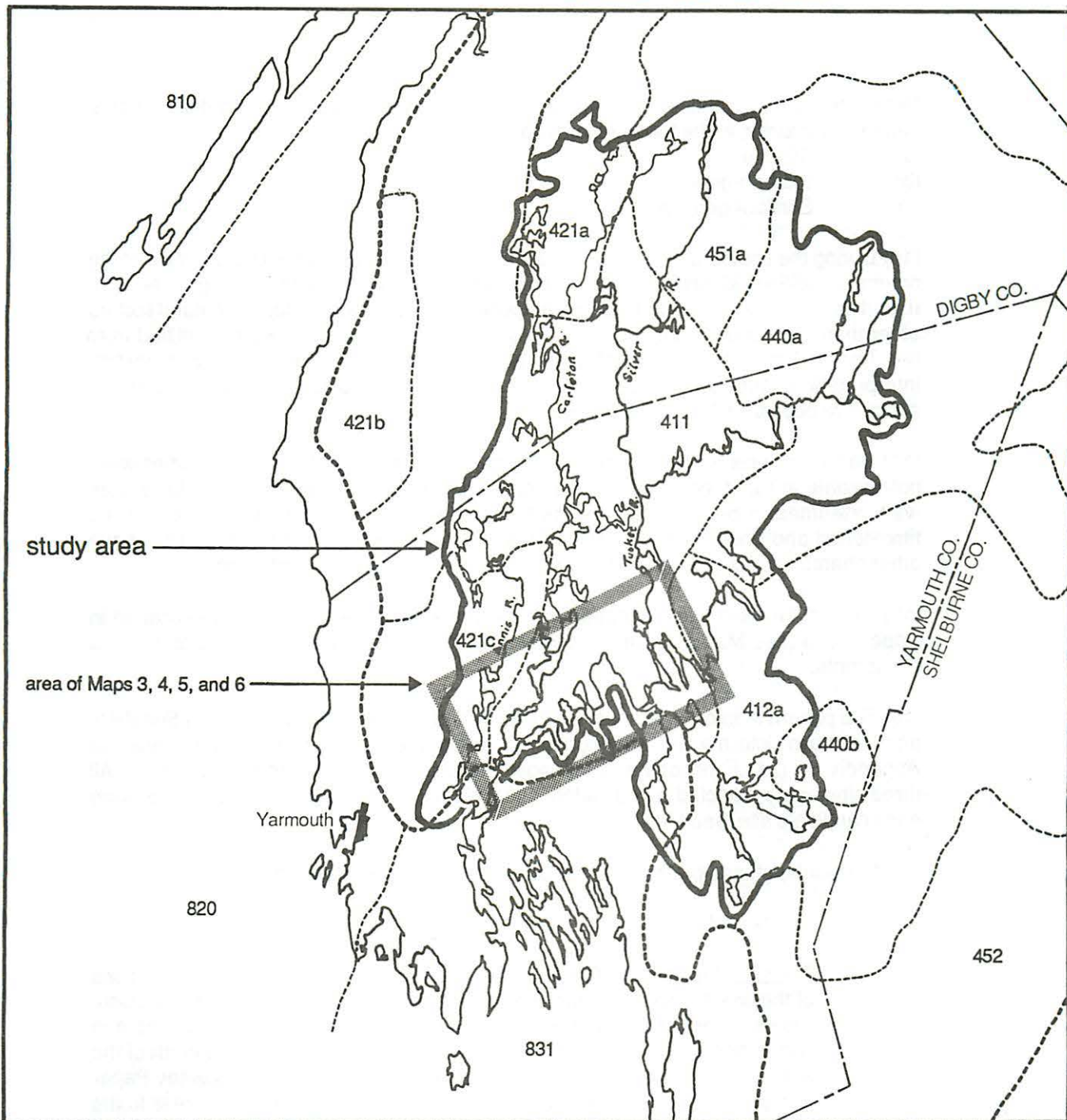
- (a) "peaty, sandy, or gravelly lake and river shorelines" (Maher et al. 1978, 11);
- (b) seasonal water level fluctuations and glacial till soils (Keddy 1985, 311);
- (c) lake coves (A. Wilson, *in verbis* 4/85).

On these bases, quartzite till soils were mapped on the same map as the Theme Units. Visual inspection of the map indicated a correlation between imperfectly-drained quartzite till (Danesville) soils on lake shores within the Natural History Theme Units and known occurrences of coastal-plain littoral flora. Water level fluctuation data was not available, and it was not possible to confirm this as an important natural factor.

(9) As the study progressed, a variety of natural conditions and processes were put forward as closely or uniquely associated with the coastal-plain community. Various rules to identify the possible sites were consequently considered. The rule which emerged toward the end of the study, and which was accepted as being the closest approximation, is as follows:

"The following natural conditions, in order of importance, account for the particular location of the littoral coastal-plain flora, and its rarity:

- (a) interior (moderate) climate, which is warmer in summer than the coastal climate,
- (b) seasonally-exposed lake shores (resulting from seasonal water level fluctuation),
- (c) generally sandy, quartzite glacial till substrate, and
- (d) lake coves and calm shorelines."



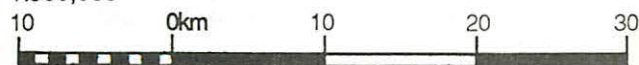
LEGEND

- - - - - Theme Region boundary
- - - - - Theme Unit boundary



SCALE

1:500,000



NOTES

1. For descriptions of Theme areas, see Table 5.1.
2. In this paper, the area that was found to contain most of the possible sites is reproduced at the original mapping scale on Maps 3, 4, 5, and 6.

SOURCES

1. base map, Theme areas: Natural History of Nova Scotia Theme Regions. N.S. Dept. of Lands and Forests, 1984
2. study area: Nova Scotia Watershed Areas. MRMS, 1980

Map 2: Theme Units in the study area

Note that the rule identifies the natural factors closely or uniquely associated with this natural community, in the following order of importance:

- (a) Climate
- (b) Water regime
- (c) Surficial geology.

(10) During the course of the study, it was not possible to establish with certainty that the natural conditions identified above accounted for the locations of the ecological feature. In addition, sufficient data for mapping purposes was not available for the natural factors other than soils and the Theme Units. As a result, possible sites were identified from the Theme Unit - soils map (Map 3), but Dr. Keddy's studies, aerial photograph interpretation, and aerial reconnaissance were also used to confirm and suggest alternative possible sites (see Map 4).

(11) Because it was winter and because there was a time constraint, field studies were not feasible at that time. (14) To test and demonstrate the entire method, three sites were assumed to be suitable because they are known to contain populations of the threatened and endangered species of the coastal-plain flora and because they have other characteristics (eg. land-use, ownership) useful in the demonstration.

(18) Current land-use was mapped for the entire study area using the classification in Appendix 3 (see Map 5). Future land-use could not be mapped because of the time constraints.

(19) The pattern map or code sheet of suitability and land-use was drawn. (20) Suitability and land-use information was combined as in the factor combination matrix of Appendix 4. (21) Functions and management plans were outlined for each site. All three sites were selected as candidate sites. (22) A buffer zone was planned around each candidate site (see Map 6).

The function(s) of, and preliminary management plans for, each site are as follows:

1. Gillfillan Lake.

The site: Much of the Gillfillan Lake shore margin contains good populations of the coastal-plain flora that includes *Sabatia kennedyana* but not *Coreopsis rosea*. Most of the west shore is Crown land; most of the east shore is subdivided to private owners. The land on the east shore that is north of the stream that drains Kegeshook Lake is owned by the Bowater-Mersey Paper Company Ltd. Access (overland) to the Crown land is difficult; access to the privately-held cottage lots is of course restricted to the owners and their visitors. Local residents frequently use the Bowater-Mersey lands for recreation (e.g. ATVs).

Function: All the occurrences of threatened and endangered species of coastal-plain flora should be designated as core sites. Sites on Crown land should be transferred to the Nova Scotia Museum for management. On adjacent Bowater-Mersey lands, negotiations should be undertaken to have the occurrences designated as core sites. On private lands, the land should be designated with the owner's permission.

Management:

- (a) Core sites: Intervention is prohibited except for semi-annual site surveys (see also 6.3.1.1).
- (b) Buffers of the core sites: A buffer zone surrounds each core site. The buffer follows the local watershed or is sufficiently wide so that any activity may proceed right on its edge with no effect to the core site. Intervention is limited to only what is necessary to maintain the buffer in good condition (e.g. to maintain access).
- (c) Privately-held sites: Use of the land is voluntarily restricted and kept as core sites.
- (d) Buffers of the privately-held sites: Ideally, these buffers should be used in the same manner as the buffers of the core sites. However, passive recreation, limited development, and limited tree harvest may be permitted.

2. Wilsons Lake.

The site: A significant length of the Wilsons Lake shore margin contains the best populations of *Sabatia kennedyana* and of *Coreopsis rosea*. All the land around the lake is devoted to cottages.

Function: All the occurrences of threatened and endangered species of coastal-plain flora should be designated as core sites. Where possible, sites should be purchased for, and managed by, the Nova Scotia Museum. Where the land cannot be purchased, the land should be designated with the owner's permission.

Management:

- (a) Core sites and buffers of the core sites: in the same manner as for Gillfillan Lake.
- (b) Privately-held sites and buffers of the privately-held sites buffers: in the same manner as for Gillfillan Lake.

