# A GUIDE TO ENVIRONMENTAL ASSESSMENTS:

# ASSESSING CUMULATIVE EFFECTS

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Note: Any errors and omissions are the sole responsibility of the author.

# HOW TO USE THIS GUIDE

The guide consists of three modules providing practical, how-to information. Background information is presented in a series of appendices. Modules and appendices may be used as independent units so that practitioners can quickly find the information that is relevant to their needs.

| For information on | Consult | Section |
|---|---|---|
| **THE GUIDE AS A WHOLE:** introduction, purpose and principles, summary of major points and glossary. | **GUIDE OVERVIEW** | **1** |
| **ROUTINE PROJECT SCREENINGS:** a synopsis of the approach applicable to most small project screenings within Parks Canada. | **PROJECT SCREENING MODULE** | **2** |
| **THE STEP-BY-STEP APPROACH:** details on each step, examples, applicable to all types of proposals. | **DETAILED APPROACH MODULE** | **3** |
| **APPLYING THE APPROACH TO PLANS:** special considerations for assessing the cumulative effects of plans. | **PLAN ASSESSMENT MODULE** | **4** |
| **WHAT CUMULATIVE EFFECTS ARE:** background information on the concept of cumulative effects. | **BACKGROUND APPENDIX** | **5** |
| **AUTHORITIES AND REFERENCES:** legislative and policy background; links with the resource management process. | **AUTHORITIES APPENDIX** | **6** |
| **GUIDELINES FOR EXTERNAL CONSULTANTS:** handout material to help clarify Parks Canada's expectations in terms of assessing cumulative effects. | **GUIDELINES APPENDIX** | **7** |
| **CASE STUDIES:** examples of application of the approach; complete assessments and assessment summaries. | **CASE STUDIES APPENDIX** | **8** |

# NOTES ON THE GUIDE

## Organizational considerations

Assessing cumulative effects is an important and worthwhile activity. Undeniably, however, it involves expanding the scope and scale of environmental assessments. Workloads are increasing and environmental assessment practitioners are often being asked to do more with less. This is why it is so important for this guide to provide relevant information as concisely as possible.

Parks Canada undertakes approximately **700** environmental assessments every year, covering a wide range of topics and issues of various levels of complexity. The majority of these assessments are small project screenings, but they also include larger projects, projects involving complex jurisdictional issues such as those occurring along the canals, and the environmental assessments of plans and policies. Therefore, the guide must provide information to deal with a fairly broad range of issues and contexts.

The modular format was adopted to organize the information in such a way that practitioners can find what they need without reading the entire guide. The modules themselves can be read in sections rather than from start to finish. This approach does entail some repetition between modules but it is felt the advantages of the format are worthwhile, especially in the long run, as the user becomes more familiar with the guide.

# Updating the Guide

The guide will occasionally require review and updating to help ensure that it remains pertinent. Users may wish to propose new references, ideas, examples, tools or other relevant information that has proven useful. The binder format will help make occasional updating easier.

PLEASE PARTICIPATE IN UPDATING THE GUIDE BY SENDING SUCH MATERIAL TO THE NATURAL RESOURCES BRANCH AT PARKS CANADA HEADQUARTERS IN HULL, QUEBEC.

NOTE: This guide is also available in French.

# A GUIDE TO ENVIRONMENTAL ASSESSMENTS: ASSESSING CUMULATIVE EFFECTS

# GUIDE OVERVIEW

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# 1. INTRODUCTION TO THE GUIDE

## Purpose of the Guide

This guide is primarily intended for **environmental assessment practitioners within Parks Canada**. Its purpose is to provide practical information on how cumulative effects can be assessed within the existing environmental assessment process. This guide provides information and tools for the assessment of cumulative effects affecting **both natural and cultural resources**.

The guide will also be useful for **decision makers** and **managers** throughout the department who may require information on cumulative effects for a variety of reasons, including the approval of environmental assessments, preparation and assessment of site or park management plans, the environmental assessment of programs and policies, or for related or complementary projects or activities.

## Principles and Assumptions of the Guide

Assessing cumulative effects involves thinking in terms of broader scales, both geographical and temporal**. As such, this guide complements and is complemented by other streams of ecosystem-based management**. The identification of stressors for State of the Parks reports provides key contextual information for the *analysis* of the cumulative effects of proposals. Identifying measurable goals and developing ecological and commemorative integrity statements provides the basis for *evaluating* the cumulative effects of proposals. Identifying key indicators and implementing the *Natural Resource Management Process*, especially integrated monitoring, provide ongoing valuable information for updating the context for environmental assessments. Equally important, the environmental assessment process, broadened to include cumulative effects, will assist decision makers at every level in understanding the full environmental implications of their decisions. Information gained from the assessment of each and every proposal will help update the context of the specific park or site in terms of whether it is moving towards or away from ecological or commemorative integrity. **In this sense, assessing cumulative effects will provide insight on more than the specific proposal under review; it will provide constant feedback on the cumulative consequences of past decisions and how they are affecting current trends.**

**This guide does not create a new or parallel environmental assessment process**. The guide uses the existing departmental procedures, processes and tools to provide the framework for integrating cumulative effects assessment. *Cumulative effects assessment is simply environmental assessment "done right".*

**Cumulative effects assessment will take time to implement**. The most effective way to undertake cumulative effects assessment is at the management planning level, based on ecosystem boundaries. Subsequent project assessments will be greatly simplified and both time and money will be saved once cumulative effects issues have been dealt with at a broader level. However, the scale of issues considered will vary according to the level of the proposal within the decision-making hierarchy. It is important to assess proposals at all levels, including projects, plans and policies.

# 2. CUMULATIVE EFFECTS: A SUMMARY OF THE CONCEPT

**Cumulative effects occur because of a mismatch in the scale at which impacts accumulate and the scale at which decisions are made**. The environmental effects of human activities can accumulate over time and space. While impacts may originate at the local level, they tend to accumulate at ecosystem or landscape levels. These various effects may interact, and the ultimate consequences of human activities can be very significant even though they appear inoffensive when considered individually. Negative consequences will occur when an impact affects an environmental system before it can recover from a previous impact. In some cases, impacts will accumulate gradually through insignificant increments. In other cases, levels of disruption may reach a critical threshold and dramatically alter the functions of the system. Unfortunately, limits and thresholds are very difficult to predict with any level of accuracy.

**Cumulative effects constitute a threat to ecological and commemorative integrity**. Cumulative effects threaten ecological and commemorative integrity in many areas. Stressors such as acid rain, habitat fragmentation, external developments and species loss all contribute to gradual losses of integrity. Different heritage areas exhibit different levels of stress, but, without exception, all are subject to some level of cumulative consequences of human activities. This has been recognized in the *Guiding Principles and Operational Policies* which states: *"Parks seldom contain complete or unaltered ecosystems. This, combined with increasing and cumulative stress from sources such as adjacent land uses, downstream effects of air and water pollution, invasion by exotic species, visitor use and climate change can result in irreversible degradation of park ecosystems, the loss of biodiversity and impoverishment of gene pools*".

**Parks Canada has a legal obligation and policy commitment to assess cumulative effects**. There are three compelling reasons for Parks Canada to assess cumulative effects within the context of environmental assessment:

1) It is a **legal obligation** under the *Canadian Environmental Assessment Act* and a policy requirement under the federal *Environmental Assessment Process for Policy and Program Proposals*; under the National Parks Act, Parks Canada is also legally required to protect ecological integrity.

2) It is **requirement** of *Parks Canada Guiding Principles and Operational Policies* through the commitment to "be exemplary in the implementation of federal legislation pertaining to environmental assessment and review in national parks".

3) It is **sound environmental practice** and constitutes an essential tool in support of ecological and commemorative integrity.

**It is very challenging to assess cumulative effects**. Despite a plethora of literature on the subject, there is as yet no universally-accepted framework for assessing cumulative effects, and no single method or widely-applicable technique is available. Uncertainty is unavoidable when dealing with large scale, long-term issues and multiple variables, and predictions are difficult to make. Assessing and managing cumulative effects usually requires the cooperation of several jurisdictions and stakeholders. All these considerations make cumulative effects assessment a challenging proposition.

**Parks Canada is in a very advantageous position for assessing cumulative effects**. Parks Canada is in a particularly strong position to take on the challenge of assessing cumulative effects. First, there is an excellent environmental assessment process currently in place into which the assessment of cumulative effects can easily be integrated. The *Natural Resource Management Process* provides a context for supporting the EA process and managing information. Many of the efforts currently underway to implement an ecosystem-based management approach are highly complementary to cumulative effects assessment and these initiatives will be mutually supporting. Existing data bases will be beneficial, especially the integrated data bases required to support state of the parks reporting. Integrated monitoring will be an invaluable tool; ecological and commemorative integrity statements will also support cumulative effects assessment.

# 3. A SUMMARY OF THE OVERALL APPROACH TO ASSESSING CUMULATIVE EFFECTS

The overall approach for assessing cumulative effects within the EA process of Parks Canada was developed through an extensive review of existing information, workshops and input from Parks staff at various levels, and a series of case studies and test cases. The overall approach involves four elements:

1) four principles
2) a conceptual framework
3) a detailed step-by-step approach
4) implementation tools, including this guide

## The Four Principles of the Approach

The four fundamental principles of the approach are as follows:

A. Implement tiering of environmental assessments.
B. Focus on ecosystem boundaries and management plan levels.
C. Consider trends, thresholds or limits; use key components and indicators.
D. Apply the precautionary principle and integrated monitoring to deal with the inevitable uncertainty that will arise.

### A. The first principle: tiering

One way of dealing with the mismatch between the scales at which impacts accumulate and the scales at which decisions are made is by tiering environmental assessments. Tiering simply means undertaking environmental assessments at all levels of decision making. At the overall policy level, strategic environmental assessments should be carried out as an integral part of policy planning. Strategic environmental assessments at the program and plan levels will greatly simplify the scoping process for subsequent project assessments. Feedback is required throughout the assessment hierarchy.

Both the *Guiding Principles and Operational Policies* and the *Procedures of the Department of Canadian Heritage for Complying with the Canadian Environmental Assessment Act* commit Parks Canada to carry out environmental assessments of policies, programs, plans and projects. To effectively assess cumulative impacts, attention must be focussed on carrying out timely strategic environmental assessments and to incorporate the results into ongoing policy

decisions. Strategic environmental assessments must be proactive in highlighting to what extent key decisions are addressing the cumulative consequences of past, present and known future projects and activities.

## B. The second principle: focussing on ecosystem boundaries and management plan levels

Environmental effects accumulate at ecosystem/landscape levels; as a result, they are best assessed from this broad perspective. One of the best ways of assessing overall directions and multiple proposals for a given heritage area, within the context of overall consequences of human-induced changes upon its greater ecosystem, is through park or site management plans. The management plan establishes strategies for ensuring long-term ecological and commemorative integrity while promoting appropriate levels of visitor use and enjoyment**. It is critical to assess cumulative effects at the level where such strategic decisions are made** since many of the cumulative effects occurring within heritage areas stem from levels or patterns of use. It is also critical to proactively integrate environmental considerations relating to cumulative effects within overall tools such as zoning.

Current environmental assessment procedures already commit Parks Canada to conduct environmental assessments of management plans. National Parks policy directs management plans to *"contain statements of management objectives in sufficient detail to indicate how a park will protect and represent the natural and cultural aspects of its region*" (p.29). An environmental assessment at this level will therefore provide insightful information on the cumulative consequences to ecological or commemorative integrity of the various management alternatives and choices.

To be successful, such assessments should be fully integrated into the management planning process. The involvement of park staff (especially wardens and ecosystem specialists) has proven to be a highly effective tool for identifying cumulative issues and concerns.

The scope of the assessment will require adjustments to reflect natural rather than jurisdictional boundaries. Since external stressors frequently affect heritage areas, collaborative management agreements and programs with external land holders, municipalities and other stakeholders will be required to assess and manage cumulative effects. This is already identified in the *Guiding Principles and Operational Policies*.

## C. The third principle: considering trends, thresholds or limits; using key components and indicators

Most cumulative effects are the result of crowding impacts in time or space, beyond the recovery rate of the affected system. EA practitioners must determine where this crowding occurs and how significant it is. This cannot be evaluated without *benchmarks* to help establish what the acceptable limits of change are and to what extent the accumulating effects are approaching those limits.

Overall trends can provide a valuable indication of the cumulative consequences of past activities. Thresholds, targets or limits of acceptable change all provide valuable insight but may be very difficult to determine. Practitioners may use a combination of early-warning indicators and key diagnostic indicators of environmental health. The adoption of an ecosystem-based management approach, with the identification and monitoring of indicators of ecological and commemorative integrity will be extremely valuable for environmental assessments of cumulative effects.

It will also be necessary to develop targets and thresholds for appropriate levels of use in heritage areas. This will be a challenging process; it will require feedback through effective monitoring and it will take time. However, in the long term, the benefits achieved for the management of cumulative effects will be worth the effort.

## D. The fourth principle: applying the precautionary principle, and integrated monitoring, to deal with uncertainty

Uncertainty is unavoidable when dealing with broad time and space scales and multiple variables. Cumulative effects are difficult to quantify, and limits and thresholds cannot be established with precision. As a result, environmental assessments should clearly identify assumptions and risks, including, in some cases, risks stemming from decisions where the ultimate consequences cannot be determined in advance.

There are two main tools for dealing with the high uncertainty involved in assessing cumulative effects in heritage areas. The first is the application of the precautionary principle. Basically, this means that decisions must always be made so as to minimize risks to long-term ecological or commemorative integrity of heritage areas.

The precautionary principle was defined by the Banff-Bow Valley Task Force as "*principles [which] emphasize the need for care and caution when changes to the natural environment are contemplated. This is particularly important when scientific understanding of a natural system is incomplete or when an area is unusually susceptible to damage. In national parks, set aside by Canadians for future generations, the principles of precaution are especially important.*

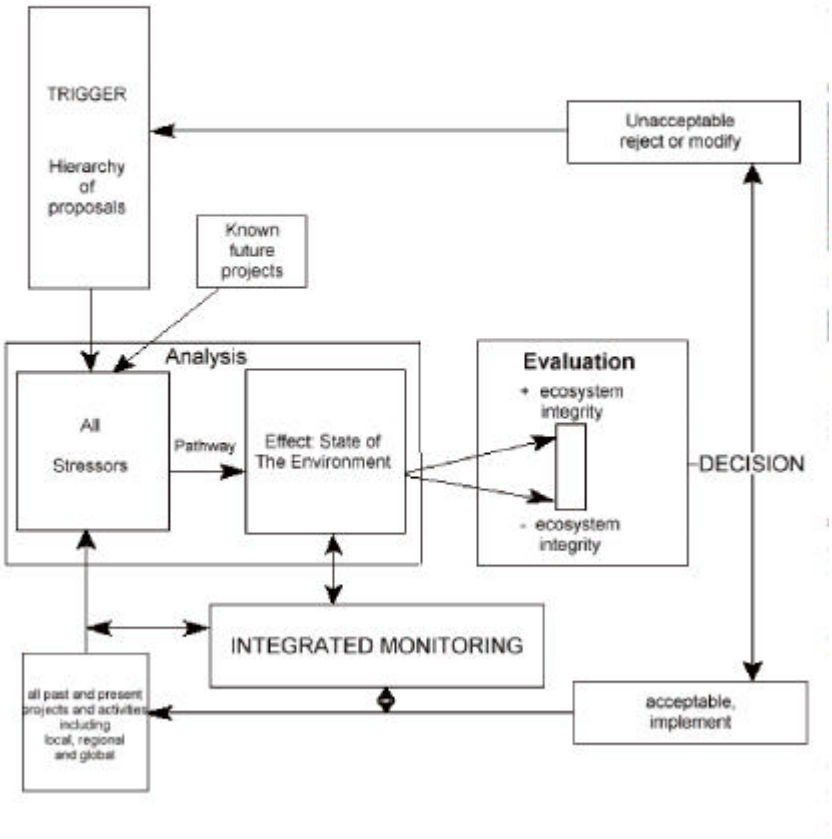
*A commonly accepted set of premises are the basis of the principle of precaution:*

- *nature is valuable in its own right;*
- *governments must be willing to take action in advance of full, formal, scientific proof;*
- *people proposing a change are responsible for demonstrating that the change won't have a negative effect on the environment;*
- *today's actions are tomorrow's legacy;*
- *all decisions have a cost. Exercising caution may mean some people must forgo opportunities for recreation or profit*"

The second tool for dealing with uncertainty is the use of integrated monitoring. Monitoring programs constitute a legal obligation under the *Canadian Environmental Assessment Act* when identified as a requirement in an environmental assessment. Integrated monitoring is a way of meeting the legal obligation arising from multiple projects and activities while promoting information exchange and feedback within the *Natural Resources Management Process*.