3. Ellenwood Lake.

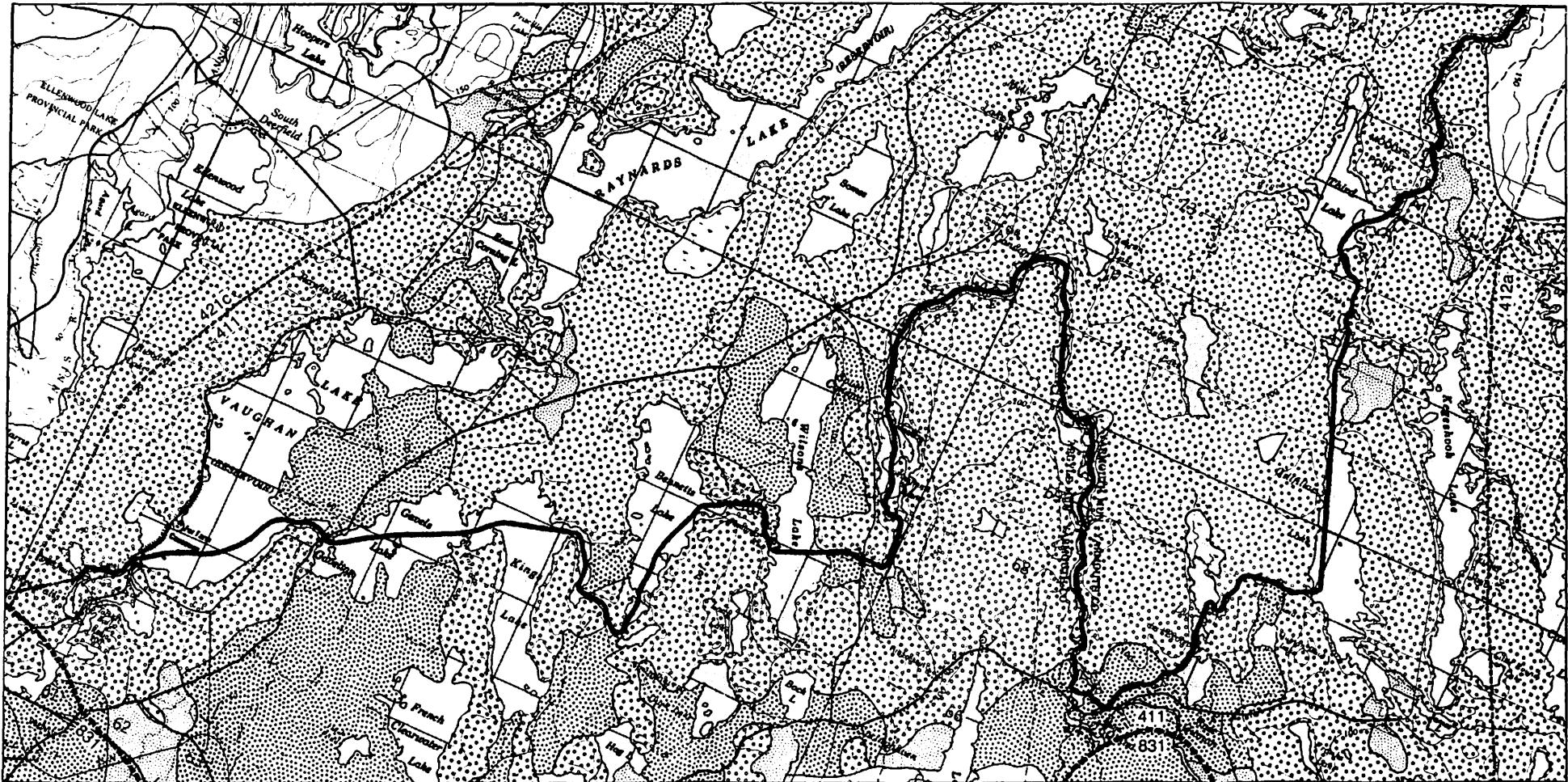
The site: Parts of the Ellenwood Lake shore margin, including the shore of Ellenwood Provincial Park, contain populations of the coastal-plain flora. The Provincial Park contains visitor reception facilities.

Function: Where the coastal-plain flora occurs on land within the Provincial Park, educational opportunities should be pursued.

Management: Educational programmes are a significant part of the ecological reserve in the Tuskent River system. The Parks and Recreation Division of the Department of Lands and Forests, by providing these programmes, would assist greatly with the conservation of coastal-plain flora.

Table 5.1: Descriptions of Theme areas and soils in the Tusket River study area (after Simmons et al. 1984 and Hilchey et al. 1960)

| THEME REGION 400 - Atlantic Interior | | |
|--|--|---|
| <p>"Inland of the coastal forest the immediate climatic influence of the Atlantic Ocean is replaced by slightly warmer summers and cooler winters with much less wind exposure. On the planed surface of the old, hard rocks, which is tilted gently to the southeast, flow some of Nova Scotia's longest rivers. Most of the province's lakes have been created by glacial action on this relatively flat surface. Vegetation varies from mature spruce-hemlock-pine forests common on the Kejimikujik drumlins (433) to the heath vegetation on the granite barrens (440)" (Simmons et al. 1984, 505).</p> | | |
| <p>DISTRICT 410: underlain by resistant metamorphic rocks - greywacke (quartzite) and schist; elevations are low and there is little relief. Three Units are distinguished within the District on the basis of surficial deposits.</p> | | |
| UNIT | SURFICIAL GEOLOGY | PARENT MATERIAL: SOILS |
| 411 | Quartzite and schist tills with numerous low drumlins (2m to 20m high). Drainage is through a deranged pattern of sluggish streams. | Quartzite: Shallow, stony sandy loams - well-drained Halifax, imperfectly-drained Danesville, poorly-drained Aspotogan; peat. Schist: Yarmouth, Mersey, Liverpool, Pitman. |
| 412a | Quartzite till. Drainage is relatively unimpeded. | Schistose parent materials: Moderately coarse-textured soils - well-drained Mersey, imperfectly-drained mottled Liverpool; well-drained Halifax and Gibraltar sandy loams; imperfectly-drained Danesville toward the coast. |
| <p>DISTRICT 420: dominated by Halifax slate which occurs in folds within the Goldenville greywacke. There are seven localities within the District;...in three, (the slate) has been buried by glacial deposits and forms a flat lowland.</p> | | |
| UNIT | SURFICIAL GEOLOGY | PARENT MATERIAL: SOILS |
| 421a | Slate tills and drumlins | Slate: Sandy loams - well-drained Bridgewater, imperfectly-drained River port. |
| 421b | Slate tills and drumlins | Schists and quartzite (away from the coast): Well-drained Mersey, imperfectly-drained Liverpool; also mottled Pitman, peat. |
| 421c | Quartzite till and drumlins | Schist and quartzite: Moderately-drained Yarmouth, mottled Deerfield; Liverpool and Pitman. Sands and gravels: Well-drained Medway. |
| <p>DISTRICT 440: The bedrock in each (Unit) is granite.</p> | | |
| UNIT | SURFICIAL GEOLOGY | PARENT MATERIAL: SOILS |
| 440a,b | both Units overlain with a thin cover of loose, stony granite till with no drumlins; the surface is strewn with boulders... has poor drainage. | Granite: Coarse-textured, well-drained sandy loam - Gibraltar, also slowly-drained Bayswater and Aspotogan; many peat bogs. |
| <p>DISTRICT 450: outcrops of granite. The largest...is the South Mountain Batholith (Unit 451) which stretches from near the Tusket River across to the Halifax-Dartmouth area. Two other similar bodies are the Eastern Shore Granite (Unit 453) and the Shelburne Granite (Unit 452).</p> | | |
| UNIT | SURFICIAL GEOLOGY | PARENT MATERIAL: SOILS |
| 451 | a rather uniform topographic feature; presents a level horizon when viewed from North Mountain... Across the surface are many large boulders that were plucked out and then dumped by the ice. | Granite: Coarse-textured, well-drained sandy loam - Gibraltar (usually shallow, heavily leached, and very acid); also poorly-drained Bayswater and Aspotogan; peat. |
| 452 | mantle of thin stony till with no drumlins | Granite (in the Yarmouth Co. area of the Unit): Gibraltar, Bayswater, Aspotogan; also peat. |
| THEME REGION 800 - Atlantic Coast | | |
| <p>"Exposure to winds from the Atlantic Ocean dominates coastal environments from Digby Neck to Scatarie Island... The coastal forest is found throughout and its inland extension marks the regional boundary. Headlands...are frequently barren. Almost every major rock type in Nova Scotia is found in this region but the soils are often dominated by hardpans due to excessive moisture. Coastal erosion is rapidly reshaping coastal areas with drumlins; there beaches, marshes and waterfowl habitat are found. Seabird nesting colonies and marine mammals are common on coastal islands" (Simmons et al. 1984, 674).</p> | | |



LEGEND

- Theme Region boundary
- Theme Unit boundary
- [Dotted pattern] Halifax soil
- [Cross-hatched pattern] Danesville soil
- [Horizontal line pattern] Aspotogan soil

NOTES

1. For descriptions of Theme areas, see Table 5.1.
2. In the Tuskot River test case, soils were mapped over the entire study area. In this paper, this map reproduces only a portion of the original map: the area that was found to contain most of the possible sites.

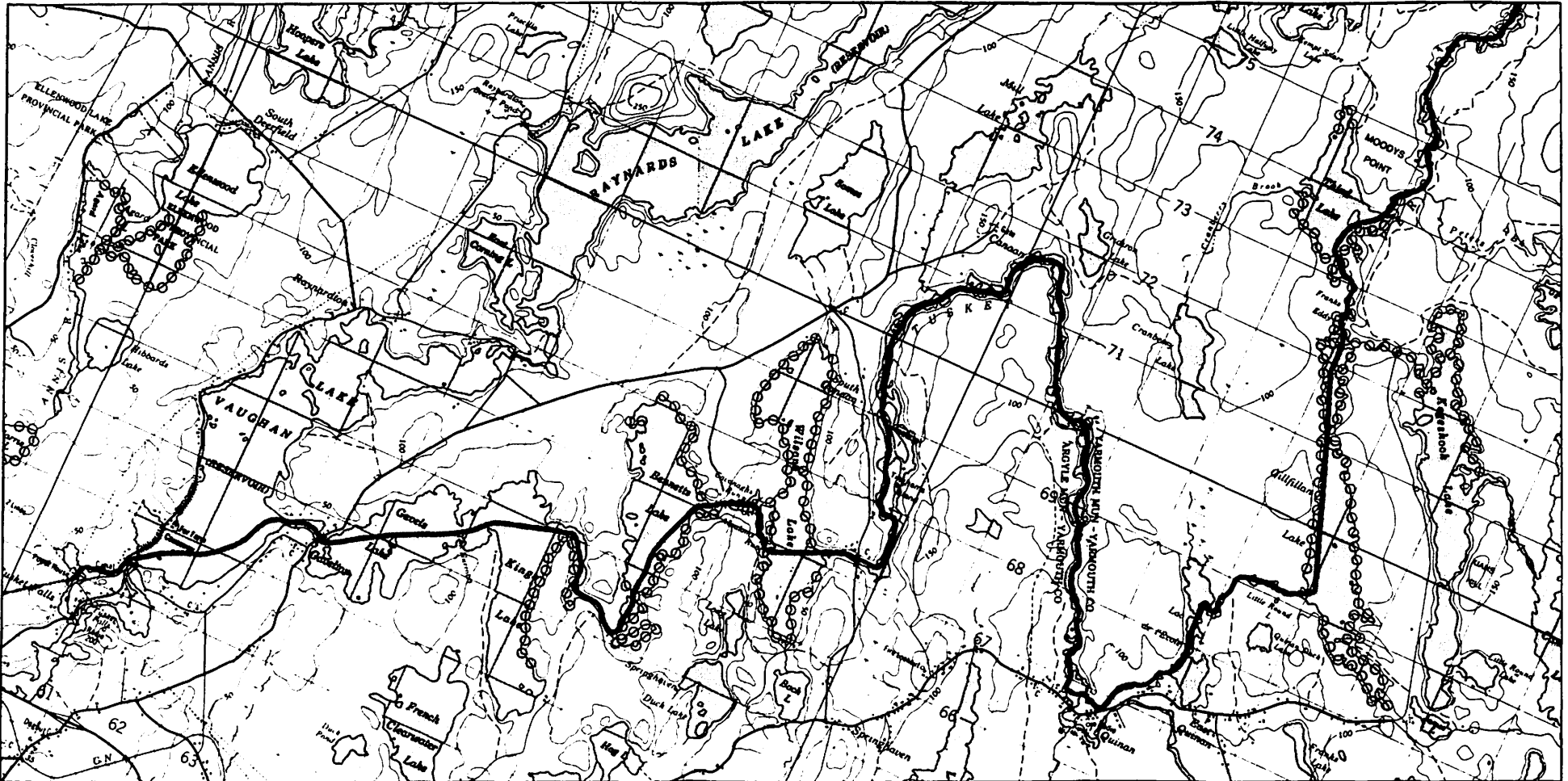
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SOURCES

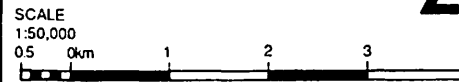
1. base map: This map is based on information taken from N.T.S. maps 20 O/16, 20 P/13, and 21 A/4 © Her Majesty The Queen in Right of Canada, with permission of Energy, Mines, and Resources Canada.
2. Theme areas: N.S.D.L.F. 1984, op. cit.
3. Soils: Hilchey et al., 1960.

Map 3: Theme Units and quartzite till soils in part of the study area



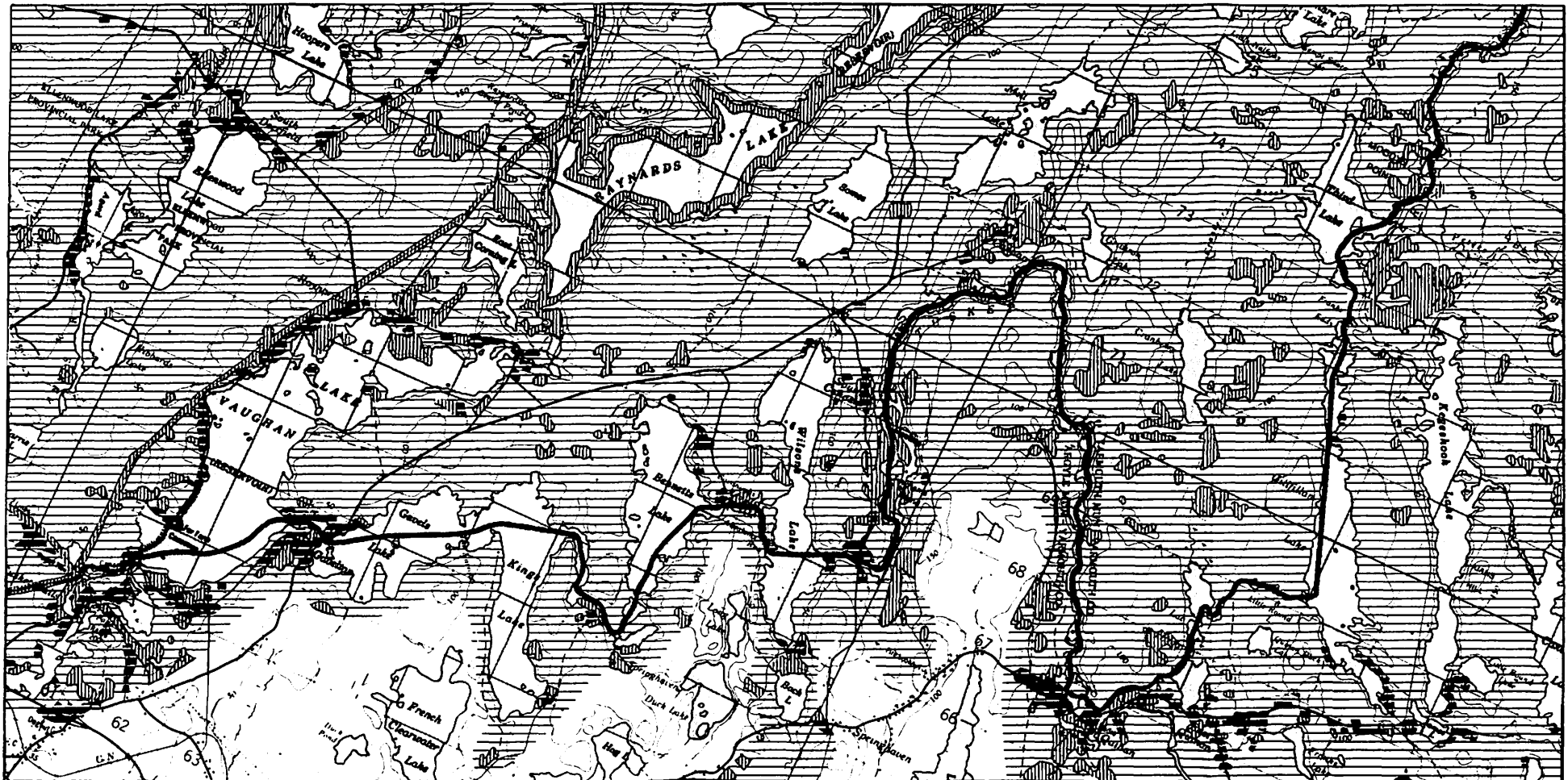
LEGEND
 ○○○○ Possible sites

NOTES
 In the Tuskent River test case, it was found that most possible sites occur only in this portion of the study area. See 5.2, operation 10.







SOURCES
 base map: N.T.S. maps op. cit.

Map 4: Possible sites for the coastal-plain flora



LEGEND

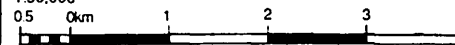
Land-use classes

-  "undisturbed" lands
-  "wild" lands
-  "rural" lands
-  "urban" lands

NOTES

1. For descriptions of land-use classes, see Appendix 3.
2. In the Tusketeau River test case, land-use was mapped over the entire study area. In this paper, this map reproduces only a portion of the original map: the area that was found to contain most of the possible sites.
3. There is no undisturbed land in this part of the study area.

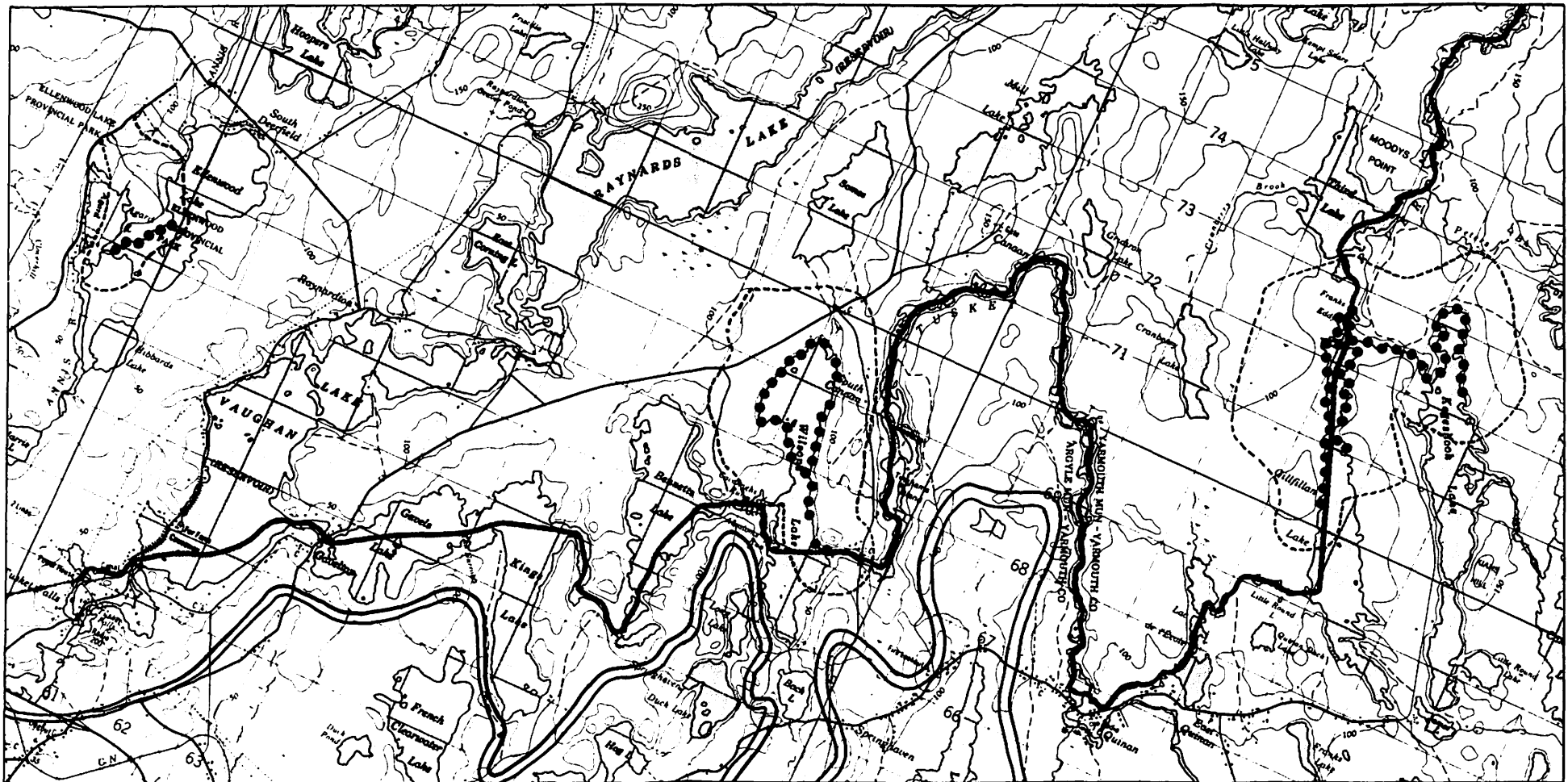
SCALE
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SOURCES

1. base map: N.T.S. maps op. cit.
2. land-use: Aerial photographs nos. CAS 75551 30 - 33 and CAS 75552 30 - 163. M.R.M.S., 1984.