## The Conceptual Framework

Figure 1
A Conceptual Framework for Cumulative Effects Assessment




A conceptual framework, shown in Figure 1, provides the context for the implementation of cumulative effects assessment. The framework consists of four broad elements:

1) a **trigger** which initiates the environmental assessment process
2) an **analysis**, based on a cause-effect model, to identify the larger context of past decisions and overall consequences in which the effects of a proposal must be considered

3) an **evaluation** to determine whether the proposal, within the identified context, will promote or detract from the ecological or commemorative integrity of the heritage area
4) integrated **monitoring**, to provide feedback and information on the actual effect of a proposal once it has been implemented, within the context of all other impacts affecting the system

When an analysis is first undertaken for a given heritage area, it will identify the various stressors acting upon the system and the resulting consequences on key components. Subsequent environmental assessments will become easier to undertake as each one builds upon information obtained in the previous assessment and updated by integrated monitoring. To facilitate information exchange and feedback, it is recommended that information be compiled within a single data base or document for each heritage area.

## Step-by-Step Approach

A step-by-step approach is described to assist practitioners in assessing cumulative effects within an environmental assessment. The approach is based on four steps common to most environmental assessments, to facilitate full integration into the EA process:

1) scoping
2) analysis
3) evaluation
4) feedback, documentation and monitoring

The step-by-step approach is generic in nature and can be applied to all types of environmental assessments, including small or large project screenings and strategic environmental assessments. However, a synopsis of the approach can be applied to most small, routine screenings. Specific information is provided on how to adapt the approach for plan assessments.

## Case Studies

Both test cases and case studies were used to develop and test the overall approach. While the findings and examples are provided throughout the guide, the test cases and case studies are summarized in an appendix to provide practitioners with an example of a complete environmental assessment using the described approach.

# GLOSSARY

This glossary presents an alphabetical listing of key terms used in the guide. Definitions and additional explanations are generally incorporated into the text where the words are first used. For information on authorities and references, consult Section 7.

**CARRYING CAPACITY:** Carrying capacity can be defined as the maximum level of use or activity which a system can sustain without undesirable consequences. This is a subjective determination, which depends on values and contexts involved. Ecological carrying capacity reflects biophysical limits and may be quite different from social or recreational carrying capacity, which is determined largely by user perception and levels of satisfaction associated with a specific activity.

**CHECKLISTS:** pre-established lists of potential common effects which can be used in an environmental assessment as a memory-aid.

**COMMEMORATIVE INTEGRITY:** Commemorative integrity means "*ensuring that the resources that symbolize the significance of a historic site are not impaired or under threat, that the reasons for the site's national historic importance are effectively communicated, and that the site's heritage values are respected*." (Parks Canada, 1994)

**CUMULATIVE EFFECTS:** The effect on the environment which results from effects of a proposal when combined with those of other past, existing and future projects and activities. These may occur over a certain period of time and distance (modified from FEARO, 1994)

**CUMULATIVE EFFECTS ASSESSMENT (CEA):** This guide views cumulative effects assessment as an integral element of environmental assessment. Reference to CEA therefore implies the portion of an EA which considers cumulative effects.

**DOCUMENTATION:** Any document prepared to record an environmental assessment, including a screening report, screening form or matrix, comprehensive study or panel report, and all records related to the above.

**ECOLOGICAL INTEGRITY:** Ecological integrity has been defined as the "*the condition of an ecosystem where 1) the structure and function of the system are unimpaired by stresses induced by human activity, and 2) the system retains*

*resilience in that biological diversity and supporting processes are likely to persist*" (Parks Canada, 1994).

**ECOSYSTEM-BASED MANAGEMENT:** The term "ecosystem approach" or "ecosystem-based management" describes a comprehensive approach to planning and management which focuses on natural units and processes, including natural fluctuations and cycles, usually at broad spatial and temporal scales. The approach typically investigates the major attributes of the system in combination rather than single components, emphasizing connections and linkages, including humans as part of the ecological system.

**EFFECTS:** Changes which occur to the environment as a result of human-induced activities. Effects are defined within the *Canadian Environmental Assessment Act* as"*any change that the proposal may cause on the environment, including certain effects that flow directly from those changes, such as effects on health and socio-economic conditions, on physical and cultural heritage, on the current use of lands and resources for traditional purposes by aboriginal persons, or on any structure, site or thing that is of historical, archaeological, paleontological or architectural significance, and any change to the proposal that may be caused by the environment, whether any such change occurs within or outside Canada*". Within the context of this guide, "effect" is used interchangeably with "impact".

**ENVIRONMENT:** The *Canadian Environmental Assessment Act* defines "environment" as follows: *Environment means the components of the Earth, and includes a) land, water, and air, including all layers of the atmosphere; b) all organic and inorganic matter and living organisms; and c) the interacting natural systems that include components referred to in paragraphs (a) and (b).* Within the context of this guide, the definition of "environment" has been extended to include cultural heritage.

**ENVIRONMENTAL ASSESSMENT (EA)** Environmental assessment (EA) is a systematic, open, participatory process which identifies and predicts the potential environmental impacts of a project or activity before irrevocable decisions are made. In this guide, environmental assessment (EA) and environmental impact assessment (EIA) are used interchangeably.

**FEEDBACK:** Feedback is a means of communicating information obtained in the course of an environmental assessment or monitoring program to other environmental assessments, to data banks, to management programs or systems, and vice-versa, in order to avoid information loss or duplication of effort; and ensure that information is available to decision-makers/managers when needed.

**FOLLOW-UP:** A follow-up program is a means of measuring the accuracy of predictions made in an environmental assessment, as well as the effectiveness of mitigation measures applied. Follow-up programs also verify whether unpredicted or unanticipated impacts are occurring.

**GEOGRAPHICAL INFORMATION SYSTEMS (GIS):** GIS involves the manipulation of digitized mapping information, often through overlays or selection/combination of data.

**GROWTH-INDUCING POTENTIAL**: The potential for stimulating future growth, either through the creation of a precedent which will lead to further demands for similar proposals; or by the implementation of a proposal which leads to eventual demands for associated activities or facilities.

**IMPACTS:** Changes which occur to the environment as a result of human-induced activities. Impacts may be positive or negative and their significance must be established as part of the EA process. In this guide “impact” and “effect” are used interchangeably although some authors distinguish between the two on the basis that “effect” is a scientific observable fact while “impact” implies a value judgement.

**INDICATORS:** Indicators are surrogate measures which provide information on changes to key environmental components over time. Indicators have been used to monitor overall system integrity, to provide early-warning of stress, or to measure the magnitude or degree of exposure to stressors. Indicators may be associated with specific targets or objectives.

**INTEGRITY:** For national parks, “integrity” has been defined as *“completeness, soundness and unity - for both ecosystems and historic places*” (Parks Canada, 1994). See also specific definitions for “ecological integrity” and “commemorative integrity”.

**KEY COMPONENTS:** Elements which are valued because of their ecological, scientific, social or commemorative role. Key components often include features critical to ecosystem structure or function.

**MATRICES:** Two-dimensional checklists designed to highlight and help quantify individual interactions between two elements, usually project activities and environmental components. Matrices can be used as a memory-aid, or to weigh various options or alternatives. Matrices can be used in series to identify more complex linkages.

**MITIGATION:** The elimination, reduction, avoidance or control of the adverse environmental effects of a proposal, or the enhancement of positive effects, usually through modifications or adaptations to the proposal itself. Mitigation may include restitution for environmental damage through replacement, restoration, compensation, or by other means.

**MODEL:** Representation of reality, which simplifies relationships in order to represent linkages and interrelationships between key components. Computer modeling is often used to combine information on a number of variables in order to predict future conditions. Modeling may be mathematical in nature and often provides quantitative information on the linkages under study.

**MONITORING:** Monitoring has been used as a generic term to refer to all types of follow-up. Compliance monitoring refers specifically to surveillance during proposal implementation to ensure that mitigation measures have been implemented and that recommendations have been respected.

**NETWORK OR SYSTEM DIAGRAMS:** Network diagrams are conceptual maps which identify the linkages and interrelationships between multiple causes and series of effects through a form of loop analysis. Networks are especially helpful for identifying cause-effect relationships.

**NIBBLING:** Accumulation of effects through very gradual but constant increments.

**PATHWAYS:** The process of change by which sources of stress lead to environmental effects. Pathways may be viewed as links between causes and effects. Pathways may be additive, where accumulation occurs in a linear manner. Pathways may also be interactive; for example, synergism occurs when the resulting effect is greater than the sum of individual impacts.

**PRECAUTIONARY PRINCIPLE**: Principle which recognizes the uncertainty involved in predicting the nature or extent of changes to the environment, and therefore recommends the adoption of caution, to minimize such changes and avoid risks. The precautionary principle is especially important when scientific understanding is incomplete, when carrying capacities are unknown, or when the environment is particularly sensitive or vulnerable. The principle states that lack of scientific proof should not constitute a reason for failure to act to protect the environment.

**PROPOSAL:** The term “proposal” refers to any project, programme, plan or policy which can trigger an environmental assessment.

**RESPONSE:** The term “response” describes the reaction of the environment to various stimuli acting upon it. The response of the environment will be a function of the nature of the system, its level of complexity, resilience and stability.

**SYSTEMS:** Within this guide, the term “system” is used to denote an association of interacting biological and physical components and includes both natural systems such as ecosystems and cultural/heritage systems.

**SCALES:** Scales are a reference point for assessments and refer to both temporal and spatial units. Geographical or spatial scales can include local, regional, landscape, national or global levels while temporal scales can vary from short-to long-term.

**SCREENING:** An environmental assessment that is carried out pursuant to section 18 of the *Canadian Environmental Assessment Act*; screenings are self-directed assessments for which the responsible authority retains the greatest degree of flexibility over scope and process. Screenings account for the vast majority of environmental assessments undertaken under the federal regime, and can vary widely in scope, length and complexity of issues examined, according to the potential for environmental effects.

**SCOPING:** Scoping is the first phase of an environmental assessment and involves the identification of appropriate boundaries and key issues of concern on which to focus the assessment.

**SIGNIFICANCE:** The significance of an impact is a measure of its importance, and is established by determining whether potential effects are likely and adverse. The probability, magnitude, duration, frequency, extent and context all provide information on the significance of an impact. Because the concept can be subjective, existing information on standards, thresholds, norms or carrying capacity, or official designations, all assist in establishing significance.

**SPACE LAGS:** elapse of distance before impacts are observed.

**STANDARDS:** Standards and guidelines generally identify the levels of change which are considered tolerable based on the goals and assimilative capacity of a system. For example, water quality guidelines are generally linked to potential uses which will be made of the aquatic system (drinking, recreation, etc).

**STRATEGIC ENVIRONMENTAL ASSESSMENT (SEA)** is a process to assess the environmental impacts of strategic-level proposals such as policies, plans and programmes, and similar higher-level, conceptual or pre-project initiatives.

Such assessments focus on conceptual-level issues and tend to be less detailed than project-level EAs.

**STRESS:** This term has been used in stress ecology to denote perturbations acting upon a system. Such perturbations may be either human-induced (such as pollution) or natural, (such as fire). Cumulative effects assessment generally focuses on human-induced perturbations although natural stress must also be factored into the analysis since it may affect overall system functions and capacity.

**STRESSORS:** Sources of stress; agents of change acting upon systems (see stress).

**SURVEILLANCE:** Surveillance is undertaken to ensure that mitigation measures and assessment recommendations are correctly implemented as the proposal proceeds. Surveillance may be used interchangeably with the terms “compliance monitoring” or “surveillance monitoring”.

**TARGETS:** Targets and goals usually reflect a desired condition which is determined through a consultative process. Some cumulative effects assessments have identified specific targets for all components retained in the analysis.

**THRESHOLDS:** Thresholds may be defined in a generic sense as the limits beyond which cumulative change becomes a concern, for either social or scientific reasons. The term “critical threshold” has also been used to denote sudden changes in system behaviour, such as the point at which soil structure changes and loses its capacity to retain toxic metals.

**TIERING:** Tiering refers to the application of a nested series of assessments corresponding to the different levels of proposals within the decision-making hierarchy. Broad policy, program or plan proposals are assessed at a strategic level; subsequent project proposals can then be assessed through EAs which can focus on site-specific issues.

**TIME LAG:** elapse of time before an impact is observed.

**TRENDS:** Tendencies or directions established over time. Trend analysis involves considering the historical context of a specific component and extrapolating to future conditions.

**VALUED ECOSYSTEM COMPONENTS (VECs)**: VECs are defined as elements of the environment which are valued for scientific, societal, aesthetic, or cultural reasons. VECs are generally identified in the scoping process and may be used

to focus the environmental assessment. This guide does not distinguish between VECs and key components.

## REFERENCES CITED:

FEARO, 1994. **"Addressing Cumulative Environmental Effects: A Reference Guide for the Canadian Environmental Assessment Act"** Federal Environmental Assessment Review Office; 1994

Parks Canada, 1994. **"State of the Parks 1993 Report".** Department of Canadian Heritage. Minister of Supply and Services Canada.

## A GUIDE TO ENVIRONMENTAL ASSESSMENTS: ASSESSING CUMULATIVE EFFECTS

# PROJECT SCREENING MODULE
# A SYNOPSIS OF THE APPROACH

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# A SHORT INTRODUCTION

## Why Assess Cumulative Effects?

Many of the adverse changes affecting our environment stem not from a single project but from a combination of various human activities and projects. In recent years, there has been a growing recognition of the importance of understanding, assessing and mitigating cumulative effects. Traditionally, environmental assessment has been oriented to single projects. Yet, with some modifications, environmental assessment can be an effective tool for assessing cumulative effects. In fact, cumulative effects assessment has been defined as "environmental assessment done right".

## About the Guide

Parks Canada has prepared this guide as a reference to assessing cumulative effects. The guide consists of three modules:

1) a synopsis of the approach
2) a step-by-step detailed approach
3) special considerations for assessing plans.

Additional background information is presented in the appendices.

## About this Module

The Project Screening Module provides a synopsis of the detailed approach. It can be applied as a short cut for the assessment of cumulative effects in project screenings when issues are relatively simple. The synopsis is like a sieve: it is primarily designed to help recognize and quickly assess cumulative effects in fairly simple, routine situations. Occasionaly, even small projects may give rise to complex cumulative issues. The synopsis will become unweildy to apply and you should then refer to the detailed step-by-step module. Remember that it is not an all-or-nothing situation: you may wish to combine the synopsis with specific aspects of the more detailed approach to get a good handle on the potential cumulative effects of the project you are assessing. Using best professional judgement is the most important rule in cumulative effects assessment.

## How to use the Project Screening Module

This module can be used as an independent unit. You may wish to keep a separate copy for handy reference outside the guide itself. It may be helpful to add your own notes and comments as you gain experience with cumulative effects assessment. You would also benefit from reading the Background Appendix and the Detailed Approach Module. Keep them handy to consult when required.

# 1. WHAT ARE THE BASICS?

> ***"Cumulative effects assessment is not a methodology for adding together assessments of separate projects, but rather a means for putting the effects of any project into the perspective of larger dynamics of human activities and environmental change".*** *(Roots, 1986)*

**There is no absolute recipe for cumulative effects assessment**. It is not an easy challenge to address, especially at the project level. Effects often occur individually at a local level but accumulate at a regional or ecosystem level; this means that, even for a local project, you may have to broaden the scope of the environmental assessment to consider certain issues from a broader perspective. In some cases even projects with insignificant impacts can lead to real problems when cumulative effects are not considered. On the other hand, many of the small, routine projects which occur at Parks Canada will not contribute to important cumulative effects. **To make the best use of limited resources, it is important to recognize projects which may lead to cumulative effects, and which can be screened without broadening the scope of the assessment**. It is important to identify and focus on those potential cumulative effects which pose the greatest risk to ecological or commemorative integrity, especially where critical limits or thresholds are being approached**. In fact, cumulative effects assessment means that we are asking the question: "what are the limits and how close to them are we?"**

**No new process is required for assessing cumulative effects: it just means doing environmental assessments better than before**. Existing sources, such as park data bases, heritage area management plans and ecological or commemorative integrity statements, will provide relevant information. Of course, there will be information gaps: it is a judgement call to determine when you know enough to complete an assessment. And remember: you are not expected to know all the answers. If the potential consequences of a proposed course of action are unknown, it is important to point that out to decision makers. By consistently identifying which key information is missing and gradually working towards obtaining that information, we will better understand and manage the cumulative effects affecting our heritage areas.

**To assess cumulative effects, you must use the best available information and the best professional judgement.**

# 2. THE BIGGER PICTURE

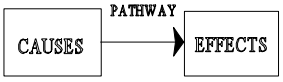
The synopsis presented in this module is linked to a broader effort to assess and manage cumulative effects. The overall approach espoused by Parks Canada for assessing cumulative effects within environmental assessments consists of four elements:

1) four principles
2) a conceptual framework
3) a step-by-step approach
4) implementation tools, including this guide

**It is a legal obligation to assess cumulative effects in all assessments carried out under the *Canadian Environmental Assessment Act***. Cumulative effects must also be considered in the EAs of all proposals which could have adverse effects on natural or cultural resources within lands administered by Parks Canada, including proposals which arise outside heritage areas but which could affect resources within the heritage area. (*Procedures of the Department of Canadian Heritage for Complying with the Canadian Environmental Assessment Act*.)

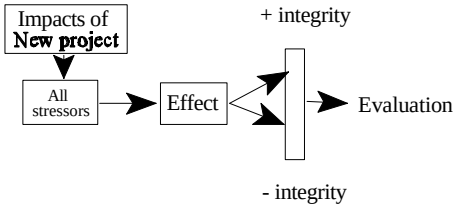
It is important to keep this bigger picture in mind when assessing projects, even very small screenings. The basic principles and conceptual framework, briefly presented in Figure 1, are discussed in greater detail in the Background Appendix of this guide. The step-by-step approach is presented in the Detailed Approach Module. The following elements may help provide a context for project assessments.

**Figure 1**
**A CONCEPTUAL FRAMEWORK FOR CUMULATIVE EFFECTS ASSESSMENT**




The simplest possible framework for cumulative effects assessment is a cause-effect diagram. The **cause**, or source of stress, is the combination of all past, present and known future projects or activities which affect a given environment. These various stressors act upon the environment in different ways, sometimes through indirect or complex pathways. The environment will also *respond* in different ways, depending on its sensitivity and resilience. Ultimately, however, there will be *effects*, the overall consequences (impacts) resulting from the combination of stressors, which will determine the current state of the environment. Usually, this state will be somewhere on a scale between absolute integrity and total disaster.

Now, add a new project to this framework. The potential impacts of the new project will be added to all those existing impacts. A change in the cause means a corresponding change in the effect: the state of the environment will shift, either towards or away from integrity. The new position can be compared to existing objectives to evaluate its significance and, hence, determine the acceptability of the impacts.




To be effective, cumulative effects assessment must be implemented at all levels of decision making and most importantly at overall planning levels such as management plans. This provides an opportunity to assess the implications of fundamental concepts, and to fully evaluate alternatives and trade offs, including the need for subsequent projects.

To assess the full implications of a project in terms of its cumulative effects, it is important to understand the potential impacts of that project, to know about the existing stressors which may interact with those impacts, and to understanding how they may combine to produce overall trends. To evaluate these trends, it is important to have clear and specific objectives and targets. This information will not need to be re-generated for every project assessment. Once the sources of stress and main pathways are understood for a given heritage area, only an understanding of the changes brought about by the project will be required. This is why links between the various levels are essential.

## The Basic Principles:

1) **Environmental assessments must be tiered and the various decision-making levels must be linked.** Is there a plan or program EA you should know about? Is a mismatch occurring between the scales at which impacts occur and the scales at which the decision is being made?

2) **The optimal context for assessing cumulative effects is the planning level, using ecosystem boundaries.** What issues were raised in the management plan EA? What ecosystem boundaries should be considered?

3) **Assessing cumulative effects involves considering trends, thresholds or limits.** Which ones have been identified for your heritage area? Which ones may be identified in the near future? Remember that when actual thresholds or limits are not available, it is important to consider trends: are key components moving towards or away from ecological or commemorative integrity?

4) **The precautionary approach must be used and monitoring implemented to help deal with uncertainty:** Use best professional judgement to determine when the best available information is adequate. Check the results of past or ongoing monitoring programs. Update information when require and adapt practices to reflect the current context.

## Consider the Steps Needed to Identify Cause and Effect

At the project level, concentrate on the key components affected by the project. What are the other relevant sources of stress? How do they interact? What is the outcome? Consider the steps outlined in the Detailed Approach Module. Remember these steps are iterative, not linear. The synopsis is a short-cut version of the detailed approach.

Assessing cumulative effects really means changing the way we think - adopting a broader perspective when considering impacts. This complements Parks Canada's overall move to adopting an ecosystem-based management approach. Think of cumulative impacts when planning monitoring programs and determining research priorities, and ensure that the information resulting from environmental assessments, even small project screenings, is incorporated into existing data bases and the various products of the *Natural Resources Management Process*.

**Cumulative effects have occurred in the past because we have forgotten to consider the bigger picture**. Decision makers have not considered the full implications of their choices at broad scales and over long periods of time. As a result, impacts have occurred so frequently in time, or so closely in place, that the system could not recover form one perturbation before the next one arrived, and impacts accumulated.

# 3. THE SYNOPSIS: THE APPROACH IN A NUTSHELL

The synopsis is a short-cut version of the detailed approach. It can be used for project screenings which involve minor environmental impacts. The synopsis serves two purposes:

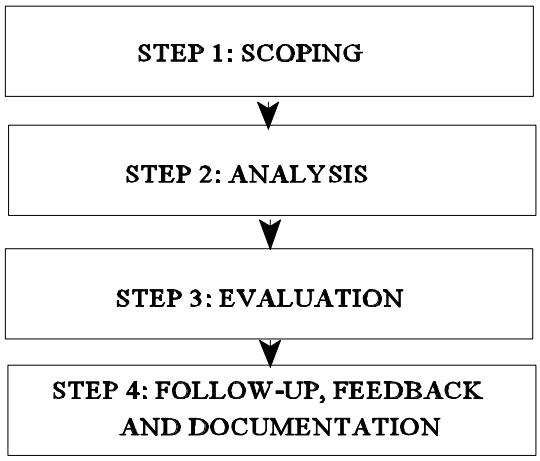
1) it helps you to distinguish between projects which do not entail cumulative effects, those which result in few cumulative effects and those which require more in-depth analysis

2) it helps you assess cumulative effects rapidly and efficiently within small screenings, while providing the context to examine potential effects more closely should the need arise

## Four Basic Steps Integrated into the Environmental Assessment

The synoptic approach is simply a condensed version of the detailed approach and consists of the same four basic steps, as shown in Figure 2 below. These steps can be fully integrated into the environmental assessment process and included in the relevant sections of the Department of Canadian Heritage Screening Form. For example, the analysis for cumulative effects involves identifying the sources of stress, pathways of change and resulting trends of key components, all of which are part of the "*Description of the environmental setting*" (section 22 in the screening form). The analysis of the relative contributions of the project to the overall cumulative impacts should be incorporated into the section on "*Nature and extent of adverse environmental effects*" (section 24 in the screening from). The analysis of mitigation measures for cumulative effects will obviously be part of "*Mitigation measures*" (section 26). The evaluation of the significance of overall cumulative effects based on relevant objectives and targets can be incorporated into *"Residual adverse effects and their significance*" (section 27). The detailed approach, shown in Figure 5 (page 25) provides more in-depth information on how the steps can be implemented; for more information on the departmental EA process consult Table 2 on page 52 of the Detailed Approach Module.

**Figure 2**
**FOUR STEPS IN THE CEA APPROACH**




You will note that these steps are also integral components of standard environmental assessments. The information provided here simply shows how scoping, analysis, evaluation and monitoring can be modified somewhat to cover cumulative effects.

**THIS IS IMPORTANT**: Before applying the synopsis approach, ensure that the project is consistent with existing policy and plans. Inconsistencies lead to cumulative effects, and cannot be resolved through environmental assessments. They should be addressed before the assessment is initiated.

## What if the Project is Too Small for Effective Assessment of Cumulative Impacts?

There are cases of repetitive small projects with insignificant impacts which, collectively, can become important. A classic example is the licensing of stormwater sewage outlets along the Trent Severn Waterway. It is anticipated that hundreds of such projects will be triggered in the near future. When numerous small projects may lead to "destruction by insignificant increments", it may be appropriate to group them and assess the projects collectively as a class.

### Consider grouping your screenings if any of the following apply:

- many projects of the same type are occurring
- the same issues are being repeated within those projects
- the same key components are being affected
- it is difficult to pinpoint a single source of an overall problem or concern
- it is difficult to mitigate the issues individually within each assessment

**EXAMPLE 1** - **No Cumulative Effects.** An assessment was undertaken for a project involving the removal of an underground gas tank in Georgian Bay Islands National Park. The purpose was to replace the old tank by a new above-ground tank which meets all environmental standards including triple-walled containment units and leakage warning systems. The work was to take place in a paved or cut lawn area and there were no designated species located nearby. The assessment recommended mitigation measures to reduce the risk of spills and a contingency plan was developed to mitigate any potential impacts should a spill occur. All work undertaken was consistent with the CCME code for below-ground storage tanks and technical guidelines developed by the federal government. Because of the overall low risk of negative effects, no cumulative effects would arise from this project. No further steps would be required.. **"When there are *no* potential impacts, there can be no cumulative effects**". Document the fact in the departmental screening form. No further steps are required.

# STEP 1 - SCOPING: ARE CUMULATIVE EFFECTS AN ISSUE IN THIS SCREENING?

By their very nature, cumulative effects are always an issue! However, not all cumulative effects can be dealt with at the project level, and efforts must be directed towards the most important issues and the most effective way of dealing with them.

> **"In many ways, scoping is the key to analysing cumulative effects; it provides the best opportunity for identifying important cumulative effects issues, setting appropriate boundaries for analysis, and identifying relevant past, present and future actions. Scoping allows the ...practitioner to 'count what counts' "**. (CEQ, 1996)

The first step in cumulative effects assessment involves recognizing the specific potential for cumulative effects resulting from the project under review. This can be done as part of the scoping process for the environmental assessment. Consider what the potential impacts of the project are. **When there are *no* potential impacts, there can be no cumulative effects**. However, when there *are* potential impacts stemming from a project, they can interact with other impacts stemming from the project or with impacts from other projects or activities, including past projects, projects occurring outside park or site boundaries, or even global impacts such as acid rain. When such interactions occur, it becomes necessary to assess the impacts of the project in combination with all of these other existing stressors.

**How do I know if the potential impacts of a project are likely to lead to cumulative effects?** Here are some key questions that will help you determine if the potential effects of the project you are assessing may interact sufficiently with existing stressors to cause cumulative effects:

- Are the potential impacts of the project, as well as other existing stressors, occurring so closely over time that the recovery capability of the system could be exceeded?
- Are the potential impacts of the project, along with other stressors from other sources, occurring within a given geographical area, so close together that their effects overlap?
- Could the impacts from the project interact among themselves, or interact with other existing or known future stressors, either additively or synergistically?

- ❖ Do the potential impacts of the project affect key components of the environment? Have those components already been affected by other stressors from the same or other projects, either directly, indirectly or though some complex pathway?
- ❖ Is the project one of many of the same type, producing impacts which are individually insignificant but which affect the environment in such a similar way that they can become collectively important over the longer term (nibbling effect)?

## Is the Scoping over Now?

If you determine that there *is* a potential for cumulative effects which should be investigated further, there are three more elements which should be scoped at this stage: **the nature of the main cumulative effects, the key components affected** and **the appropriate scale at which to assess the cumulative effects**. In other words, what are the major issues involved, how are the key components being affected and what are the geographical boundaries of the assessment?

The major issues are obviously related to the key components affected. Focus on key components affected by the potential impacts of the project, as determined in the environmental assessment. The questions identified in the first part of the scoping, which help determine whether cumulative effects are a concern, will also help identify the nature of that concern. For example, if the project being assessed is the construction of a new boardwalk in a given wetland, and several other projects are also underway within that same wetland, you may have identified cumulative effects as a potential issue because impacts are being crowded in space. The main cumulative effect may be gradual loss of wetland habitat, and the key components are the habitat itself, as well as several species of rare plants that thrive in the wetland. This information helps you focus your attention on the important issues.

The appropriate scope of the assessment will be determined by the geographical area in which the impacts accumulate. In the above example, the assessment must consider the entire wetland and not only the part of the wetland affected by the boardwalk. If the scope of the assessment vastly surpasses the scope of the project, you may need to consider whether some issues have been dealt with at a broader decision-making level. In the boardwalk example, if every wetland in the park is being affected by other projects, the loss of wetland habitat should more appropriately have been dealt with at the management plan level. Integrate the directions provided at the planning level into the EA. If the issue has not been adequately addressed at an overall level, you have no choice but to broaden the scope of the project assessment. Make sure the results of the assessment get incorporated into the overall resource management process.

# STEP 2 - ANALYSIS

The analysis involves identifying the existing stressors contributing to overall issues of concern, examining the pathways by which these stressors act upon the key components to bring about changes and showing what cumulative impacts ultimately result from these dynamics. It is then important to consider what the project under review contributes to these overall effects.

The stressors (or sources of stress) include all past, present and future projects or activities acting upon the environment, including those which are local, regional or global in origin. The pathways of change (or cause-effect linkages) are the mechanisms by which the stressors act upon the environment. The cumulative impacts are ultimate consequences which result from the actions of the stressors.

The identification of existing stressors can be accomplished as part of the "environmental setting" within the EA, since the description of the environment should normally include stressors and the current state of the resources.

**EXAMPLE 2 - Determining Cause-Effect Pathways.** It has generally been recognized that when the pathways of change are understood, cumulative effects will be easier to mitigate or manage. Consider the example of wolf mortality in the Central Rockies Ecosystem. The sources of mortality are well known. They include: shooting (58%), collisions with vehicles (40%) or trains (14%), and trapping (3%). Natural causes account for only 5% of the deaths, while only 5% are unknown. Compared to the rest of the Central Rockies Ecosystem, Banff National Park has the highest survival rates for wolves, although the number of vehicle and rail collisions there was higher than in any other area of the Ecosystem.

The pathways at work here are straightforward and additive: the more collisions, the higher the mortality and the greater overall stress on the wolf population. The effects are also clear: during 1986-1995, an average of 26% of the overwintering population were victims of human-caused mortality. Since the maximum sustainable mortality rate in harvested populations has been calculated to be 28%, the cumulative effects on the wolf population are obviously significant. Understanding the causes has highlighted the importance of mitigation such as fencing portions of the Trans-Canada Highway.

It can be difficult to mitigate known cumulative effects when they arise from a well-established pattern of use. However, it is more difficult to mitigate such effects when the sources are unknown or when the mechanisms of change are poorly understood. (Page, *et al*., 1996)

In some heritage areas, previous studies may have dealt specifically with cumulative effects, providing information that can be applied to several different environmental assessments. Using this information can avoid duplication and save lots of work. Even if there are no previous studies which deal specifically with cumulative effects, you may still find existing sources which can provide you with very relevant information. Check ecosystem management plans, ecological or commemorative integrity statements, State of the Parks reports or environmental assessments of management plans. Concentrate on key components affected by project impacts.

A matrix can be used to summarize relevant information:

**Figure 3**
**ANALYSIS MATRIX**

| Key components affected by the project | Other stressors affecting the key components | Pathways of change (cause-effect linkages) | Consequences: resulting trends of key components | Contribution of the project to overall changes |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Once this matrix is completed, consider what mitigation could be applied to eliminate or reduce the potential cumulative impacts. Where existing stressors are contributing to overall impacts, mitigation may be applied to the existing sources of stress (such as existing infrastructure or ongoing activities).