Map 5: Land-use in part of the study area



LEGEND

- Candidate sites
- Buffer zone boundary
- Greater management area boundary

NOTES
 In the Tuskent River test case, three candidate sites were described as shown on this map. For descriptions of the candidate sites, see 5.2, operation 21.

SCALE
 1:50,000
 0.5 0km 1 2 3 4

N

SOURCES
 base map: N.T.S. maps op. cit.

Map 6: Candidate sites for the coastal-plain flora

(23) The greater management area is the study area or watershed of the Tusket River system upstream from and around the candidate ecological sites; it should be governed by an "environmental performance standard" (see Map 7).

The natural process which the performance standard protects is as follows: Within the 411, 412a, and 421c Natural History Theme Units of Nova Scotia in the Tusket River system, there is a heavy spring runoff and a low summer runoff. As a result, broad, gently sloping shorelines of certain lakes, inundated in winter, are exposed in summer, and deposition of sediments and humus on these shorelines is prevented. The gently sloping shorelines have a variety of substrates; the most common is derived from quartzite glacial till which ranges in size from sand and gravel to small cobbles. A variety of species of the coastal-plain floral element of Nova Scotia, including several rare, one threatened, and two endangered species, grow on these different substrates.

The performance standard should address the natural process as follows: All development which does not significantly change or affect the process or conditions described above, may proceed within the greater management area.

Some implications:

- (a) Existing and future damming of rivers or lakes must be carefully designed to ensure that the existing water regime is maintained.
- (b) Significant quantities of chemicals, heavy metals, detergents, etc. may not be released into the Tusket River system (studies are required to set precise p.p.m. standards; a temporary standard could be established by agreement).
- (c) Cottage and urban development, and forest harvesting must not disturb the shores.
- (d) All-terrain vehicles (ATVs) and other vehicles, and canoes and other craft are not permitted on the relevant shorelines. In some cases, it may be appropriate to reroute ATV trails and to identify alternative boat landing places.

5.3 A Review of some Aspects of the Application of the ISIS Method

5.3.1 A framework for identifying the environmental factors associated with an ecological feature

The successful use of the combined approach in this method depends upon assembling enough knowledge of the ecosystem to suggest environmental factors closely or uniquely associated with the ecological feature and upon formulation of the rule to identify possible sites.

At the beginning of the application of the ISIS Method, the environmental factors associated with an ecological feature may not be known with certainty or may not be known at all. In the Tusket River test case, the environmental factors associated with the coastal-plain flora were not known with certainty. The experience of the Tusket River test case indicates that in future cases, a framework of working hypothesis, test, and revision could be successful, as

follows:

1. **Suggest working hypothesis:** On the bases of all available information, suggest the set of environmental factors that best defines or describes the existence and geographic extent of the ecological feature.
2. **Test working hypothesis:** The field studies are used not only to test whether the possible sites actually exist as predicted, but also to test whether the selected set of environmental factors accurately describes a possible site.
3. **Revise working hypothesis:** Revise the set of environmental factors on the basis of the results of the field studies. Test the revised hypothesis if necessary.

It is probably incorrect to assume that the environmental factors closely or uniquely associated with any ecological feature will be well enough known to proceed in the field without checking whether they accurately or sufficiently describe a possible site.

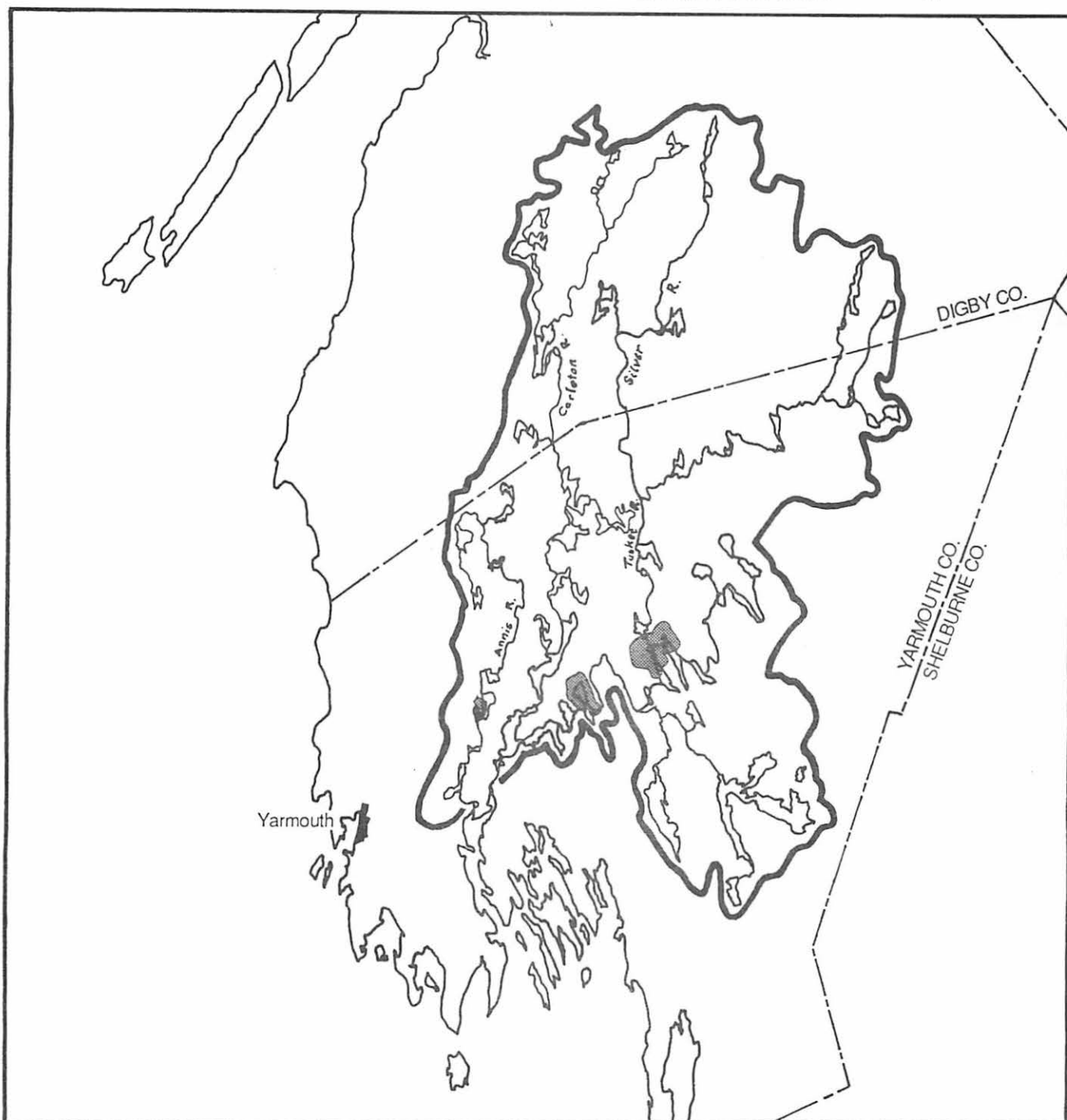
There are alternative ways to generate and test a hypothesis. For example:

1. Identify a site of high quality. Identify its prevalent environmental factors. On the basis of these factors, identify all the possible sites.
2. On a hunch or on a "gestalt" of the environmental factors and geographic extent of the ecological feature, carry out systematic field studies, in an attempt to encounter all the possible sites.


5.3.2 Identifying possible sites from available data

In the Tusket River test case, sufficient data for mapping purposes was available for only two natural factors: the derived factor of the Theme Units (climate - geology) and soils. As a result, when the rules of combination method of land suitability analysis was applied, these two factors alone could not provide enough information to identify all the possible sites. As noted, other sources of information were used to confirm and suggest additional possible sites.

When applying the ISIS Method in future cases, information from any source should be carefully considered and used if appropriate to confirm and suggest additional possible sites.

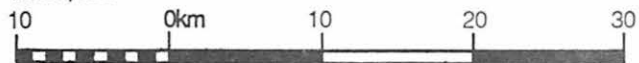


LEGEND

-  Candidate sites and buffer zones
 Greater management area boundary



SCALE
1:500,000



NOTES

In the Tuskent River test case, three candidate sites and their greater management area were described as shown on this map. For descriptions of candidate sites, see 5.2, operation 21. For description of the greater management area, see 5.2, operation 23.

SOURCES

base map: N.S.D.L.F. 1984, op. cit.

Map 7: Recommended ecological reserve for coastal-plain flora



6.1.2 Submitting a proposal

Anyone may propose that a unique ecological feature or that a particular site containing a unique ecological feature should be protected under the Special Places Protection Act. The proposal should follow the outline in 4.3.1 operation 1. Proposals should be accompanied by full supporting documentation and should be addressed to the Director of the Nova Scotia Museum. The Curator of Special Places should acknowledge receipt of the proposal and communicate the status of the proposal to the proponent at appropriate times.

6.1.3 Introducing the ecological reserve to local communities

The following three steps may serve as a guide:

1. **General publicity:** Insert articles in local newspapers, schedule the Information Coordinator and/or the Curator of Special Places of the Nova Scotia Museum to appear on local radio or television, and post announcements at the local library, the town hall, and supermarkets. Goal: to draw attention to the Museum and its ecological reserves activities - details of the specific project are unnecessary at this time. Content might include how the Nova Scotia Government, through the Museum, is preserving the provincial heritage; and it might include general information about ecological reserves. Lead time: about one year before designation of the ecological sites is probably sufficient.
2. **Direct correspondence:** For ecological sites on Crown land, the Director of the Museum or the Curator of Special Places contacts by mail local wildlife or nature organizations as well as the municipal planning office. Goal: to request and encourage their cooperation and participation in the establishment and later management of the ecological reserve.

For ecological sites on privately-held land, the Director of the Museum or the Curator of Special Places contacts the landowners of possible sites. Goal: to request their cooperation in site studies with a view to designation. The letter might refer to recent publicity and describe in detail an ecological reserve and a Designated Ecological Site.
3. **Follow-up:** The Curator of Special Places organizes meetings with the local nature organizations, interested individuals, and municipal planners; the Curator arranges independent meetings with the landowner of each possible site.