The “short-cut” approach can become unwieldy when there are too many key components affected by a proposed project, or when a large number of existing stressors already affect those key components. This is a good indication that the screening of cumulative effects requires closer attention and that the detailed approach should be consulted.

**EXAMPLE 3 - Use of the Analysis Matrix.** A proposed hydroelectric reservoir on a lake would lead to water impoundment effects. The matrix shown here summarizes some of these effects and shows the mechanisms by which they affect fish reproduction. (The project is fictitious but the information has been drawn from Page, *et al.*, 1996.)

<table>
<tr><th>Other stressors affecting the key components</th><th colspan="2">Pathways of change</th><th>Consequences: resulting trends</th></tr>
<tr><td rowspan="3">existing hydroelectric dams and generating stations</td><td>modification of seasonal fish migration - spawning beds become inaccessible</td><td rowspan="3">diminished access to spawning sites and dessication of eggs combine to lower reproductive success (additive pathways)<br><br>change in littoral invertebrate species composition favour fish species that are less reliant on littoral zone</td><td rowspan="3">modifications in fish community; overall loss of biodiversity in lake</td></tr>
<tr><td>destruction of littoral zone by flooding shifts invertebrate species composition</td></tr>
<tr><td>spring/summer filling and overwinter drawdown result in dessication of eggs or stranding of emerging fry</td></tr>
</table>

# STEP 3 - EVALUATION

Evaluation involves comparing the predicted changes resulting from the cumulative effects of the project and other stressors to established goals or objectives. The fundamental question you are asking yourself is: "Is this contributing to, or detracting from, ecological or commemorative integrity?" Since this question is fairly broad, more precision should be obtained from specific targets or objectives available from the park or site management plan, the ecosystem management plan, ecological or commemorative integrity statements, specific resource conservation plans or sometimes from the literature (see Example 4 below).

**THIS IS IMPORTANT**! When the impacts of a project are bringing the environment or key components of the environment close to a critical threshold, alarm bells should be ringing! Use the detailed approach to analyse the issues in greater depth. Approaching critical thresholds is a sign that the project must be abandoned or significantly changed and re-assessed. In fact, if a project assessment shows that critical limits are being approached, this information must be brought to park or site management staff's attention. Remedial action may be required beyond the scope of the project under review.

Often, specific objectives, targets or thresholds may not be available. It will be necessary to rely on best available information and best professional judgement as to the risks of significant overall impacts. Remember that in national parks the precautionary principle applies. It will also be necessary to identify information requirements so that, over time, cumulative effects assessment will become easier.

**EXAMPLE 4** - **Evaluation.** The EA of a proposed day-use facility expansion determined that the project would lead to disturbance of nesting piping plovers. While the effects were very difficult to quantify, it was still possible to establish significance because the piping plover management plan defined a specific target of 18 nesting pairs of this endangered species in Kouchibouguac National Park. The average number of breeding pairs at the time was only 13, so the loss of even a single pair was considered significant. At a provincial scale, the effects were also considered significant since the park population represents 21% of the provincial population of piping plover. Even at a broader scale, the potential effects of disturbance to park population would be significant since the overall Atlantic coast experienced a 27-30% decline in these shorebirds. (Kalff, 1995)

# STEP 4 - FOLLOW UP, FEEDBACK AND DOCUMENTATION

The findings of the analysis and evaluation of cumulative effects must be integrated into the environmental assessment screening form. Be sure to include any mitigation requirements which relate specifically to cumulative effects. Similarly, any special requirements in terms of surveillance or follow up must be incorporated into the screening. Follow up may be needed to verify whether predictions are correct (important where there is uncertainty!) and whether unexpected impacts occur. Without follow up, we cannot learn from our experiences. You may wish to clarify why the monitoring is important and how it relates to cumulative effects, to ensure that the results of the follow up program are made available to the next project assessment.

In some cases follow up may extend beyond the specific scope of the project to include follow up of other relevant sources of stress upon the system. This is why feedback to the resource management processes is so important. Be sure to highlight information which should be incorporated into ongoing monitoring programs (preferably integrated monitoring programs), resource conservation plans, integrity statements or management plans. When there was a problem created by lack of information, such as the absence of specific and relevant targets or thresholds, be sure to outline the potential importance of this information to cumulative effects assessment in the long term. Ensure that this gets considered in ecosystem conservation plans, management plans and other priority-setting exercises.

If the analysis suggested that trends or patterns are such that a critical threshold may soon be approached or limits exceeded, you must ensure not only that this information is clearly documented in the environmental assessment report, but also that it is fed back into the resource management process. It is vital that critical thresholds be identified and brought to the attention of heritage area managers. Identify any further studies that may be required to define the issues and threshold as clearly as possible. This should then be reflected in the heritage area management plan and integrity statements.

**Remember that considering cumulative effects generally means increased uncertainty**. Make sure that any assumptions you made are clearly stated so that the decision maker will understand what risks are being taken relating to uncertain information.

**A summary of the synopsis is presented in Figure 3 on page 14 as a "short-cut" work sheet. You may wish to use this work sheet in conjunction with other screening tools your heritage area has developed.**

**A NOTE OF CAUTION**: The short-cut work sheet is best applied to screenings that are fairly routine and easy to assess. **Please note that even small projects can sometimes raise challenging issues relating to cumulative effects**. It should become obvious in these cases that more intensive analysis will be required. Each of the four main steps is outlined in greater detail in Figure 4 on page 22. The Detailed Approach Module provides in-depth guidance on each of these steps. You may refer directly to specific sections as required.

**EXAMPLE 5 - How the Short-cut Approach can be Used.**
A proposed extension to an existing campground involved the addition of 90 new sites, leading to the loss of approximately 1.5 hectares of forested lands. The questions on the short-cut work sheet helped highlight the potential for cumulative effects. It was shown that several projects were affecting the same key environmental component (forested lands). One other project (road rehabilitation) would generate noise (possible overlap of noise effects) and higher levels of use at the campground could affect a nearby sensitive wetland with existing erosion problems.

Further scoping eliminated noise from the list of possible cumulative effects since it could easily be mitigated by scheduling construction operations to avoid excessive disturbance to visitors and wildlife. The potential effects on wetlands and forests were retained for further assessment.

The analysis revealed that, while several stressors currently were affecting forest integrity, the overall forested area was relatively stable and changes brought about by the project were not significant. High levels of use were leading to local erosion and loss of wetland quality. While no standards existed for the evaluation of these changes, it was determined that such trends were not appropriate. Mitigation was proposed involving a rehabilitation program for the wetland with the construction of a broadwalk to prevent further erosion, as well as the use of interpretive signs.

The analysis and evaluation were documented in the screening report. Overall cumulative effects were not considered significant.

## EXAMPLE 6 - When a Short Cut is not Enough.

The project involved the removal of sand trap fencing at Cavendish beach, as well as the use of a bulldozer to remove approximately 600 cubic metres of sand which the fencing had caused to accumulate on an adjacent broadwalk. Manual attempts at removal had proved unsuccessful. The assessment noted that the long-term effects of such removals were largely unknown and could not easily be predicted. Potential effects included alterations to coastal processes resulting in further disruption to adjacent dunes. The report commented that the area currently contributes to cumulative effects through inadequate/altered sand movement to maintain beaches in this area.

The environmental assessment recognized the potential for cumulative effects. Scoping the issues is relatively simple: the sand dunes are a valued component currently affected by numerous other projects and activities. The key issue is the dynamics of the sand dunes and natural removal and deposition of sands. The analysis could involve the following matrix:

| **Key components affected by the project** | **Other stressors affecting the key components** | **Pathways of change (cause-effect linkages)** | **Consequences: resulting trends of key components** | **Contribution of the project to overall changes** |
|---|---|---|---|---|
| sand dune dynamics | shoreline parkway, roads, boardwalk, beach facilities, etc. | direct impeding of sand deposition and removal, additive effects | loss of integrity of dune ecosystem; gradual loss of dune structure | continuation of this project to overall cumulative effect minimal in short term but incremental sand removal could become important |
| dune structure | same as above | direct loss of sand, increased movement due to fence removal | loss of movement | removal of fence may lead to more natural dune structure |

Because of the complexity of the issues at hand and the importance of the overall cumulative effects relating to sand dune dynamics, this project would require a closer examination (using the detailed approach) to determine cause-effect linkages and the relative contribution of the project under review.

# Figure 4
# A SUMMARY OF THE SHORT-CUT APPROACH

## STEP 1 - SCOPING

When you are doing the EA of a project, you are identifying the potential impacts of that project. **When there are no potential impacts, significant or otherwise, there can be no cumulative effects**. **Document the findings; no further steps are required.**

**When potential effects are identified in an EA, it is important to determine whether those impacts may interact with existing or potential impacts from other past, current or known future projects, including local, regional or global projects.**

**To do so, consider the following:**

- Are the potential impacts of the project, as well as other existing stressors, occurring so closely over time that the recovery of the system is exceeded?
- Are the potential impacts of the project, along with other stressors from other sources, occurring within a given geographical area, so close together that their effects overlap?
- Could the impacts from the project interact among themselves, or interact with other existing or known future stressors, either additively or synergistically?
- Do the potential impacts of the project affect key components of the environment? Have those components already been affected by other stressors from the same or other projects, either directly, indirectly or through some complex pathway?
- Is the project one of many of the same type, producing impacts which are individually insignificant but which affect the environment in such a similar way that they can become collectively important over the longer term (nibbling effect)?

**If the answer to any of these questions is yes, the potential for cumulative effects exists and must be investigated further.**

**The following questions will complete the scoping:**

- What are the potential impacts of the project which could give rise to cumulative effects?
- What is the appropriate scale to consider those impacts?

**Figure 4 (continued)**
**A Summary of the Short-Cut Approach**

## STEP 2 - ANALYSIS

Complete a matrix showing the effects of the proposed project on key environmental components in the perspective of existing stressors and trends. How does the project change the overall situation?

| Key components affected by the project | Existing stressors affecting those key components | Pathways of change (cause-effect linkages) | Consequences: resulting trends of key component | Contribution of the project to overall changes |
|---|---|---|---|---|
| | | | | |

Identify appropriate mitigation to eliminate or reduce the potential negative contribution of the project to overall stressors.

## STEP 3 - EVALUATION

How do the changes brought about by the project affect the integrity of the environment? Compare with existing goals or use best professional judgement.

## STEP 4 - FOLLOW UP, FEEDBACK, DOCUMENTATION

Document all pertinent information in order to undertake a determination under the *Canadian Environmental Assessment Act*. Include in the departmental screening form. Make sure that decision makers understand any uncertainties involved in the analysis. Include any feedback or monitoring requirements relating to cumulative effects.

# 4. THE DETAILED APPROACH: A SNEAK PREVIEW

For practical purposes, Parks Canada is using a systems approach to cumulative effects assessment. The conceptual framework involves linking causes to effects and evaluating the significance of the overall effects in terms of ecological or commemorative integrity. The short-cut work sheet is a condensed version of this concept. The detailed approach outlined in Figure 5 provides an overview of the step-by-step information available in the Detailed Approach Module.

## Four points to consider:

1) The detailed approach is **iterative and non-prescriptive**. The various steps are presented in a logical sequence for the sake of simplicity, but you will probably find it necessary to review some steps as others are completed. Don't be afraid to improvise and innovate.

2) The approach can be adapted to both large and small screenings. **Adjust the level of effort required to the level of risk of cumulative effects**.

3) In some cases a manager may be faced with numerous small projects of a similar nature, such as shoreline modification requests along a canal. Typically, these projects have insignificant impacts on an individual basis, but collectively the overall impacts may be quite significant. This is the classic "nibbling" effect. **The most effective way of dealing with such projects is to assess them collectively as a "class" to establish critical limits and a baseline for assessing significance**. You may follow the detailed approach for such "class assessments".

4) The approach does not replace the EA; it is part of the EA. **You must still undertake all the requirements of your environmental assessment**. For example, public consultation is not identified as a specific step within the approach. However, public consultation must be undertaken as part of an environmental assessment when appropriate. Consult the *Procedures of the Department of Canadian Heritage for Complying with the Canadian Environmental Assessment Act*.

Remember to group small, repetitious projects with "nibbling" effects into a single, class assessment. For more information consult the Detailed Approach Module.

**Figure 5**
**DETAILED APPROACH TO ASSESS CUMULATIVE EFFECTS**
**A step-by-step guide for project screenings**

**1. SCOPING**

**1.1** What is the **policy context** within the given area? Is the project consistent with current policy and plans? Ensure consistency with the decision-making level and established plans and policies.

**1.2** What are the **main issues and concerns** stemming from the project under review?

**1.3** What are the **key environmental components** involved?

**1.4** What is an appropriate **scale** of assessment? Include geographical and temporal boundaries.

**2. ANALYSIS**

**2.1** What are the **sources of stress** acting upon the key components affected by the project?

**2.2** What are the major **pathways** involved?

**2.3** What are the responses and overall **trends of the key components**?

**2.4** What is the **relative contribution of the project** to this overall situation? Consider any proposed alternatives to the project. How do the potential impacts that may arise from the project affect overall context and trends?

**2.5** What **mitigation methods** can be applied to eliminate or reduce the overall cumulative effects?

**3. EVALUATION**

**3.1** What specific **goals and management objectives** are relevant to the issues at hand? What are the **targets or carrying capacity** established for these components?

**3.2** What is the significance of residual impacts in terms of **overall integrity**? Will the changes brought about by the project bring the heritage area closer to its overall objectives? Will ecological or commemorative integrity be enhanced or diminished?

**3.3** What **uncertainties** and risks are involved?

**4. FOLLOW UP, FEEDBACK AND DOCUMENTATION**[1]

**4.1** Identify **surveillance** and **follow-up** requirements.

**4.2** Identify **feedback** requirements (to the management plan, cumulative effects background studies or other appropriate feedback points).

**4.3** **Document** relevant information (include in the screening form or report: environmental setting, nature and extent of cumulative effects, mitigation, public concern, monitoring requirements, etc.).

Note: These steps complement the standard environmental assessment process and should be fully integrated into the project EA.

[1]Documentation refers to the screening report and not to a separate document for cumulative effects.

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# A GUIDE TO ENVIRONMENTAL ASSESSMENTS: ASSESSING CUMULATIVE EFFECTS

# DETAILED APPROACH MODULE

# A STEP-BY-STEP APPROACH FOR ASSESSING CUMULATIVE EFFECTS

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# INTRODUCTION TO THE DETAILED APPROACH MODULE

## About this Module

The Detailed Approach Module provides more in-depth information on each of the steps identified in the *detailed approach*. The information is organized into four sections, corresponding to the four main steps of the approach: scoping, analysis, evaluation and follow up/feedback/documentation.

## How to Use this Module

This module is not intended to be read from start to finish. It provides you with more information than you are likely to need for any single environmental assessment. You may prefer to refer specifically to the step for which you need additional information. The approach can be adapted to both large and small screenings; your level of effort should be proportional to the potential risk and significance of cumulative effects. You will find that the steps are not linear: the assessment of cumulative effects is an iterative process. You may find yourself moving back and forth in the module as you progress through your environmental assessment.

The same approach can be used for project and plan assessments. There will be variations, however; you will need to adjust the scope and scale of the assessment (as well as the issues considered) accordingly. Information is provided on how to do this.

The detailed approach outlined in this module is non-prescriptive. Cumulative effects assessment is still fairly new and it may be necessary to modify, innovate and adapt tools and techniques to your particular needs. No tools can replace your ingenuity and professional judgement.

## Links to Other Modules

The Project Screening Module provides a synopsis of the approach for assessing cumulative effects and is intended for project screenings where cumulative issues are fairly easy to address. You may wish to use it as a starting point for all project assessments: it will help you recognize and identify potential cumulative effects at

the project level. It will also help you determine when it is best to group small project screenings together as a class assessment; this is especially useful for small repetitive projects which create individually insignificant impacts which can be destructive at larger scales. The Detailed Approach Module will provide you with more in-depth information on the synopsis presented in the Project Screening Module.

If you are assessing a plan, you should use the Detailed Approach Module in conjunction with the Plan Assessment Module, which addresses special considerations related to the assessments of plans. Consult the Background Appendix for information on cumulative effects or on the conceptual framework.

## Integration into the EA Process

Assessing cumulative effects is not a separate process, nor does it replace or duplicate the environmental assessment. Assessing cumulative effects is an integral component of any environmental assessment. The steps outlined in this approach are merely extensions of good EA practice. This means that you must still undertake all the requirements of your environmental assessment, according to existing legislation, policy or accepted standards. For more information, consult the *Procedures of the Department of Canadian Heritage for Complying with the Canadian Environmental Assessment Act.*

Some EA requirements are not described in detail since they are not altered by the requirement to assess cumulative effects. This is the case, for example, for public consultation, which must still be undertaken when appropriate.

## Cumulative Effects Assessment and Ecosystem-Based Management

Assessing cumulative effects within the context of environmental assessments involves thinking in terms of broader temporal and spatial scales and adopting a broader perspective. It requires the integration of information coming from various sources.

The integrated park data bases, required in support of State of the Parks reporting, will provide support to cumulative effects assessment and, in turn, CEA will produce information which can be used for SOP. Integrated monitoring is also recommended for various follow-up needs and it, too, will support cumulative effects assessment. Ecosystem-based management requires the development of measurable goals and indicators. Ecological and commemorative integrity

statements are being prepared in various parks and sites and will complement cumulative effects assessment.

In short, because all these streams are moving in the same direction, you will find that they are mutually supportive. Some of the information requirements for CEA may already be available through these supporting initiatives. Similarly, remember that the results of environmental assessments, especially those involving cumulative effects, will be relevant to many other management endeavours and must be fed back into the management process.

# STEP 1.0 - SCOPING

Scoping is the first step of an environmental assessment. It helps establish whether and to what extent the proposal under review would lead to cumulative effects. Effective scoping is difficult. Common challenges include failure to eliminate unimportant issues and difficulties in establishing the significance of issues (Gilpin, 1995). These difficulties are exacerbated when issues are conceptual. Scoping is well worth the time, however, since the subsequent steps become much more efficient.

Scoping will help demystify cumulative effects assessment. The apparent "open-ended" nature of cumulative effects has caused concern, since the boundaries and scales of assessments are broadened. Scoping will help you clarify what is important and what is reasonable. Scoping is a balancing act: if you select very broad boundaries, you will not manage to pin down effects or address issues; on the other hand, cumulative effects will be missed altogether if the scale is too restricted. It is the scope of the potential cumulative effects that will determine the ultimate scale of the assessment.

Scoping helps link projects with plans and policies by establishing consistency between the proposal and its policy context. In turn, this can help ensure that decisions are being assessed at the appropriate level: project issues should be assessed at the project level, and policy issues should be assessed at the policy level.

## Determining When Cumulative Effects are an Issue

A proposal cannot lead to cumulative effects when it doesn't have any impacts at all. However, when there *are* effects, even small or insignificant, you must consider the following questions to determine to what extent cumulative effects may be an issue. Could the potential impacts of the proposal, along with other existing or known future stressors,

- occur so closely together over time that the recovery of the system is exceeded?
- occur within a given geographical area, so close together that their effects overlap?
- interact among themselves, either additively or synergistically?
- affect the same key components of the environment, directly, indirectly or through some complex pathway?

- ❖ accumulate through insignificant increments? This may happen if the proposal is one of many of the same type, producing impacts which are individually insignificant but which affect the environment in a way that they can become collectively important over the longer term (nibbling effect).

**If the answer to any of these questions is yes, the potential for cumulative effects exists.**

The examples provided below are matrices which were used in a cumulative effects assessment of proposed projects in Kluane National Park Reserve (Hegmann, 1995). The matrices assemble information from multiple sources, creating a visual, organized structure to help identify the potential for cumulative effects. The first illustrates the seasonal nature of various sources of disturbance and clearly identifies time crowding of effects. The second examines geographical nodes of disturbances to identify potential space crowding of effects.

## EXAMPLE 1 - Temporal Overlap of Disturbances.

(from Hegmann, 1995)

| Activity (human) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aircraft landings | | | | | | | | | | | | |
| Aircraft overflights | | | | | | | | | | | | |
| Highway traffic | | | | | | | | | | | | |
| Communities | | | | | | | | | | | | |
| Horse riding | | | | | | | | | | | | |
| Hunting | | | | | | | | | | | | |
| Hunting (aboriginal) | | | | | | | | | | | | |
| **Wildlife (periods species are active in the park)** | | | | | | | | | | | | |
| Grizzly bear | | | | | | | | | | | | |
| Dall sheep | | | | | | | | | | | | |

**EXAMPLE 2 - Geographical Crowding of Impacts.** By identifying synergies between disturbance nodes; intensity of shading reflects intensity of synergy (from Hegmann, 1995).

| Disturbance nodes | Aishihik region | Alaska Highway | Alsek Pass | Alsek-Kaskawulsh River valleys | Hiking trail network |
|---|---|---|---|---|---|
| Aishihik region | | | | | |
| Alaska Highway | | | | | |
| Alsek Pass | | | | | |
| Alsek-Kaskawulsh River valleys | | | | | |
| Hiking trail network | | | | | |

## 1.1 The Policy Context

*What is the **policy context** within the given area? Is the proposal consistent with current policy and plans? Verify the consistency with the decision-making level and established plans and policies*.

Decision making is usually tiered, with fundamental, overall policy orienting narrower policies which are then expressed as program or plans eventually leading to projects. In reality, the hierarchy is somewhat more complex, with a network of policies and plans guiding issues which are often interrelated and multi-dimensional. Because of this complexity, conflicts between decisions made at various levels can and do occur.

It is important to recognize that **an environmental assessment is a very inappropriate tool to resolve fundamental policy inconsistencies**. It is best to identify any potential inconsistencies before initiating the environmental assessment and to refer such issues to an appropriate forum for their resolution. Only then should the EA be initiated.

It may happen, however, that previously unrecognized inconsistencies with environmental policy come to light while examining the environmental implications of a proposal. These should be referred to an appropriate forum for resolution.

Situating the policy context of a proposal is a useful scoping exercise in itself, especially for strategic EAs. It involves considering the fundamental purpose and overall goals of the plan or project under review. This is the first step in issues scoping. **Consistency with the policy context is required prior to initiating an environmental assessment**. Should there be inconsistencies (e.g. zoning irregularities, activities which are contrary to policy or to the park management plan, targets surpassed), these issues should be resolved as soon as possible.

**EXAMPLE 3.** The environmental assessment of **a proposed long-distance hiking trail** in La Mauricie National Park recognized the potential conflicts between conservation and use, and examined the existing policy context through reference to Parks Canada's mission statement, national parks policy, and the management plan and zoning for La Mauricie National Park. The conformity analysis noted that the proposed activity, which involved low levels of use, was compatible with existing zoning and would promote a quality wilderness experience which would support the objectives of La Mauricie National Park and Parks Canada.

Many cumulative effects originate from policy. Ideally, such cumulative effects should be addressed at the policy/plan levels, through strategic environmental assessments. This would resolve issues such as overall limits and thresholds, or allowable levels of future growth or expansion, thereby simplifying project-level assessments. Difficulties are bound to occur when the policies are absent or when they have not been properly assessed. Since it is the scale of the potential cumulative effects that determines the scale of the assessment, the ultimate result of a failure to address broad issues at the policy level is the broadening of the scope of project-level assessments, in an attempt to deal with the gaps.

**EXAMPLE 4.** The project you must assess is licensing the **removal of increased quantities of water for snow-making operations**. What policy context must be considered?

In this example, while recognizing that commercial ski areas are somewhat of an anomaly within national parks, the continued use of the facilities in question is approved in a park management plan, and zoned accordingly. However, would the proposed increase in snow-making operations lead to extended seasons or higher levels of use? It is important to ensure that any increase in levels of use is in conformity with existing limits, thresholds and targets which have been set to respect overall ecological integrity and approved by Parks Canada. In an ideal situation, a long-term development plan would have been prepared (and assessed). This plan would identify relevant cumulative issues at the strategic level: for example, the site carrying capacity, specific seasonal use targets and allowable footprints for facilities. Any increase in snow-making operations must be within the context set by this plan.

In the absence of a clear strategic context, trying to resolve such overall issues through the environmental assessment of water removal activities will be an exercise in frustration: the scope of the assessment would be broadened considerably. On the other hand, cumulative effects cannot be adequately assessed (as required by law) without an understanding of the limits and thresholds involved. Therefore, if it appears likely that the project would lead to increased levels of use, further studies to identify appropriate and acceptable levels of use would be required.

## 1.2 Scoping Issues and Concerns

### What are the Main Issues and Concerns Stemming from the Project under Review?

Scoping focusses the assessment on relevant concerns. Not all issues warrant close attention; the effort invested should be proportional to the risk and potential severities of the impacts. Scoping will establish the appropriate scale and level of detail: it is a question of the most effective use of investigative/analytical resources. Scoping is what allows practitioners to "count what counts" (CEQ, 1996).

Identifying which issues are relevant does present a few unique challenges. The importance of potential cumulative effects is not necessarily proportional to the size of a project. Small, local projects must be considered in terms of the broader region or ecosystem in which they are located. How are they affecting overall integrity? What other sources of stress currently exist and how would the project add to this existing situation? In some cases, even potentially insignificant impacts that could result from the project under review may need to be retained in the scoping exercise because of the potential overall cumulative effects.

Cumulative effects usually result from crowding impacts in time or space. They occur when the carrying capacity or limits of acceptable change of a site are exceeded, or when targets have never been established and limits are not understood. It is very difficult to identify clear scientific thresholds beyond which integrity will be irrevocably threatened. It is even more difficult to negotiate such limits once numerous conflicting demands have been created for an area. Prevention is better than cure and Parks policy clearly states that the precautionary principle will apply.

In essence, scoping the main issues and preoccupations means identifying the questions which the assessment should address. It can be helpful to actually phrase the issues as questions, to keep the analysis on track. For example, the proposed expansion of an existing campground may lead to loss of mature forests, raising questions such as: "What is the overall loss of mature forests in the park?"

Brainstorming sessions with park staff is a highly effective method for scoping issues. Existing plans such as the ecosystem conservation plan or commemorative integrity statements may help identify issues of concern. Note that scoping is iterative: if an important issue is highlighted in the course of the assessment, the scoped issues may be revisited.

**EXAMPLE 5.** A new long-distance hiking trail was proposed in the wilderness zone of La Mauricie National Park. A brainstorming session with park wardens and the project manager proved highly effective in scoping potential cumulative issues of concern. One of the main issues raised concerned the two wolf packs which use these sections of the park. The survival of top predators with large territories was identified as a key goal in the draft ecological integrity statement. Long-term survival of these animals is currently in doubt since they are subject to numerous stressors including disturbances from resource extraction activities and trapping outside park boundaries. It was determined that the analysis should consider the following question: "*To what extent will low-level human presence in the last large blocs of relatively undisturbed territory adversely affect the wolf population, given the existing stressors which currently affect these animals*?"

## Which Issues to Include and When to Stop

Assessing cumulative effects usually broadens the scope of the EA: as a result, cumulative effects assessment may appear open-ended, and it is important to ensure that the scope of the assessment remains manageable while addressing the issues which must be assessed. The challenge lies in determining how far to go. For example, do you consider the growth-inducing potential related to building a new trail in previously undeveloped back country? Should a request for shoreline modifications along a canal involve the assessment of the state of the shoreline along the entire canal? How do you decide?

A valuable rule of thumb is to consider the potential scale and severity of the cumulative effects. How broad are the potential impacts? Are extensive shoreline modifications occurring all along the canal or only in specific geographical areas? What percentage of shoreline is being affected? Has this been considered from an overall perspective, such as a management plan or integrity statement? How severe are the potential impacts? **The scale and severity of the potential cumulative impacts should guide the scope of the assessment.**

In some cases, this may lead to an assessment which is much broader than the scope of the decision under review. The only way to avoid this is to ensure that environmental assessments occur at the appropriate levels of decision making; this means that strategic policy issues, such as setting thresholds and targets, should be dealt with at the policy/plan levels, and project-specific issues, such as local siting, are dealt with at the project level. Consider Example 4 on page 6. When a long-term development plan addresses issues such as appropriate thresholds and limits, all projects stemming from that plan can be assessed much more effectively. If broader issues are not dealt with at the policy or plan levels, they will surface as potential impacts at the project level and force a broadening of the scope of the assessment. The following example further illustrates this point.

**EXAMPLE 6 - Assessing a concept at the appropriate level.**
**Proposal**: licence for withdrawing an increased amount of water for snow-making operations.
**Scope of project:** whether or not to allow commercial ski area operators to increase the amount of water removed for snow making.
**Scope of assessment:** the EA **WOULD** include effects on the aquatic habitat (water quantity, quality) within the lake (including cumulative effects from other activities affecting water quantity and quality), and the effects of increased amounts of snow being spread on the slopes (e.g. effects on vegetation); it would include the effects of existing snow making as they interact with the effects of the project under review.
**The overall effects of the commercial ski area itself** should normally be considered at a broader level: through a long-term development plan into which specific environmental considerations have been integrated. However, if overall seasonal thresholds, visitor targets and facilities footprints are not available, increased snow making would not occur within an environmentally-acceptable target-oriented framework; future growth potential then becomes a legitimate cumulative concern which must be addressed prior to a decision at the project level. This would lead to an assessment with a scope beyond its immediate decision-making potential.

## A Special Note on Growth-Inducing Potential

The question of inducing future growth or creating a precedent that will lead to further projects is an important one for cumulative effects especially in heritage areas. **Cumulative effect assessments must address the issue of growth-inducing potential**. This does not mean that all growth is unacceptable: what it means is that we should identify reasonable limits to ensure that, over time, development does not creep up through insignificant increments until an ecosystem collapses. Remember to apply the precautionary principle!

**EXAMPLE 7 - Considering growth-inducing potential.**
**Proposal:** construction of a new road through Louisbourg.
**Scope of project:** whether or not to allow the road to cross federal lands; if yes, where and under what conditions.
**Scope of assessment:** consider the impacts of the road, such as noise, destruction and fragmentation of habitat, loss of species, effects on water quality, etc., as well as impacts from other projects or activities affecting those resources; the assessment would also include potential impacts resulting from possible future growth stimulated by the roadway unless an overall framework established specific limits to such growth within and around the historic site.

# 1.3 Identifying Key Environmental Components

## What are the Key Environmental Components Involved?

The use of key components makes an assessment manageable while providing information relevant to the entire ecosystem or heritage area. Key components include elements which are valued because of their scientific, social or commemorative nature. They may include key features of ecosystem structure or function. Sonntag, *et al*. (1987) observed that cumulative effects assessments involving physico-chemical changes were more advanced than those which involved ecological changes because of a greater consensus over which parameters and indicators are the most appropriate to use.

Key components will usually be fairly easy to identify, especially once the major issues have been scoped. Ultimately, however, to be useful in an environmental assessment, key components must be fairly specific and measurable.

Not all key components can be measured directly. In some cases indicators can be used to provide information on the key components. Indicators are simply proxies: they are elements which will provide information on something else; usually, this information is reasonably easy to obtain. An element which is extremely difficult or costly to measure and monitor would not be an appropriate indicator. Fecal coliform is a classic example of an indicator of water quality. Samples of easily cultivated bacteria will be grown under laboratory conditions: their presence indicates fecal contamination, which means that other, potentially more toxic bacteria may also be present and as a result, beaches will be closed.

Ecological integrity may be identified as a key component because it directly relates to the goal of a park; however, integrity is best addressed within an environmental assessment if it is further broken down into individual components with measurable indicators to further qualify (and quantify where possible) the concept. **Such indicators will be available from ecological integrity statements.**

Key components should relate to the issues of concern identified in the scoping; this is why, in the context of environmental assessments, key components are often linked to stressors. For example, if the long-term survival of grizzly bears has been identified as an issue of concern related to a particular proposal, then grizzly bears should be retained as a key component in the assessment. If trends of increasing acidification of lakes have been identified, water quality

would be an important key component to retain. Where a particular source of stress is understood, early warning indicators can be helpful in showing how close the system is to a target or threshold. When a large number of key components have been identified, consider the criteria established in Table 1 to assist in the selection of a workable suite of key components.