6 ESTABLISHMENT OF ECOLOGICAL RESERVES IN NOVA SCOTIA

This section addresses several aspects of the establishment of ecological reserves in Nova Scotia. Public participation in the planning and management of an ecological reserve is explored. Some aspects of the management of Designated Ecological Sites, buffer zones, and the greater management area are reviewed, and the management of fire and disease in an ecological reserve is considered. The section ends with notes on the legal status of ecological reserves.

6.1 Public Participation in the Establishment and Management of Ecological Reserves in Nova Scotia

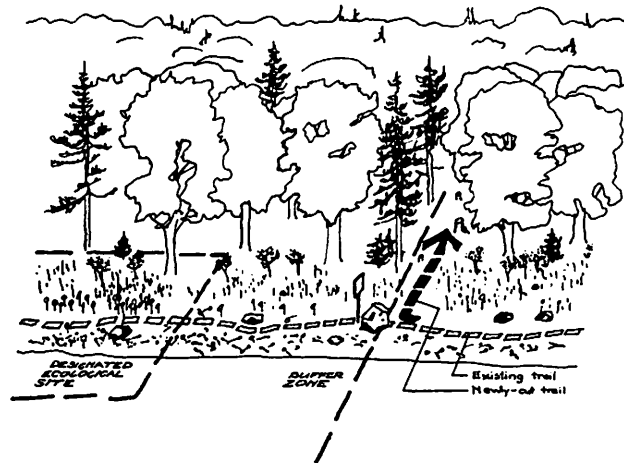
6.1.1 Reasons for public participation

- (a) Most of the land in Nova Scotia is privately-owned, not Crown-owned.
- (b) In Nova Scotia, there is broad public interest in nature conservation.
- (c) One goal of the Nova Scotia Museum (the provincial agency responsible for the establishment and management of Designated Ecological Sites) is the long-term enhancement of Nova Scotians' awareness of natural phenomena and processes, so that daily life becomes enriched, and so that plants, animals, and concepts of ecology grow in meaning and value.
- (d) Public participation is encouraged in order to generate volunteer, knowledgeable, experienced, sensitive, inexpensive, and community-building maintenance of Designated Ecological Sites.
"Volunteer": because of interest
"Knowledgeable": volunteers will probably have some scientific knowledge and/or detailed knowledge of the area
"Experienced": volunteers may wish to participate for several years
"Sensitive": volunteers will be aware of the ecological feature and careful about the operation of the natural processes in "their" Ecological Sites
"Inexpensive": costs include supplies only
"Community-building": people work together.

6.1.4 Alternatives to current use of the candidate ecological sites

Candidate sites may be currently used for passive recreation by local residents or for seasonal activities such as harvesting of berries or trees. The uses should be identified in site checks and in interviews, and in each case alternatives should be provided if necessary (see Figure 6.1).

Figure 6.1: Example of an alternative to current use of a site: rerouting an ATV trail



Because any wall or fence can be penetrated if it is unsupervised, a boulder and a sign are strategically placed to request trail users to take the newly-cut path. By giving local residents the choice whether or not to enter, Ecological Site planners respect the residents' traditional activities and care for the land. (The width of the buffer zone is reduced for graphic demonstration.)

6.1.5 Reserve management activities - a scenario

Following is a scenario of some activities to manage an ecological reserve. These activities should be in the context of a site monitoring program.

An organization to care for Designated Ecological Sites could be formed by residents in or near each ecological reserve. Twice a year, in spring (after the snow has gone but before the flowers are out) and in fall (a few weeks before the snow), about three members of this local "Ecological Reserve Management Club", of whom at least one is a natural scientist or forester, will travel through the ecological reserve. They will thoroughly visit each Designated Ecological Site and its buffer. The "Club" members will note any changes or developments in the Sites and buffers as well as any evidence of trespassing. They will note any changes in the greater management area that might affect the Designated Ecological Sites. They will make recommendations for intervention in the Sites necessary at that time or in the future.

Unusual reasons - a flash flood or a violent storm, for example - may warrant additional visits; a discussion with the Curator of Special Places should confirm the need for such visits.

The three "Club" members should compile a consensus report or two or three reports with dissenting views. The report(s) should be submitted to the Curator of Special Places of the Nova Scotia Museum; each "Club" may also keep a copy.

With "Club" members and, when necessary, in consultation with other specialists, the Curator will decide what, if any, intervention activities to carry out. The Curator will then issue a document which may be called a "limited intervention permit" which will state exactly what is to be done in the Ecological Sites and buffers and when it is to be done. To do more than what the permit allows would contravene the Special Places Protection Act.

6.1.6 Five year review of the management plan

Every five years, the whole management plan (including the boundaries of the Designated Ecological Sites, buffers, and the greater management area) should be reviewed by the Curator of Special Places, the "Club" members, and Museum staff. After each new plan is produced, but before it is presented to the Special Places Committee, it may be useful to have the plan reviewed by consulting scientists and planners.

6.2 Notes on the Management of an Ecological Reserve

"Management" in the context of nature conservation refers to particular activities at certain times of the year in certain areas or zones; the purpose of the activities is to maintain or improve the protected ecological feature.

6.2.1 Management of the areas of an ecological reserve

6.2.1.1 Management of Designated Ecological Sites

An alternative to complete exclusion of human intervention in an Ecological Site (as described in 5.3, operation 26 - management of Gillfillan Lake) is limited intervention: there is no conclusive scientific evidence that complete absence of human intervention will most benefit the survival or flourishing of the protected ecological feature. For example, if a threatened plant species is restricted to just a few sites, and a tree falls and threatens within a short time to obliterate one site, what is the proper course of action? It has been suggested (Keddy *in verbis* 1985) that if such a situation could occur then the site is too small. However, in some places and for some species, there may be no alternative. Therefore some sites could be "complete exclusion" sites and other sites could be "limited intervention" sites.

6.2.1.2 Management of buffer zones

Buffer zones should also be managed as "limited intervention" areas. Intervention activities should be limited to what is necessary to:

1. maintain the Ecological Site, and
2. prevent entry to the Ecological Site by unauthorized persons.

6.2.1.3 Management of the greater management area

Protected ecological features do not exist in isolation from the rest of the natural and human world. To protect the ecological feature in a broad context as well as in a local context, a management tool is necessary. According to the ISIS Method, specification standards or "zoning" - typically areas outlined on maps with accompanying lists of permitted and prohibited activities - are the tools used to protect an ecological feature in a local context: in the Designated Ecological Site and its buffer. In a broader context, that is in the greater management area, performance standards have the following advantages (after Thurow et al. 1975, 96-7):

1. they encourage innovation to ensure compatibility of development with the natural environment;
2. they eliminate the need for drafters of legislation (by-laws, etc.) to know all the details of the natural processes being protected;
3. they may be politically and socially responsive;
4. they require individuals to do their share to maintain the natural environment in proportion to the problem each creates.

6.2.2 Management for fire and disease

Both fire and disease tend to spread by contagion: they move from the burn or infected area to an adjacent area. Both fire and disease, often natural events, are also caused by humans. "There are some practical questions, the answers to which must be pragmatic, but others whose answer depends on the concept of what an Ecological Reserve is and what it is for. How, for example, are fires and epidemic insect or disease outbreaks that threaten to spread beyond the reserve to be dealt with? . . . Once 'natural' forces such as hurricanes, fires or disease do destroy a forest stand, for example, what then becomes of the site?" (Taschereau 1985, 92). On the one hand, efforts should be made to protect unique or threatened ecological features. On the other hand, many species and habitats depend on such agents as fire for their regeneration.

An ecological reserve with a landscape plan as proposed in section 4.1 offers a solution in which conservationists have two options: where Designated Ecological Sites are not contiguous, some may be protected from fire and disease; others, not. In any case, if a species is threatened or endangered, efforts might be made to cultivate it on one or more of the sites (perhaps on

the sites of moderate quality) so that if the species is eradicated on a "natural" site, the gene pool remains intact.

6.3 Notes on the Protection (Legal Status) of an Ecological Reserve

- 6.3.1 Although the Special Places Protection Act only provides specifically for Designated Ecological Sites, it also provides for a management plan "which shall contain. . . information and regulations which will assure the protection of the site" (S.N.S. 1980, c.17, s.14.2. see also s.20). Buffer zones and the greater management area would be established under this section.
- 6.3.2 It is recommended to add a section in the Special Places Protection Act that would allow designation of provisional ecological sites. This would give the Nova Scotia Museum a firm legal basis for quick action to protect a significant ecological feature or site. This protection would be on an interim basis pending a detailed study of the proposal. c.f. "Wilderness and Ecological Reserves Act" (Newfoundland 1980).

CONCLUSION

Ecological Land-use Planning

Application of the ISIS Method is not restricted to nature conservation: the method can be adapted, the schematic landscape plan modified, and public participation coordinated to address virtually any land-use in any landscape. This process may be called ecological land-use planning because:

- (a) it is responsive to natural processes;
- (b) it adopts an ecosystemic approach to human interaction with the natural landscape.

In general, ecological land-use planning deals with the site as part of a larger territory and and the site activity as part of a greater system. Thus wilderness parks (Provincial and National Parks), mines and farms, and towns and cities are each part of a larger territory and of a greater system; to recognize these relationships and to plan on this basis may resolve difficult planning problems.



SUMMARY

"Planning for Ecological Reserves in Nova Scotia" is a development manual and planning strategy. As a development manual, the ISIS Method is a method for selecting sites for, and planning, ecological reserves in compliance with the Special Places Protection Act. As a planning strategy, the paper emphasizes public participation in the planning and management of ecological reserves in Nova Scotia.

The following are the highlights of the ISIS Method and the accompanying landscape plan of an ecological reserve:

- (a) Environmental planning methods are applied to nature conservation.
- (b) Ecological land-use planning is the general planning approach.
- (c) The ISIS Method is applied to protect unique ecological features.
- (d) The priority for protection of an ecological feature or a site is based almost entirely on threat and is determined early in the process.
- (e) The ISIS Method considers all possible sites for designation rather than just one site.
- (f) The identification of suitable sites is based on site quality, rather than a combination of quality and threat to the ecological feature.
- (g) The ISIS Method selects several sites, rather than a single site, as candidates for designation.
- (h) The four conservation functions and associated management requirements are satisfied through integrating, in an ecological reserve, several candidate sites, each surrounded by a buffer zone, and all surrounded by a greater management area.
- (i) Performance standards, rather than zoning, regulate land-use in the greater management area.