Key components and indicators can often be linked to specific targets, standards or thresholds. For example, water quality standards are fairly well defined in terms of allowable levels of fecal coliform, total coliform counts and so on.

Key components are scale-specific. Components selected at a local scale may not be easily adapted to an ecosystem level. The local scale will often concentrate on individuals, while a broader-based ecosystem scale will consider communities or populations.

It is important to consider the nature of the information available on the key components selected. There is little point in selecting obscure lichens if no information is available for the subsequent analysis. In a recent panel review, a panel member recommended the rejection of an environmental assessment because insufficient information was available on key components selected to support an analysis. On the other hand, if a component is essential to understanding potential impacts, and no substitute is possible, it must be retained even if available information is scanty. This is where the need for further studies may be established.

**Table 1 - Selection criteria for key components.**

**In selecting a set of key components for assessing cumulative effects, consider including key components which:**

- represent a broad range of species and ecological functions over scales which are appropriate to the assessment in question
- represent a range of successional stages and reflect our understanding of the dynamic nature of the ecosystem
- represent a range of conditions (i.e. from natural to stressed conditions)
- reflect specific objectives or goals of the heritage area
- relate to known stressors which are cumulative in nature
- relate to the ecosystem and not to jurisdictional boundaries

**Examples of key components to be included:**

- species with large body size or large territory requirements
- old-growth or benchmark species
- early warning or vulnerable species
- rare species
- dominant species such as top predators or keystone species
- exotic or non-native species living in the heritage areas
- species which accumulate or biomagnify toxins

**Indicators selected should be:**

- relatively easy to measure
- scientifically valid
- present a high signal/noise ratio

Remember that you are not being asked to invent key components and indicators: usually they will already be available from various sources and it will be a question of selecting which are most appropriate for the assessment at hand. In fact, the challenge in most environmental assessments will be to select, from a long list of potential candidates, a balanced, effective and reasonable set of key components and indicators. If the list is too long, it defies effective analysis, yet if too few are selected some issues may not be adequately reflected in the analysis. Examples of sources of information include heritage area management plans, which will often identify key components. Many heritage areas have a suite of key indicators identified through their ecological or commemorative integrity statements. Other pertinent information may be available from resource management plans, ecosystem management plans, resource management plans, past or current monitoring programs or the literature.

**EXAMPLE 8 - Key Components Selected for a Project-Level Assessment.**
The scoping exercise for the assessment of a proposed long distance hiking trail in La Mauricie National Park focussed on three key components of particular significance to the potential cumulative effects of habitat disturbance (Les Consultants Jacques Bérubé inc., 1996a).

- **bears** (due to potential user-bear conflicts)
- **wolves** (large territory, potentially very sensitive to disturbance, at risk due to existing stressors)
- **loons** (sensitive to disturbance, population trends indicate lower reproduction rates)

**EXAMPLE 9 - Key Components Selected for a Planning-Level Assessment.** Selection of a suite of indicators for various components (referred to as icons) by the Banff-Bow Valley Task Force (Page, *et al.*, 1996a, 1996b).

| Icon | Indicator/measurement |
|---|---|
| Aquatic systems | |
| Water quality | effluent discharges (phosphorous, fecal coliforms, salt, long-range transport of pollutants) |
| Water quantity | regulation overflows, stream channelizations |
| Aquatic biodiversity | introduction of non-native species |
| Habitat loss | aquatic and riparian habitat loss in montane areas, flooding of land |
| Terrestrial systems | |
| Grizzly bear | landscape fragmentation, sensory avoidance of humans and habitat alienation, human-caused mortality, regional habitat connectivity |
| Wolf | changes in wildlife movements, recolonization of valley, human-caused mortality, regional and local connectivity |
| Elk | integrator of fire succession, herbivore and predation, habituation to humans TCH mitigation |
| Aspen | fire control, herbivory and insects, relation to songbird habitat |

# 1.4 Determining the Appropriate Scale

## What is an Appropriate Scale of Assessment? Include Geographical and Temporal Boundaries?

The assessment of cumulative effects poses a dilemma: cumulative effects often occur at a local scale but accumulate at a regional or global scale. One of the reasons cumulative effects are often overlooked is that decision makers consider implications of their choices at an inappropriate scale. This is especially true for project assessments. On the other hand, one of the reasons that cumulative effects are often ignored in environmental assessments is that the issue may seem too vast and open-ended to deal with.

Effective scoping must establish appropriate scales and boundaries, broad enough to include cumulative effects but not so broad that the assessment becomes meaningless. Consider the following:

## Geographical Scales

Geographical (or spatial) scales will determine the physical extent of the analysis and, to a certain extent, the nature of the elements to consider (individual versus populations or communities)**. As a rule of thumb, the scale of the assessment should match the scale of the overall potential cumulative effects**. Therefore, the nature of the issues and key components provides an effective guide to determining an appropriate scale for the assessment. For example, if the survival of a wide-ranging top predator is an issue, obviously the scale selected must be large enough to include that species' territory.

Generally speaking, impacts tend to accumulate at regional/landscape scales. Logically, whenever possible, natural system units (such as ecosystems or watersheds) should be used to establish boundaries, guided by the scale of the potential cumulative effects. However, ecosystems themselves are hierarchical; it is usually possible to identify larger or smaller units based on overall issues. For example, a watershed may be too large for the purposes of a project EA; however, a lake system within that watershed could be a natural unit on which to focus.

The geographical scales selected must also be practical. This is why, although some global impacts may be generated, it is not usually feasible to address global issues to any great extent in the context of a park project or plan. Such impacts

may be noted; the assessment can state that further analysis is beyond its scope.

Similarly, while ecosystem boundaries are preferable, it may be logical under certain circumstances to use political boundaries. In some cases jurisdictional units may be extended to include natural features which would make the boundaries rational from an assessment perspective.

It may be useful to select several scales for an assessment, considering local trends as well as the broader perspective. This was the approach adopted for the EA of the proposed twinning of the Trans-Canada Highway in Banff.

**EXAMPLE 10 - The Environmental Assessment of the Twinning of the Trans-Canada Highway** considered two geographical areas as the basis of the assessment(Canadian Heritage, 1995).

The main focus of the assessment was on the **Middle Bow Valley**, covering an area of approximately 1150 km $^2$, which was considered an appropriate geographic area for the cumulative effects assessment. The Middle Bow Valley was defined by the Banff National Park Warden Service for the purposes of wildlife management and this description was used in the EA. However, for the assessment of cumulative effects on fish, the study area was extended to the Bow Falls because of its role as a barrier to most fish species.

In order to assess the cumulative effects of the project within a larger context, another set of geographical boundaries was identified by consultation with other jurisdictions. The Central Rockies Ecosystem covers an area of 43,000 km$^2$ and includes a complex of national and provincial parks defined by the Columbia River and drainage divides of the Rocky Mountains.

## Temporal Boundaries

Temporal boundaries for the assessment are important in that they determine how far back the assessment should go in identifying past stressors and establishing a baseline state of the environment. Temporal boundaries also establish how far ahead the predictions can reasonably be expected to cover.

Available information will be an important factor in determining how far back baseline information can be considered. The needs may vary depending on the key elements being assessed and the characteristics of the communities involved. For example, fragmentation trends may be based on twenty years of aerial photos. On the other hand, understanding population trends in species subject to cycles of population bursts and crashes may require considerably more data over a much longer period of time.

The temporal boundaries relate to the issues and concerns under review. For example, if the focus of an environmental assessment is on the potential effects of a proposed visitor centre, the analysis of the total stress load on water quality may only need to include projects as far back as when water quality was known to be affected. In other words, the important consideration is to be in a position to identify relevant trends.

Some assessments may require greater attention to temporal boundaries than others.

**EXAMPLE 11.** While relevant timeframes were identified in the **EA of the proposed Trans-Canada Highway Twinning**, time was not considered an important variable since projects considered were all long-term: "The time frames used for management of the Banff National Park include a 5-year Management Plan (CPS, 1988), wildlife management plans for 20 years (White, personal communication) and prescribed burns for 50 years (White, *et al*., 1993). As described in section 6.3.1, most projects in MBV (Middle Bow Valley) ecosystem have an indefinite life. Because of the permanent nature of most of the projects that affect the study area, time was not made a variable in the assessment" (Canadian Heritage, 1995).

**EXAMPLE 12 - The Louisbourg Test Case** raised several questions relating to the particular challenges in identifying temporal boundaries for assessing cumulative effects on heritage resources. The identification of past, present and future activities included changes due to natural processes as well as human-induced changes throughout the history of the region. However, some of these changes created the very resources which are being commemorated at the site:

"Louisbourg provides an example of the difficulty of establishing a baseline for cumulative effects assessment. Are the changes wrought to 18th century cultural resources by 19th (century) settlers considered an impact? For example, the Kennington Cove area would likely possess many more 18th century archaeological sites had this not been the site of a 19th and 20th century community. Should the loss due to activities and development between the post-commemorative intent period and park establishment be considered an impact? Or should the slate start fresh when a national historic site is established?" (Kalff, 1996)

# STEP 2 - ANALYSIS

The analysis identifies sources of stress, pathways of change and, ultimately, the overall effects and state of the environment that result from these changes. There are two fairly distinct steps to the analysis. The first relates to the land base itself and involves studying existing cause-effect relationships to understand how they shape the current state of the environment (the existing cumulative effects context). The second relates to the specific proposal under review and involves studying how the potential impacts of the proposal would interact within the existing context to bring about a changed state of the environment.

Once the first part of the analysis, the existing cause-effects relationship, has been completed, it will provide the needed cumulative effects context for the environmental assessments of any proposals within the heritage area.

Relevant information on the stressors acting upon a given heritage area may also be acquired gradually. In the test case carried out in La Mauricie National Park, a brainstorming session with park wardens and the project manager proved to be a very effective tool for scoping the main issues involving the cumulative effects of the project under review. The same session was effective to identify existing stressors acting upon the relevant key components and to establish some of the broad cause-effect linkages. This information was supplemented by existing documentation, especially the draft ecological integrity statement, the aquatic ecosystems conservation plan and specific monitoring programs. The analysis provided information which was applicable to the entire park and which was useful for the preliminary environmental assessment of the park management plan.

Many national parks have studied the cumulative effects acting upon the greater park ecosystem, a specific ecosystem within the park or key resources. Each approach represents a way of analysing the cumulative effects context for the park. For example, the Atlantic parks have prepared "*cumulative effects studies*"; the Bruce Peninsula has recently completed a *cumulative effects assessment framework*. The Banff-Bow Valley Task Force prepared a report which included an assessment of cumulative effects within the Banff-Bow Valley. Kluane National Park undertook a study of cumulative effects on selected wildlife species. As a rule of thumb, the more complete a picture provided by these studies, the more applicable it will be to specific EAs.

Ideally, quantified information is generated in the analysis. However, it must be recognized that some issues defy quantification, at least with existing knowledge. Again, this is a case for best available information and best professional judgement.

## 2.1 Identifying the Sources of Stress

### What are the Sources of Stress Acting on the System?

A single source of stress may lead to cumulative effects if the source is repetitive in nature. More often, however, cumulative effects originate from multiple sources. The overall effects will result from the combination of all stressors stemming from past or present projects or activities, interacting through various pathways to shape the state of the environment. Only those past projects and activities which continue to have an effect on the area under review need be retained for analysis.

Potential sources of information on past and present projects and activities include:

- brainstorming sessions with park or site staff, especially scientific/technical staff
- existing documents, such as ecological or commemorative integrity statements, management plans, conservation plans, site plans, development plans and so on
- park or site records, including EA files and records, realty transaction files, past management plans or service plans
- aerial photographs
- historical maps or records or documents which record past activities
- consultation with long-term staff, local residents or local associations, local municipalities, local municipality archives
- records from other departments or levels of government, such as hunting or trapping records from provincial environment ministries, or information on flooding histories from conservation authorities

In practice, brainstorming sessions with park/site staff have proven to be an effective way of identifying existing stressors. For all of the test cases, a half-day session produced an extensive preliminary list of all past and current projects and activities affecting the area; this list included activities and developments occurring outside park or site boundaries as well as global trends such as acid rain.

Relevant information was obtained from existing and draft documents. Projects and activities were grouped and catagorized; they were often linked to known effects, impacts or overall trends. As a result of this exercise, some elements were considered irrelevant to the proposal at hand and were dropped from the list, while others were grouped differently or new elements added. The end product was a list of all known sources of stress, linked, in a preliminary manner, to overall effects or general trends.

Future projects or activities do not contribute to the *existing* load of stress, but must be included for several reasons. First, some proposals are certain to be implemented in the near future; this category includes approved projects and activities. Since their effects will soon join all the other stressors acting upon the system, it is important to include them within the current context, especially when specific limits or thresholds are involved. Similarly, it is important to include projects or activities that may not yet have been approved, but that have a reasonable chance of occurring. This is a common-sense judgement call but it is important to remember the precautionary principle.

Second, anticipated projects or activities which are of great importance or high priority should also be considered, even if they are only in the initial planning stages. This is because decisions taken today may foreclose future options: a decision about a project today necessarily affects the environment's ability to absorb impacts from future projects. The proposal currently being assessed may bring the overall levels of stress close to the limits of what is acceptable, so that implementing future projects with similar effects will become unacceptable without important and perhaps costly mitigation or remediation. An example of this are pulp mills along a waterway; the waterway may be able to absorb effluents from only four mills; the fifth one proposed must be rejected even if it meets all effluent standards. Rationally, then, the decision to allow the fourth mill was also a decision to reject the fifth, even if it had not yet been proposed.

A third category of future projects or activities involves potential stressors resulting from catastrophic events such as accidents. In such cases, it is important to consider the likelihood of such events as well as the risk to key components should the event occur. For example, the Fortress of Louisbourg National Historic site is located in close proximity to oil tanker shipping lanes. One of the external future

stressors considered was the damage of coastal resources due to possible oils spills or cleanup operations. However, the probability of occurrence was judged to be small and this was not included in the analysis.

There is a fine line to be drawn between known or anticipated future projects (as described above) and projects which will be engendered by the proposal under review. The latter, known as "future growth potential", are definitely part of the equation in assessing cumulative effects; however, they should not be considered part of the existing load of stressors. The potential for future growth associated with a proposal is best assessed as part of the impacts of that proposal: they are part and parcel of the proposal's contribution to the total load of stress acting upon the system (Example 13).

Example 13 also illustrates the point that future projects included in the list of stressors acting upon a system are not being assessed in themselves: their effects are simply being considered as part of what is happening in the environment.

Sources of information on future projects and activities include:

- any land use plans describing future orientations, such as management plans, service plans, municipal plans, regional official plans or development plans
- consultation with park staff (such as planners, park superintendents and general works managers)
- consultation with local municipal offices and municipality staff
- in some cases, consultations with private landowners adjacent to the park

**EXAMPLE 13 - The Construction of a New Ski Lift in a Commercial Ski Area** is located within a national park. The lift will attract more skiers; as a result, increased parking facilities will be required. The parking lot extension is not part of the initial proposal but, since the need for increased parking will be engendered by the lift proposal, the potential impacts of the parking lot must be included as part and package of the lift proposal. When assessing how the proposed lift interacts with existing stressors to change the overall state of the environment, the potential effects of the parking lot are included with the project being assessed and not as part of the existing load of stresses.

Compare this to an existing lift being replace by an equivalent proposed new ski lift. There would be no future growth engendered by this replacement since the two lifts are equivalent in nature. However, a parking lot extension has been proposed to accommodate the increased number of visitors attracted by new marketing initiatives. In this case, the parking lot expansion would be considered as part of the existing load of stressors acting upon the ecosystem (as a future project); the assessment of the proposed lift would analyse how the impacts of the new lift would change the overall situation.

The scoping exercise guides which of the past, current or future projects and activities should be retained for analysis. Projects or activities which do not affect the environment are not sources of stress. Only those sources of stress acting upon the selected geographical area or affecting the selected key components or issues of concern need be retained. Generally speaking, strategic environmental assessments will require the analysis of a broader range of stressors than the more specific project-level assessments.

**EXAMPLE 14 - Dropping Past Projects from the List.** An initial list of potential stressors affecting the Fortress of Louisbourg National Historic Site included the harvesting of salt marshes which occurred from the 17th century until 1969 when the historic site was created. It was later determined to be highly unlikely that any impacts of this activity still linger today and, as a result, salt marsh harvesting was dropped from the list.

It is important to remember that the steps being described are not necessarily sequential. It is possible that potential stressors which were not considered previously may lead to the revision of the scoping exercise. Similarly, some sources of stress may be identified, only to be subsequently dropped from the list if it is determined that they have no lasting impact on the environment and are not contributing to cumulative effects.

**EXAMPLE 15 - Identification of Existing and Future Activities in Banff National Park.** To identify past, current and known future projects and activities acting upon the area under review, the environmental assessment of the proposed twinning of the Trans-Canada Highway (TCH) prepared a matrix identifying year of initiation, location (Banff National Park or Middle Bow Valley) and projects retained for analysis in the EA. The list included:
**Linear projects:** C.P. Rail, Bow Valley Parkway, Hwy 93 (North and South), TCH, Trans Alta Power Line, Canadian Western Utilities Gas Pipeline
**Other projects:** Town of Banff, Banff Springs/Chateau, Banff Airport, Lake Louise - lake side, Lake Louise - townsite, Lake Louise - ski area, castle area accommodation, Sunshine ski area, Mystic Ridge ski area (Norquay), Silver City Town and mine, Birkenhead coal mine, Cascade Power Development
**Activities:** prescribed burning, logging, hunting, rabies control program, wildlife culling (elk), habituated bear control, fishing, fish stocking, tourism, back country

## 2.2 Identifying Relevant Pathways

### What are the major pathways involved?

> "Cumulative effects that are the result of well-understood pathways have an increased chance of successful management" (Peterson, *et al.*, 1987)

The importance of pathways lies in understanding the links between causes (sources of stress) and effects (cumulative impacts). Experience has shown that when pathways are understood, there is a higher likelihood that the impacts will be managed. Not surprisingly, understanding pathways of change is one of the greatest challenges in cumulative effects assessment.

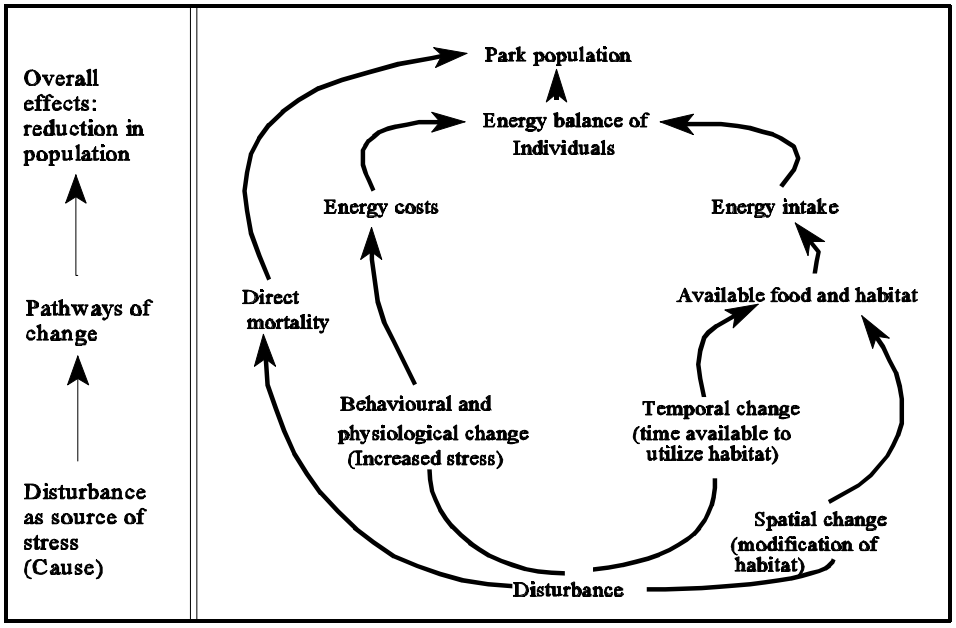
Essentially, two major types of pathways have been recognized: additive and interactive (Peterson, *et al.*, 1987). Additive pathways occur when impacts from one or several sources accumulate in the environment without interacting. Such accumulation may reach a critical point, however, at which point the system is tranformed and unexpected interactions occur: for example, increasing acidity may change soil mechanics such that heavy metals are no longer retained in an additive manner but are released into the system to interact with biological components. Thus, given a time lag, additive pathways can become synergistic.

Interactive pathways occur when synergism occurs between impacts from one or several sources in such a way that the overall effect is greater than the sum of individual impacts. Examples include toxins such as DDT which in itself was not sufficiently toxic to kill birds of prey. However, DDT caused a breakdown in steroid hormones leading to thin egg shells and eventual reproductive failure. Another commonly used example of synergism is photochemical smog: nitrogen oxides and hydrocarbons are considered more toxic in the presence of ultraviolet radiation.

Matrices can be used to establish pathways; however, they have their limitations, since they cannot always illustrate the complexity of some of the linkages involved. Clark (1986) used a series of four matrices to establish pathways for cumulative atmospheric effects. He linked sources to impacts, established the relative importance of those sources and identified possible interactions between sources, and then prepared a synoptic matrix showing the relative impact of each source on key atmospheric components.

Network diagrams have also been used successfully to map pathways of change. Network diagrams involve sketching the links between the original source of the impact and the various interactions in the environment. The following example, from Heggman (1995), illustrates some wildlife effects linkages:

**Figure 1**
**EXAMPLE OF A NETWORK DIAGRAM**
(from Heggman, 1995)




**EXAMPLE 16.** The environmental assessment of the **proposed twinning of the Trans-Canada Highway in Banff National Park** (Phase IIIA) established broad pathways of change for several fish species affected by the project. First, various stressors were identified, such as logging, loss of habitat, fishing mortality, introduction of non-native species and subspecies, population fragmentation and genetic isolation. Pathways of change were identified to establish how the stressors were affecting the fish species. For example, substrate sedimentation resulting from logging and the faulty construction of access roads was linked to the decline of bull trout through its effects on egg-to-fry survival, reduced fish food production and reduced habitat suitability for juveniles. A matrix was prepared establishing the relative contribution of each stressor to the overall cumulative effects. (Canadian Heritage, 1995)

# 2.3 Identifying the Response of the Environment

## What is the Response of the Environment? Focus on Existing Trends of Key Components

Some systems are much more resilient than others, and the *response* of the system to the various stressors will ultimately determine the overall state of the environment. Sensitive systems may show loss of integrity subject to a minimum amount of stressors whereas other systems may not bear any obvious effects even when subject to greater levels of stress. However, the response may change over time: this is the classic "time lag"element. For example, the levels of mercury in Swedish lakes increased even though the mercury emissions from industrial sources had decreased significantly two decades ago. This was linked to changes in the buffering capacities of soils and sediments as they were exposed to increasing acidity: the soils were no longer able to retain contaminants they had accumulated over 20 years ago (Stigliani, 1988).

Similarly, "space lags" will affect environmental trends. Global impacts, such as the effects of acid rain, global warming or ozone depletion, will continue to alter the response of local systems and must be factored into the equation.

In considering the response of the system to human-induced stressors, it is important to consider and understand the role of natural change. Natural change is a fundamental element of ecological integrity and includes evolutionary changes such as forest succession, natural fluctuations around average conditions (such as cyclic changes to populations or periodic floods) and catastrophic changes such as fire or insect outbreaks (Woodley, 1993). For the purposes of environmental assessment, and particularly cumulative effects, it is important to differentiate between natural changes and human-induced stresses.

The response of key components to the trends acting upon them must be considered in terms of the established goals for the heritage areas in question. In historic sites, natural ecosystem functions can exacerbate human-induced stress, causing a cumulative degradation of key resources. This was the case in Louisbourg, for example, where archaeological vestiges of the 18th century siege camp are being gradually destroyed as the relatively short-lived trees in the surrounding spruce forest die and are uprooted.

Within national parks and other natural areas, the goal of ecological integrity means that Parks Canada has recognized the inherent dynamism of natural systems and

strives to preserve ecosystem functions such as natural forest fires, for example. When considering the response of key components to human-induced stressors, natural change must be factored into the overall trends. Thresholds, where they are identified, must not be so low that a population becomes vulnerable to catastrophic events.

**EXAMPLE 17.** In an environmental assessment of a proposed day-use facility expansion at **Callenders Beach, Kouchibouguac National Park**, piping plovers were identified as valued ecosystem components and trends relating to piping plovers were considered as follows:

"Piping plovers are being adversely affected due to infrastructure development and recreational use within their habitat throughout their range. As a result of these impacts, piping plover numbers have been decreasing over time and reached such low numbers that in 1985 the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) listed them as endangered (Haig, 1985).

Nesting pairs counted in the park indicate that the population rose to a high point in the mid 1980s (21 pairs in 1983 and 22 pairs in 1984) and have subsequently been relatively stable with numbers of pairs fluctuating between 12 and 17 (although only 9 pairs were recorded in 1994). The park also monitored the number of birds fledged each year since 1987. The number of chicks fledged is much more variable, ranging from 6 to 33 between 1987 and 1994" (Kalff, 1995).

Within this context, then, the relevant response of the system to overall stresses can be established by focussing on trends of key components. The key question here is how the component is changing over time. The purpose is to consider the rate of change, overall vulnerability and potential for reaching critical thresholds or limits.

Matrices are very practical, workable tools for summarizing the response of key components to the cumulative stressors acting upon them. For each specific key component, a matrix can show the various sources of stress, the main pathways involved and the resulting overall trends (such as gradual loss of habitat, increasing fragmentation, population fluctuations, etc.). GIS techniques can also be very useful to establish trends. Maps of changes over time can be very effective for this purpose.

In Example 18 described below, the response of key components to the various stresses acting upon them was presented as a series of hypotheses which were then each examined in greater detail. This illustrates the links between the identification of relevant trends which result from an accumulation of stresses acting upon the system, and the need for research or follow up to validate those trends.

**EXAMPLE 18.** Species-specific and impact-specific tables were prepared showing the **response of key components to the various stressors** acting upon them. Response was presented as a hypothesis which was then assessed in greater detail later in the study. Only the first part of the table (species-specific response for grizzly bears) is shown here. (from Hegmann, 1995)

| Impact type | Area | Effect supposition due to impacts | Information required | Data quality | Research focus |
|---|---|---|---|---|---|
| Road and trail use | Deazdeash, Kaskawulsh and Slims River valleys | Adversely affect survival in the park | Status of VEC in area, rate and nature of growth and human use, nature of VEC response to disturbance | good | response to vehicular and foot traffic, viability of current population |
| Aircraft and water craft use | Alsek River valley | Adversely affect survival through behavioural changes and habitat alienation | Nature of VEC response to disturbance, use of traditional range | fair | response to aircraft |
| Hunting and encounters | Region outside park | Adversely affect survival through behavioural changes and direct mortality | VEC movements, range, human activity outside of park | fair | large regional movements, mortality statistics |

## 2.4 Predicting how the Proposal Changes the Existing Context

### What is the relative contribution of the proposal to this overall situation? Consider any proposed alternatives. How do the potential impacts of the proposal affect overall stressors and trends?

Once the context has been established for a given area - that is, all relevant sources of stress have been identified, pathways are understood as well as possible and trends of key components are clear - the relative contribution of the project to this overall situation must be considered. How will the proposal change the situation? To what extent does the proposal exacerbate existing stressors? What and how does the proposal contribute to the overall trends established for key components? How is the situation changed?

This is where it is important to consider not only the direct effects of the proposal under review, but also the indirect effects, including growth-inducing potential. For example, the introduction of a boat tour operation on Western Brook Pond in Gros Morne National Park led to the gradual construction of several other facilities over the next few years, such as a new trail, a boat shed and toilet facilities (Keith, 1995). These projects were the direct result of the initial project and, since future growth potential had been identified in the initial environmental assessment, as such it would normally be included in the assessment of overall effects.

**USEFUL QUESTIONS TO HELP IDENTIFY GROWTH-INDUCING POTENTIAL** (adapted from Kalff, 1995)

Will the proposal influence park and/or regional growth patterns or land use?
Are regional population levels likely to increase?
Is the goal of the proposal to increase the number of visitors to the park or region?
Will the proposal require that other developments (e.g. facilities) be built to accommodate changing activities or numbers of visitors?
Will the proposal lead to or facilitate the development of other projects?
Will the proposal open up isolated or little used areas of the park or region?

Where several alternatives are proposed for a project, the potential implications of each alternative in terms of the overall context must be considered. It may be appropriate in some cases to include as an alternative the "no-go" option, that is, the implications of not going ahead with the project, as well as the alternative of re-examining current land uses.

**EXAMPLE 19: Including the No-Go Option.** One of the goals of the initial assessment was "to determine the relative contribution of twinning of the Phase IIIA highway to the overall cumulative effect of human developments and activities in the Middle Bow Valley ecosystem"(p.12). The assessment used a series of matrices to assess the relative contributions of various past projects and activities to overall cumulative effects on key resources (see matrix below). For grizzly bears, one of the main areas of concern, the report concluded that: " The overall effect is major whether the Phase IIIA project or the "no-build" option is included. ...The main contributors to this overall cumulative impact are the existing TCH, Lake Louise townsite and the incremental effects of the twinning completion of the TCH... The incremental effect of Phase IIIA or the increased traffic volumes under the "no-build" option... are predicted to make a moderate contribution to the overall impact". (Canadian Heritage, 1995)

In most cases it will be possible to establish the relative contribution of the project to the overall stress load by focussing on changes to existing trends. Existing data on key components and past experience, coupled with expert opinion where necessary, can lead to reasonable and practical predictions.

**EXAMPLE 20 - Twinning of the Trans-Canada Highway.**
**PARTIAL REPRODUCTION OF A MATRIX IDENTIFYING THE CONTRIBUTION OF EXISTING AND FUTURE PROJECTS IN THE MIDDLE BOW VALLEY TO CUMULATIVE EFFECTS ON GRIZZLY BEARS**
**(Canadian Heritage, 1995**).

| Project/Activity | CONTRIBUTION OF PROJECT BY CUMULATIVE EFFECT CATEGORY (GRIZZLY BEAR) | | | | | Contribution of project to cumulative effects |
|---|---|---|---|---|---|---|
| | Direct habitat loss | Disturb./ displace. | Fragm. of habitat/ popul. | Collision mortality | Destruct./ removal of bears | |
| **Existing Projects** | | | | | | |
| Existing TCH | ++ | +++ | +++ | ++++ | ++ | high |
| CP Rail | + | ++ | ++ | ++++ | N/A | moderate |
| Hydro Line | - | - | + | - | N/A | low |
| Hwy 1A and Facilities | + | ++ | ++ | ++ | +++ | moderate |
| Sunshine Ski Area | ++ | ++ | ++ | - | + | moderate |
| **Incremental Effects of Proposed Future Projects or Conditions** | | | | | | |
| Existing TCH (no build) | - | ++ | +++ | ++ | ++ | moderate |
| Twinning of Phase IIIA | ++ | +++ | ++++ | ++ | ++ | moderate |

## Methods for Modelling and Predicting Change

Predictions are extremely difficult to make in cumulative effects analysis. GIS techniques may be useful to track past changes and current trends which can then be extended to consider future projections. Predictive modelling systems can also serve as valuable decision-making tools, although the development of accurate models is always challenging.

**EXAMPLE 21 - The Yellowstone Cumulative effects Model for Grizzly Bear Management.** An interagency task force was appointed by managers in the Greater Yellowstone Ecosystem to develop a cumulative effects assessment model for grizzly bear management. The purpose of the model was to quantify the cumulative effects of land use and activities on grizzly bears, and to provide managers with an analytical tool for effective decision making. The model involved vegetation mapping and the digitization of habitat components and human activities. Habitat and displacement sub-models were used to determine habitat value, while a mortality submodel was developed to quantify risks of bear mortality due to human activities. The model is intended to enhance decision making by providing managers with a computerized tool to simulate cumulative effects of various potential land uses. The model is presented as an evolving tool for the assessment and management of cumulative effects. (Weaver, *et al*., 1987).

## Uncertainty In Predictions

Uncertainty will always be an issue in environmental assessments, but more so when multiple variables are being considered over broad spatial and temporal ranges, as is the case when predicting cumulative effects. It is important to ensure that analyses and predictions are accompanied by an indication of the probability of occurrence of impacts and approximate levels of uncertainty. There are two main tools for dealing with uncertainty: use of the precautionary principle and increased use of monitoring for validation of predictions and ground truthing (discussed in section 4.1 on page 48).