In addition, the ISIS Method includes a land-use classification, field studies procedure, and draft site ranking scheme for Nova Scotia.

APPENDIXES

1

Field Studies

(see 4.3.2, operation 11)

1.1 Objectives

- (a) Prior to designation of any ecological site, the objective of field studies is to identify suitable sites by the following two steps:
 1. examination of each possible site (identified in Stage II, substage 1 from published information) to determine if the ecological feature exists there.
 2. detailed studies at each possible site where the ecological feature is found to exist to determine the extent, quality of, and threat to the ecological feature.
- (b) After designation of an ecological site, the objective of field studies is to collect data which will become the baseline information for the site monitoring program. A site monitoring program is essential if the Designated Ecological Site is to fulfill site function 2 (see 4.3.2, operation 21). These field studies should be carried out as soon as possible after designation and annually thereafter.

Description of post-designation field studies is beyond the scope of this paper.

1.2 Procedure for field studies prior to designation

If the result of the initial examination of the possible site is that the ecological feature does exist at that location, the field specialist may adopt any standard procedure such as a transect or a quadrat that is most appropriate for the ecological feature and the site. The field specialist should draw a map of the site outlining the ecological feature and identifying the location of the transect or quadrat.

1.3 Description of the site

A description of "the lay of the land" is required; information on vegetation "quantity" as well as quality is required; and it is desirable to document the history of human intervention on the site. Therefore the field specialist should describe the site according to a system based on Fosberg (1967).

Fosberg arranges information on vegetation in seven categories. The system for field studies suggested here adds categories for topography and current human intervention; the system replaces Fosberg's "Habitat or environmental relations" with a category for Ecology and a category for Habitat according to the Natural History of Nova Scotia.

There are thus ten categories for describing the site, as follows:

- (a) **Topography:** refers to the general appearance of the site including slope, aspect, presence and disposition of water on the site (eg. swales, ephemeral streams, streams, rivers, marshes or fens, lakes), and soils.
- (b) **Physiognomy:** refers to "the appearance, especially the external appearance, of the vegetation, partly resulting from, but not to be confused with, *structure* and *function*, which are much more exact and objective categories" (Fosberg 1967, 76).
- (c) **Structure:** is "defined as the arrangement in space of the components of vegetation . . . (including) the phenomena of height of plants, branching habit, size of stems, size of crowns, density of crowns, thickness and density of canopy, layering or stratification, and depth, density, spacing and stratification of root systems" (ibid. 76-7). In this category, the field specialist should also include comments on dominants/dominance association.
- (d) **Function:** signifies notable biological functions - "special adaptations to environmental situations, present or past" (ibid.).
- (e) **Composition:** consists of a "list of species making up the vegetation" (ibid.). Fosberg suggests that this category "is without doubt the most significant type of information about vegetation" (ibid.). However, this may not be true for all proposals for ecological sites.

In the field, the specialist should take photographs where appropriate. In the report, the specialist should note the presence on the site of rare, threatened, or endangered species. It is desirable to include a table with the numbers of all species and an estimate of the age of the dominant species.
- (f) **Dynamics:** refers to "successional phenomena" (ibid. 78). The field specialist should suggest the likely seral development or stages of succession (including formation) that has resulted in the present state of the site. The specialist should suggest possible future development.
- (g) **Ecology:** refers to the production-consumption cycle. The field specialist should characterize the level of production on the site; the specialist should identify primary and secondary producers and consumers, and draw a diagram if appropriate.
- (h) **Habitat:** refers to the habitats as described in *The Natural History of Nova Scotia*. The field specialist should classify the site according to the habitat descriptions and note any special features.

- (i) **History:** refers to historical influences that have helped "shape the vegetation" on the site. Fosberg cautions that "it is rarely possible to be sure of historical influences , except by inference from other characteristics. This makes history a dangerous thing to be allowed a place in a classification, as it is too hard to stick to facts. When inferences are brought into the classification, the whole scheme may be weakened" (ibid.). From what is known about the site, and from what is evident (such as evidence of old fire, cutting, agriculture, and the remains of buildings), the field specialist should suggest the history of the site.
- (j) **Current Human Intervention:** refers to current influences on, and threats to, the site. The field specialist should describe current uses such as all-terrain vehicle (ATV), ski, or hiking trails; trampling, berry-picking, bonfire pits, residues of pesticide spray, deposits of airborne or waterborne pollutants, and the nearest cottage development. The field specialist should indicate how the ecological feature is threatened or enhanced by the land-uses.

1.4 Summary, conclusions, limitations

The purpose of this section of the field report is to highlight the salient aspects of the ecological feature and the site. In the report of the field studies, the specialist should address the following:

- (a) What physiographic, climatic, or other conditions are optimum for the ecological feature at this site?
- (b) List five major actual or potential threats to the ecological feature. What is the priority that this site should have for protection?
- (c) Evaluate the suitability of the site. This will be the field specialist's general appraisal of site quality.
- (d) Identify practical limitations affecting the field studies (such as a blizzard that prevented completion) and theoretical limitations affecting the field studies (such as other relevant but in progress scientific research).
- (e) Propose directions for further field studies and research, including the best approach for post-designation site monitoring.
- (f) Add any other comments.

2 Draft Site Ranking Scheme

(see 4.3.2, operation 13)

2.1 General directions

Using this site ranking scheme, rank each possible site upon completion of the field study.

2.2 Specific directions

(a) Enter site name, number, location, and area on the Ranking Chart.

(b) For each environmental factor on the Category-value Chart,

1. select the category that best describes the site characteristic and
2. enter the value of the category on the Ranking Chart.
3. assign a factor weight and enter it on the Ranking Chart (The weight may be different for each proposal).
4. multiply the category value by the factor weight to yield the weighted value.

(c) Sum the weighted values; the total represents the suitability rank of the site.

2.3 Notes for Table A.1

1.1 The site field report will identify all the seral stages of the ecological feature.

2.1 "Regionally" refers to the Theme Regions of *Natural History of Nova Scotia*.

2.2 "Restricted" is measured against the total area representation of the ecological feature in Nova Scotia or North America and is evaluated on a case basis.

2.3 This environmental factor ranks community status: factor 4 ranks species status.

3.1 "Species that constitute the distinct community" are generally listed in a standard authority eg. *The Flora of Nova Scotia*.

3.2 Choice of these percentages for ranking need to be tested in diverse communities.

Table A.1: Category-value Chart

| Factor No. | Environmental Factor | Category | Category Value |
|------------|--|--|---|
| 1. | Seral Stage (after Gehlbach 1975) | 1.1 late seral stage | 1 |
| | | 1.2 maximum climax condition possible under natural physical conditions | 2 |
| 2. | Community or Habitat Status | 2.1 ecological feature is common in Nova Scotia but Regionally important | 1 |
| | | 2.2 ecological feature has restricted distribution in Nova Scotia but is widespread in North America | 2 |
| | | 2.3 ecological feature has restricted distribution in Nova Scotia and restricted distribution in North America | 3 |
| | | 2.4 ecological feature is disjunct | 3 |
| 3. | Number of Representative Species (ie. Diversity) | Of the species that constitute the distinct community of the ecological feature, 3.1 30% and fewer of these species are present on the site | 1 |
| | | 3.2 between 30% and 60% are present on the site | 2 |
| | | 3.3 60% and more are present on the site | 3 |
| 4. | Number of Rare, Threatened, or Endangered Species (ie. Uniqueness) | 4.1 none present | Area of representation NA NS Region 0 0 0 |
| | | 4.2 one or more rare species present | 3 2 1 |
| | | 4.3 one or more threatened or endangered species present | 4 3 2 |
| 5. | Disturbance | 5.1 natural: no recovery possible (eg. climatic shift) | 1 |
| | | 5.2 human, with a broad effect: long term recovery possible (eg fire, herbicide spraying, siltation) | 2 |
| | | 5.3 human, with a local effect: short term recovery possible (eg trampling) | 3 |

4.1 "NA" = North America, "NS" = Nova Scotia, "Region" = see note 2.1.

4.2 In this Scheme, the value of a species which is threatened province-wide is equivalent to the value of a species which is rare continent-wide.

5.1 Sites which are disturbed but salvageable or sites which are vulnerable (ie. potentially disturbed) are given a high priority in the ranking schemes of other methods (for example, see Wright 1977). In this way, those methods use their ranking scheme to justify the priority for action to protect the site.

In this ranking scheme, low disturbance is given a high ranking to favour high quality sites. This method proposes, at an earlier stage (Stage I), that disturbance or the threat of disturbance to the ecological feature or site be a criterion for assigning priority of protection action.

2.4 General notes

- (a) High quality site characteristics are assigned a high category value.
- (b) Users of the Ranking Scheme may determine a scale of factor weights applicable in all cases (ie. in all proposals).
- (c) $\Sigma(\text{category value} \times \text{factor weight}) = \text{rank of the site}$
- (d) Another environmental factor which could influence the ranking would be population size, based on numbers or on area covered per unit area.
- (e) The category-value chart is designed for sites significant for the vegetative community or species. For sites significant for faunal features or for abiotic features, the chart may be modified; however, vegetation is frequently useful as an indicator of faunal or abiotic features.
- (f) Category values in the ranking scheme are assigned on the basis of scientific experience, but without reference to an absolute standard or scale.

Table A.2: Ranking Chart

| Name of Site _____ | | Site Number _____ | | |
|---|-----------------------------|-------------------|---------------|----------------|
| Location _____ | | Area _____ | | |
| Factor No. | Environmental Factor | Category Value | Factor Weight | Weighted Value |
| 1 | Seral Stage | | | |
| 2 | Community or Habitat Status | | | |
| 3 | Diversity | | | |
| 4 | Uniqueness | | | |
| 5 | Disturbance | | | |
| Suitability Rank of the site (total of Weighted Values) | | | | |

3 Land-use Classification for Nature Conservation

(see 4.3.2, operation 18)

3.1 Purpose of a land-use classification

The purpose of a land-use classification is to present what is known about the land in such a way that this information can be easily manipulated or applied.

Human activities and their impacts on the natural landscape vary from place to place. As a result, management of a site for nature conservation will require different activities from place to place. Classifying land according to the intensity of use facilitates development of management plans for the conservation and protection of any site.

3.2 Basis of the land-use classification for nature conservation

Table A.3 shows four classes of intensity of land-use and their characteristics.

In this classification there are four classes, based on the five "major procurement patterns" (Plog et al. 1980, 194); the five patterns have been reduced to four classes here according to the intensity of land-use (or energy throughput) that each entails. The five major procurement patterns are as follows:

1. hunting and gathering
2. horticulture
3. pastoralism
4. intensive agriculture
5. industrialism

3.3 Other classifications

Both Vink and Dansereau also propose four-fold classifications for, respectively, nature conservation and "improved management of the landscape" (Dansereau 1977, 1), as follows:

- (a) "At present, four different kinds of landscape are recognized in nature conservation:
1. Natural landscapes where vegetation and fauna are the original indigenous ones and have not been influenced by men.
 2. Relatively natural landscapes; . . .the vegetation has undergone some human influence but is largely similar to the natural vegetation.
 3. Semi-natural landscapes where vegetation and fauna are mainly indigenous, but structure and visual characteristics of the vegetation have undergone intensive human influence.

Table A.3: Human use of the landscape: classes of intensity of land-use

| NAME OF LAND-USE CLASS | LAND-USE (TRADITIONAL PROCUREMENT PATTERNS) | OTHER COMMON PRESENT-DAY LAND-USES | FORM OF SETTLEMENT | LANDSCAPE IMPACTS OF LAND-USE |
|------------------------|---|--|---------------------------------------|---|
| 1. undisturbed | hunting and gathering, fishing | recreational hunting, gathering, and fishing | no permanent dwellings | trampling, picking - original soil and vegetation intact |
| 2. wild | horticulture, pastoralism | passive recreation in wilderness parks and in city and town margins including hiking, snowmobile, ski, and ATV trails, and gardens | shifting and semi-permanent dwellings | occasional clearing, permanent trampling (trails), oil spills and exhaust pollution, limited effect on soils - land has been clearcut but has regenerated |
| 3. rural | intensive agriculture, fish farming, mining, logging (clear-cut and intensive select-cut) | active recreation in wilderness parks and in city and town margins; cottages, dirt roads; flowage lands | rural (permanent) | clearing, limited earth grading and infilling, raising and lowering of the water table, flooding and drying of the land, chemical spraying, soil alteration, erosion and deposition |
| 4. urban | industrialism, information processing | building construction, paved roads, underground infrastructure, dams (outside as well as inside cities) | urban (permanent) | eradication of vegetation, earth grading and infilling, complete alteration or destruction of soils |

4. Cultural landscapes in their strict sense, where composition of both vegetation and fauna have been essentially changed by men; in many extreme cases the dominant species have been imported by men ..." (Vink 1983, 235).

Vink does not indicate the origin or reason for choice of these four "kinds of landscape".

- (b) Dansereau proposes four "panels" in "a new system (of land-use classification) more uniformly based on ecological criteria" (Dansereau 1977, v). "It is on the basis of the prevailing processes, dynamic status, and degree of human control that elements composing the landscapes of the world can be assigned to four principal panels, according to the energy charge with which they are laden.

1. PANEL A. *Wild lands* essentially obey the laws of nature; . . . they are not under (man's) immediate and visible influence. . .
2. PANEL B. *Rural lands* are much transformed but sparsely occupied by man. The indigenous and other spontaneous flora and fauna are usually eliminated and replaced by chosen useful species and varieties. . .
3. PANEL C. *Industrial lands* are marked by very heavy investment, sophisticated information, very dense occupation, and intense use. . .
4. PANEL D. *Urban land* is quite densely built-up and harbours a numerous and concentrated human population. . ." (ibid. 20).

4 A Matrix to Identify Functions and Preliminary Management Plans for Candidate Sites for Coastal-plain Flora

Table A.4: Some functions of, and preliminary management plans for, hypothetical candidate sites for coastal-plain flora

| INTENSITY OF LAND-USE CLASS (L-U) | SUITABILITY (S) | | |
|-----------------------------------|---|--|---|
| | 1 | 2 | 3 |
| 1. Undisturbed | <p>Description: Some species of coastal-plain flora probably present; habitat is in good health.</p> <p>Functions: May be core, educational, or research site depending on access and other management characteristics of the site and on the number of more suitable sites.</p> <p>Management Guidelines: If designated as a core site, management guidelines as in S3 x L-U1. If designated as an educational or research site, management may be less rigorous.</p> | <p>Description: Many species of coastal-plain flora present; may include some of the rare, threatened, or endangered species; habitat is in good health.</p> <p>Functions: May be core site; may be educational or research site depending on management characteristics of the site.</p> <p>Management Guidelines: If designated as a core site, management guidelines as in S3 x L-U1. If designated as an educational or research site, management may be less rigorous.</p> | <p>Description: Many species of coastal-plain flora including some or all rare, threatened, or endangered species present; habitat is in very good health.</p> <p>Functions: Core site</p> <p>Management Guidelines: Establish a buffer around the site. Do not permit spraying of pesticides or release of waste materials (eg. toxic metals, chemicals, chemical fertilizers, sawdust, garbage) in the watershed above the site. Establish sufficient controls for development upstream from and around the site.</p> <p>If the land is Crown-owned, transfer to the Nova Scotia Museum. If the land is privately-owned, designate with permission, purchase, or establish easement.</p> |
| 2. Wild | <p>Description: Some species of the coastal-plain flora may be present.</p> <p>Functions: May be educational or research site.</p> <p>Management guidelines: If designated, management guidelines as in S3 x L-U2.</p> | <p>Description: Some species of the coastal-plain flora present.</p> <p>Functions: May be educational or research site.</p> <p>Management guidelines: If designated, management guidelines as in S3 x L-U2.</p> | <p>Description: Many species of the coastal-plain flora present; some rare, threatened, or endangered species may be present; habitat is in good health.</p> <p>Functions: May be core site. Other functions may include education or research, depending on management characteristics of the site.</p> <p>Management Guidelines: Identify current use of the site and revise eg. reroute ATV and hiking trails. Other management guidelines as in S2 x L-U1.</p> |
| 3. Rural | <p>Description: If any coastal-plain flora is present, it is under great pressure.</p> <p>Functions: This site may be ideal for education and interpretation due to its proximity to inhabited areas.</p> <p>Management guidelines: Establish guidelines sufficient to protect and develop the site.</p> | | |
| 4. Urban | <p>Description: If any coastal-plain flora is present, it is under great pressure. The site is very close to or within an urbanized area.</p> <p>Functions: Treat the site - if it is on public land - as a public park, with walks and interpretation.</p> | | |

Notes for Table A.4

Suitability represents the relative suitability of a site for nature conservation: 1 is least, 3 is greatest. Assessment of the suitability of sites may yield a range of suitabilities, but for illustrative purposes, this table uses only three. The matrix format may be adapted for any number of suitabilities.

Intensity of Land-use Class represents the intensity of human use of the landscape: 1 is least intensive, 4 is most intensive (see Appendix 3).

Suitability of a site for nature conservation plotted against the land-use at that site indicates sites which may be candidates for designation. This table is intended as a model for a matrix to identify functions and preliminary management plans for actual candidate ecological sites. Refer to 4.3.2, operations 19, 20, and 21 for details.

5 Flowcharts of the ISIS Method
(after Quebec 1981)

Legend



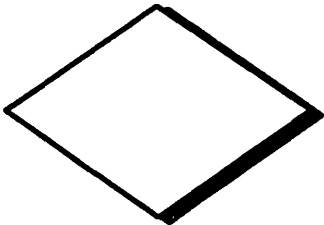
Terminal (start or stop)



Process or action



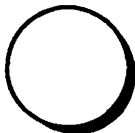
Criteria or considerations



Decision



Data transfer (send to)



Connector between stages



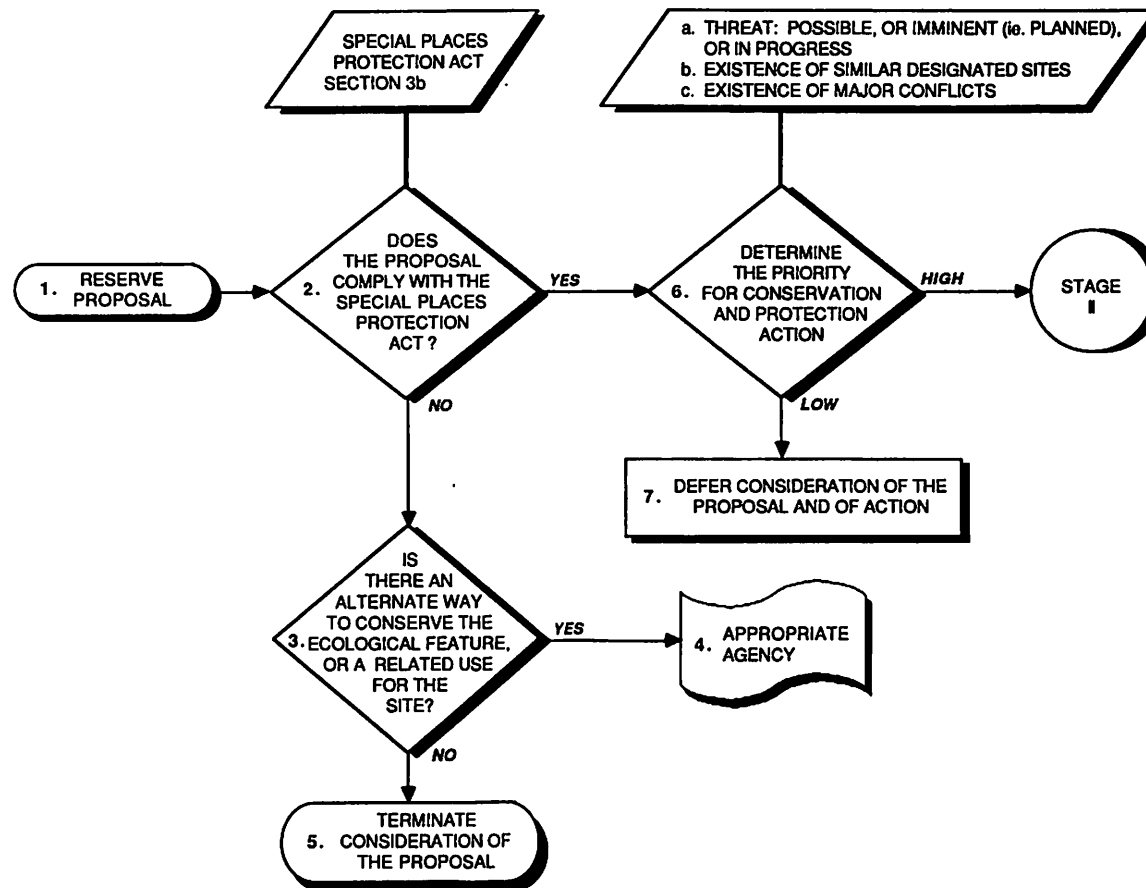


Figure A.1: Flowchart of the operations of Stage I of the ISIS Method: to determine compliance of a proposal with the Special Places Protection Act, and to determine the priority of a proposal for conservation and protection (see 4.3.1).

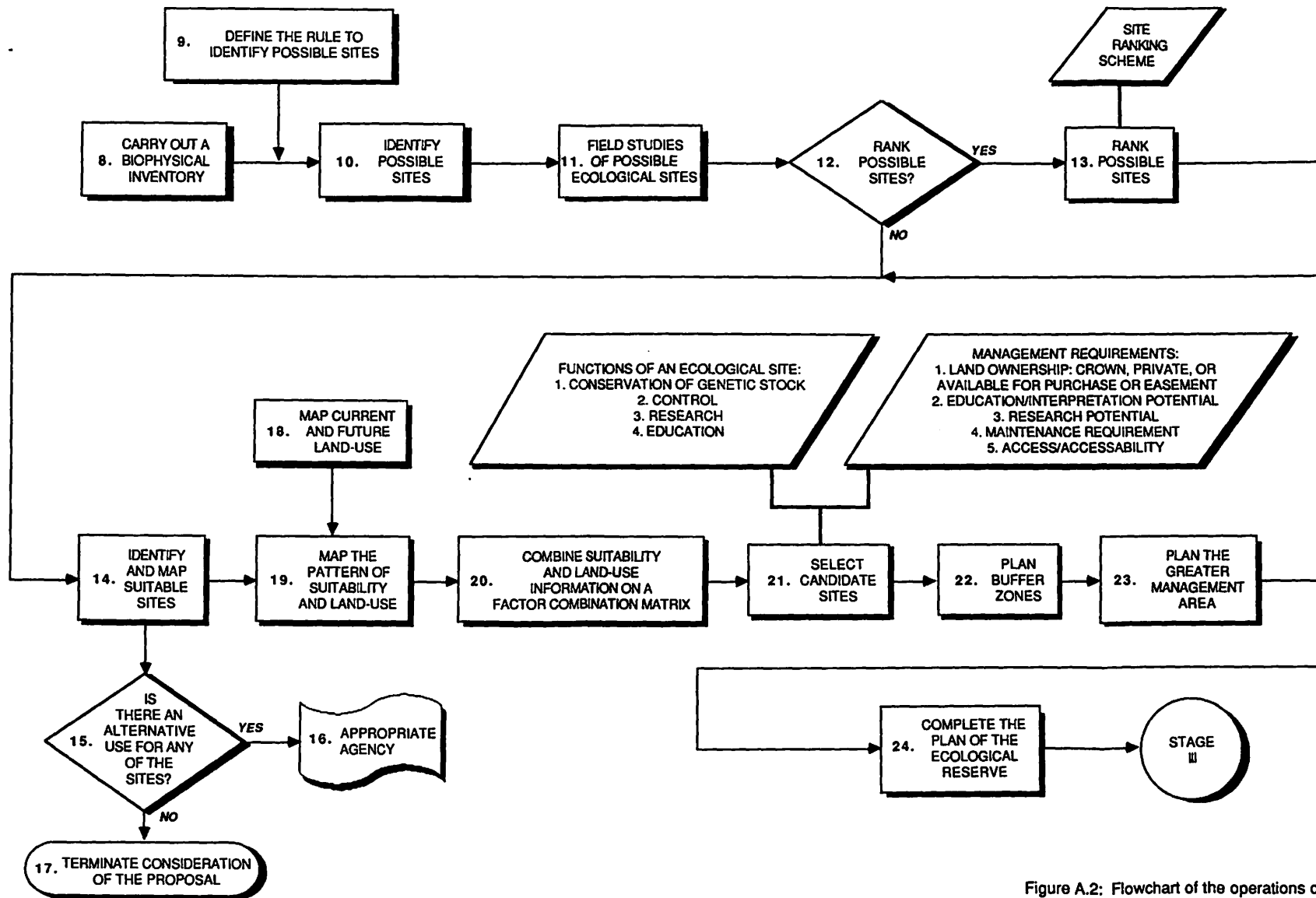


Figure A.2: Flowchart of the operations of Stage II of the ISIS Method: to select candidate sites and plan the ecological reserve (see 4.3.2).

GLOSSARY

- candidate sites** A candidate site is a site that is planned for designation under the Special Places Protection Act. A candidate site has a function assigned to it; preliminary management plans have been outlined for it. A candidate site has tentative boundaries and may have tentative zones. *Candidate site* does not refer to the list of 80 "candidate ecological sites" maintained by the Nova Scotia Museum: these are in fact proposed sites.
- category (of an environmental factor)** A category is a subdivision of an environmental factor; the category represents a point or item in the range or continuum of the environmental factor. For example, if the environmental factor is the succession stages of the plant community, categories might include pioneer, field, young forest, climax forest. Other categories could include soil types, slope classes, and land-use classes.
- conservation** In this paper, conservation refers both to non-intrusive reservation of sites and to active management programs. In addition, conservation includes activities such as education and research that enhance appreciation of the Nova Scotia landscape.
- Designated Ecological Site** "The Minister (of Education), with the approval of the Governor in Council, may on Crown land or on private land with the consent of the owner, including land covered with water, designate certain areas of the Province as ecological sites" (S. N. S. 1980, c.17, s.14.1).
- "With the coming into force of this Act, any grant of the Province of any rights under any other statute, including but not so as to restrict the generality thereof the mining rights, fishing and game rights, forestry rights, and water rights, shall be forbidden on any ecological site designated and any grant purported to be made shall be null and void" (ibid. s.18.2).
- ecological feature** In this paper, "ecological feature" may refer to a natural community, habitat, significant species, or any other significant ecological process or element.

- ecological reserve** In this paper, it is recommended that an ecological reserve in Nova Scotia should consist of one or more Designated Ecological Sites each surrounded by an insulating buffer zone and all located within a greater management area. An ecological reserve is an area in which human influence that is detrimental to the natural landscape is kept to a minimum.
- environmental factor** An environmental factor is a natural or human characteristic of the landscape. Environmental factors may be manipulated in an environmental suitability analysis; in such a case, environmental factors may be used as criteria for deciding the suitability of sites and are subdivided into categories. Factors include soils, slope, vegetation, land-use, etc.
- "Derived" environmental factors are derived from the combination of other environmental factors. For example, erosion may be a combination of soil type, wind speed, and runoff.
- environmental performance standard** "To develop this system of regulation, a community identifies the natural processes that are closely associated with public health, safety, and welfare and that provide the community important benefits ignored by the private market. Specifically, these are processes such as runoff, erosion, and groundwater infiltration... The community then establishes a specific [preferably numerical] level at which the natural process should operate, and any development of the land must be done in such a way that the natural process continues to function at this level. In contrast to a specification approach, this kind of regulation does not require designating construction techniques or site planning, but allows the developer to choose his own system of guaranteeing that the natural processes continue to operate" (Thurow et al. 1975, 96).
- feature sites** Feature sites are Designated Ecological Sites intended to conserve and protect unique ecological features.
- function (of a site)** A Designated Ecological Site may fulfill one or more of the "purposes and functions of an ecological reserve according to the IBP" (see 4.3.2, operation 21). The functions are as follows:
1. to conserve genetic resources *in situ*,
 2. to provide reference areas against which

- to compare human changes in the natural landscape,
3. to provide areas for scientific research,
 4. to provide areas for technical and public education.
- greater management area** The greater management area is the territory which includes the Designated Ecological Sites. In general, any human activity can proceed within the greater management area, but some human activities (such as pollution, widespread forest spraying, intensive development, or erosion) may have a direct effect on the ecological feature protected in the Designated Ecological Sites: the activities should be carefully planned.
- physiognomy** Physiognomy refers to the appearance of the vegetation on a site.
- possible sites** Possible sites include all the sites within a Natural History Theme Region (District or Unit) where the ecological feature is theoretically (ie. according to published biological, geological, and other information) found. A possible site is not concerned with human impact on the land (eg. the location of towns).
- protection** In this paper, "protection" implies legal status.
- quality (of a site)** Quality includes diversity of species, occurrence of rare, threatened, or endangered species, large populations, and age. Quality of a site is determined in field studies.
- representative sites** Representative sites are Designated Ecological Sites intended to conserve and protect areas representative of Nova Scotia's Natural History Theme Regions (or Districts or Units).
- suitable sites** Suitable sites include all those possible sites where the ecological feature is actually found. Suitable sites meet a certain minimum standard of ecological quality.
- Theme Regions** Nova Scotia has been divided into nine Theme Regions, which are in turn sub-divided into thirty-one Districts which are again subdivided into sixty-four Units.

The Theme Regions ecological land classification

system is the base of the biophysical inventory to determine possible sites (see operation 8 of the ISIS Method).

"The idea of natural history regions (was) first developed in 19th Century descriptive regional geographies of western Europe... The term, 'natural history theme regions', was introduced to planning for outdoor recreation and preservation in Nova Scotia by G. D. Boggs in a 1976 report to the Department of Lands and Forests... The theme region approach emphasizes those aspects of an area's natural history which are representative rather than those which are rare. It focusses on processes and on interrelationships - how a landscape develops, or why a particular environment supports a particular species" (Simmons et al. 1984, i).

"A hierarchical system of description has been developed... to aid in the understanding of how the (Regions, Districts, and Units) have been derived in Nova Scotia. This approach closely follows the Biophysical Land Classification System as first proposed by Lacate...

In the Biophysical Land Classification, Land Regions are defined on the basis of 'regional climate as expressed through regional vegetation'. The classification adopted here recognizes six regional climates in Nova Scotia but further divides two of these climatic types on the basis of regional geology...

Districts within a given region are defined by 'a distinctive landscape pattern'. This pattern (usually reflects) geology (but may also reflect) surficial materials, soils, hydrology, relief, or vegetation...

(Units) reflect a recurring pattern of landform, soils, or vegetation. In some instances various parts of a Unit may be geographically separated from each other. In these cases suffixes are used to indicate their relationship to one another" (ibid. 443-5).

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