The issue of burden of proof is a highly relevant question for assessing cumulative effects. How certain must predictions be? Must the environmental assessment provide irrefutable proof that a proposal will lead to unacceptable effects, or is it up to the proponent to prove that the proposal will not have effects? In difficult or highly controversial cases, this question may be critical to the type of decision made. To answer this question, consider that the *Parks Canada Guiding Principles and Operating Policies* recommends the adoption of the precautionary principle. A reasonable interpretation of this principle is that, in cases of doubt, the burden of proof must rest with the proponent: the environmental assessment can only be expected to prove reasonable uncertainty. It then becomes the manager's responsibility to take the levels of uncertainty into account when making decisions, and to apply the precautionary principle. (For more information on uncertainty and the precautionary principle see section 3.3 on page 45.)

## 2.5 Identifying Mitigation

### What mitigation methods can be applied to eliminate or reduce the overall cumulative effects?

Mitigation of cumulative effects presents some particular challenges which are not encountered in a more conventional approach to EA. Obviously, mitigation will most often be directed towards the project under review and those potential impacts which contribute to overall stresses. In some cases, however, mitigation can also be applied to other projects which affect the same key components, so that the overall effect will be reduced. In this sense, rehabilitation or restoration may be considered mitigation of past impacts. Rehabilitation may reduce the overall effects to such an extent that a given project becomes acceptable. In this sense, the scope of mitigation is broadened in cumulative effects assessment.

**EXAMPLE 22 - Broad application of mitigation: Point Pelee National Park.** Point Pelee National Park is one of the smallest parks in the system, occupying an area of just 16 $km^2$, a large portion of which is occupied by wetlands. The park is well known for its spring and fall bird migrations, which attract a large number of visitors. In the summer, many users concentrate on the popular beach areas.

A very high level of off-trail use by visitors led to incremental destruction of vegetation and erosion problems, which were all the more significant given the small size of the park. It was determined that the cumulative effects of trampling were so severe that no new trails could be designated.

To address this problem, all unofficial trail use was documented. Trails were closed and rehabilitated and new trails were redesignated within a capped total. A trail plan was prepared with partners to disperse visitor use to nearby provincial and local parks. These combined measures helped mitigate the cumulative effects of trampling; as a result official trails could be maintained without overall unacceptable consequences.

**EXAMPLE 23 - Chilkoot Trail** is unique as one of the only national historic sites in Canada where a growing number of recreational users are encouraged to hike and backpack in and around historic features. The trail was made famous in North America's last gold rush, when it was used by thousands of stampeders hoping to make their fortunes in the Yukon gold fields. While a wide variety of above-ground artefacts are scattered throughout the length of the trail, one of the largest concentrations can be found at Bennett City, the site of the largest temporary tent community of its kind. Gold seekers would stop at this site located on the shores of Lake Bennett to build boats which would take them on the next leg of their journey. At its peak, 20,000 stampeders were temporarily encamped at the site. The hilly, rugged terrain forced them to build a series of terraces supported by cobble retaining walls. The remains of terraces and tent platforms are historical features which today make the site unique.

The soil around Bennett City is unstable and sandy, and the thin vegetation cover led to the formation of sand dunes. Indiscriminate camping and foot traffic over the terraces gradually led to the destruction of vegetation and soil erosion. The removal of cobbles by campers to secure tents caused incremental slumping of retaining walls. The cumulative effects of this use over time were collapsed retaining walls, slumped terraces and the destruction of both the cultural and natural landscapes.

One of the interesting features of the measures used to allay these long-term cumulative effects was that mitigation served to protect both the cultural and natural heritage of the site. Rehabilitation of stabilizing vegetation combined with redirection of users to a single access trail, closure of unofficial trails, the construction of a staircase and the replacement of loosened cobbles all served to reduce erosion and increase overall site stability. The use of interpretive and directional signs and the formalizing of camping at sites adjacent to the main road further improved the situation.

A monitoring program has concluded that these measures were effective in stabilizing the site. The approach has fostered a landscape perspective in which both cultural and natural heritage are protected. (Hems, 1996; Hems and Nieuwhof, 1994)

# STEP 3 - EVALUATION

The analysis of cumulative effects (Step 2) used ecosystem science and professional judgement to identify, as explicitly as possible, the ultimate consequences of a combination of human-induced changes. To understand what those ultimate changes mean, it is necessary to explicitly describe the values context on which the evaluation is based. Existing goals, objectives, targets or umbrella policies will serve as a reference point against which to gauge the overall changes brought about in the environment by the project under review.

When values are explicitly stated, the relevance of the evaluation will be greatly enhanced. When a proposal is surrounded by controversies and divergent viewpoints, it is important to clearly show how decisions were reached. Should values change over time, the evaluation can be revisited.

Values do evolve over time. New information can modify our reaction to scientific information: for example, the growing awareness of the importance of protecting biodiversity leads to changes in various government polices. As a result of changes in values, goals and objectives may be out of date and no longer reflect umbrella policies or public opinion. This is why it is so important to verify the consistency of goals and objectives within the overall policy context in the scoping exercise. Public consultation exercises and management plan updates will also serve to integrate changing values over time. An example of this is the recognition, in Parks policy, of the importance of ecological and commemorative integrity. This is leading to changes in park management and planning, especially through the development of ecological and commemorative integrity statements.

**EXAMPLE 24 - The Banff-Bow Valley Round Table** assigned an 8-person committee with the task of assembling information on values and drafting a vision for the Banff-Bow Valley. They recognized that the strength of a shared vision lies in the collaborative process within which it was prepared. The vision identified common values and translated these into principles which should guide the actions of all parties. (Page, *et al.*, 1996b)

## 3.1 Using Objectives, Targets and Thresholds

### What specific goals and management objectives are relevant to the issues at hand? What are the targets or thresholds established for these components?

Goals and objectives are broad orientations established by Parks Canada, often with input from the public, which establish the overall directions management initiatives should take. Goals and objectives specific to each heritage area are provided in management plans, as well as other documents such as integrity statements. Targets are more specific goals relating to specific resources or components. For example, the piping plover management plan established a target of 22 pairs of nesting piping plovers for P.E.I. National Park. Thresholds are expressions of limits of acceptable change beyond which a system will change, often irreversibly. Obviously, thresholds and targets are subjective; it is impossible to predict the exact point at which ecosystem collapse will occur, just as it is impossible to predict the exact levels of mercury residue that will trigger health problems in humans. The point, however, is to determine what standards are the most reasonable to guide decision making.

Management goals and objectives help in the selection of key components, in setting targets and thresholds, and in assessing significance. Targets and thresholds provide a reference point to evaluate the significance of potential overall changes. In some cases, targets may represent a range of variables rather than a single element. The main selection criteria is that targets and thresholds should be measurable. In some cases, this means they should be quantitative; however, qualitative variables can also be measured and may represent a practical solution in difficult cases.

Where possible, established targets and thresholds should be used. For example, the Canadian Council of Ministers of the Environment developed a series of standards for water quality (CCME, 1987). Unfortunately, in some cases (especially water, air and soil quality) a plethora of standards may exist (such as federal, provincial and municipal water quality standards); in other cases, no commonly accepted targets or thresholds will be available (especially ecological integrity, habitat requirements, wildlife disturbance levels), and it may not be possible to define specific targets or thresholds. Trend analysis can then provide valuable insight into how the key component is fairing and whether it is moving towards or away from greater integrity. Again, best professional judgement will be needed in such cases.

**EXAMPLE 25 - Selecting Targets for Cumulative Effects.**
The Cumulative Effects Monitoring Program for the Niagara Escarpment Plan (MacViro Consultants Inc., 1995) identified specific targets for a series of indicators related to monitoring components. The framework developed was ultimately based on management objectives.

A similar system has been developed for the Bruce Peninsula National Park (Geomatics International, 1996). The park objectives were related to monitoring questions (similar to the concept in section 1.2 of formulating scoping issues as questions). Monitoring components were then identified and indicators and targets were established for each component. Examples are presented below:

| Monitoring questions | Monitoring component | Indicator | Target |
|---|---|---|---|
| Are faunal communities typical of undisturbed aquatic habitats being maintained? | Aquatic fauna | proportion of lakes/streams with non-native fauna species | less than 5% for park, less than 10% for the greater park ecosystem (GPE) |
| | Fish populations | no. of streams with viable trout populations | within 10% of historical maximum number |
| | | angling effort and yield | stable, commensurate with viable fish populations |
| What proportion of the natural erosional features have a high state of natural integrity? | Caves | proportion of caves undisturbed, number of cave fauna present | 95% undisturbed in park, 85% undisturbed in GPE no loss of species from park, loss of less than 5% from GPE |

**EXAMPLE 26 - Piping Plovers in Kouchibouguac National Park.** (Kalff, 1995). The assessment of the proposed expansion of a day use facility at Callenders Beach, Kouchibouguac National Park, identified a potential impact on piping plovers since it would bring users 1.5 km closer to their breeding area and would provide visitors with permanent access to prime plover breeding habitat. Targets for numbers of breeding pairs were available from the piping plover management plan prepared by Parks Canada (Atlantic Region).

"National parks will increase the previous five years nesting population of 56 pairs to 60 pairs during the next five years with individual park mean population goals of PEI National Park: 22, Kouchibouguac National Park: 18 and Kejimkujic National Park Seaside Adjunct: 20."

## 3.2 Evaluating the Significance of Residual Impacts

**What is the significance of residual impacts in terms of <u>overall integrity</u>? Will the changes brought about by the proposal bring the heritage area closer to its overall objectives? Will ecological or commemorative integrity be enhanced or diminished?**

Significance can be established most credibly when objectives, targets and thresholds have been identified. If thresholds will be exceeded as a result of a proposed project, then clearly that project becomes unacceptable.

Unfortunately, specific targets are often unavailable. While it is hoped that in the long term, relevant thresholds will eventually be developed, you may need to rely on professional judgement to determine when additional stress acting upon a system results in a shift away from ecological or commemorative integrity. Consider existing and likely future trends; in some cases studies from other areas or literature reviews can be helpful. Consult experts as required.

**EXAMPLE 27.** In assessing the **significance of the proposed day-use facility expansion** on piping plovers, it was found that the effects were very difficult to quantify. However, it was still possible to establish significance because of specific targets established through a joint management plan for piping plovers.

"At the park scale, the cumulative effects of the project are significant for a number of reasons. First, the project will cause a significant increase in the level of disturbance to these birds which will likely result in a decline in the number of breeding pairs in the park. As the average number of breeding pairs during the period 1985-1994 was only 13, the loss of even a single pair is a large enough proportion of the population to be considered significant.

The cumulative effects are also significant at the provincial scale as the park population represents 21% of the provincial population of these shorebirds (Beach, 1988). The loss of park habitat due to development would adversely affect a significant proportion of provincial numbers. Less obvious, is the significance of the project at the eastern North American scale because park populations represent only 2.3% of this population. At this scale, trends become more important for evaluating significance. For example, between 1980 and 1984, there was a 27-30% decline in breeding birds along the Atlantic coast (Haig, 1985). The obvious decline of piping plovers over the years and their status as endangered make any effect on these birds significant" (Kalff, 1995).

## 3.3 Dealing with Uncertainties

### What uncertainties and risks are involved?

Cumulative effect assessments usually involve broader geographic and temporal scales, and more variables than traditional environmental assessment. This implies a corresponding increase in uncertainty. Ecosystem science may *never* develop to the point where accurate predictions can be made concerning overall change resulting from multiple stressors. Most quantitative assessments have been done in the areas of atmospheric change and water quality due to the availability of sound and tested indicators and a better understanding of cause-effect linkages. On the other hand, overall ecosystem changes, changes to habitat and ecological integrity, have been cited as the most difficult areas to deal with.

Despite these challenges, predictions can still be made based on best available information and best professional judgement. There are three strategies for dealing with the high uncertainty involved.

The first strategy is to document all assumptions. Documentation allows predictions and recommendations to be revisited should any of the assumptions be eventually proven false. Information on statistical probabilities is relevant to determine overall uncertainty; however, qualitative assumptions are also important. When the assessment refers to studies that were based on abstractions of the real world (such as laboratory conditions, constant temperatures), this should be noted. It is also relevant to note if the assessment extrapolates data from other geographical areas. Assumptions regarding future growth conditions, visitor behaviour or environmental conditions should all be made explicit.

The second strategy involves application of the precautionary principle.

The precautionary principle was defined by the Banff-Bow Valley Task Force as "*principles [which] emphasize the need for care and caution when changes to the natural environment are contemplated. This is particularly important when scientific understanding of a natural system is incomplete or when an area is unusually susceptible to damage. In national parks, set aside by Canadians for future generations, the principles of precaution are especially important.*

*A commonly accepted set of premises are the basis of the principle of precaution:*

- *nature is valuable in its own right*
- *governments must be willing to take action in advance of full, formal, scientific proof*
- *people proposing a change are responsible for demonstrating that the change won't have a negative effect on the environment*
- *today's actions are tomorrow's legacy*
- *all decisions have a cost. Exercising caution may mean some people must forgo opportunities for recreation or profit". (Page, et al., 1996a)*

The third strategy involves follow up. Simply put, the greater the uncertainty, the more important it is to follow up on actual changes. Predictions or trends involving a high level of uncertainty should be followed carefully over time to validate the conclusions and the proposed mitigation. Monitoring allows unexpected negative impacts to be corrected should they occur. Monitoring will also allow us to learn from our experiences, so that future assessments can be improved. Issues may be investigated under specific programs, as shown in Example 28, or incorporated into ongoing integrated monitoring.

**EXAMPLE 28 - Monitoring Cumulative Effects on Cultural Resources.** At Fathom Five National Marine Park, it was determined that the cumulative effects resulting from erosion and other stressors were contributing to the deterioration of heritage shipwrecks. A program was set up to investigate the nature of this deterioration and to identify existing trends:

"Six out of a possible 27 shipwrecks have been selected, from a practical and scientific point of view, for a more systematic follow up. The areas to be monitored are the physical integrity of the hulls or wreckage, the deterioration of the materials comprising the wreck and the environment surrounding them. A major part of the study involved the placement of monitoring devices on the wreck. Simplicity of the operation and easily interpreted data have made this project a success in bringing together professionals from the Federal Archaeology Office, Parks Canada Historic Resource Conservation Branch and the Parks staff at Fathom Five. The program is ongoing since 1991". (Nadon, 1997)

# STEP 4 - FOLLOW UP, FEEDBACK AND DOCUMENTATION

The purpose of an environmental assessment is to eliminate or reduce the impacts of a proposal, and to provide the responsible authority with enough information regarding residual and unavoidable impacts to make an informed decision regarding the proposal. The potential implications of cumulative effects are an important part of these considerations.

> The *Canadian Environmental Assessment Act* directs the responsible authority to use the screening report to determine an appropriate course of action based on whether or not the proposed project is likely to cause significant adverse effects. The RA must also know if it is uncertain whether the project is likely to cause significant adverse effects, or if public concerns warrant reference to a mediator or panel review.

Documentation is important for several reasons: ensuring information is made available to interested parties, recording the reasoning which may have led to a decision and providing a basis for learning from our experiences. Conclusions of the assessment and any related recommendations presented in the screening report must include conclusions and recommendations relating to cumulative effects.

## 4.1 Surveillance and Follow-up Requirements

### Identify surveillance and follow-up requirements

Implementation of follow up is essential for effective cumulative effects assessment. Monitoring programs constitute a legal obligation under the *Canadian Environmental Assessment Act* when identified as a requirement in an environmental assessment, and cumulative effects assessment will broaden the need for monitoring. Surveillance monitoring, during proposal implementation, may be required to ensure that mitigation measures have been implemented and that recommendations have been respected. After completion of the proposal, follow up will allow us to see whether predictions are correct and whether any unanticipated effects are occurring.

Since cumulative effects involve greater uncertainty than conventional environmental assessments, it is important to carefully follow what is happening in the field and whether unexpected changes are occurring. We must learn from our mistakes and apply what we learn to our next assessment of cumulative effects.

Follow-up requirements may include factors which involve not only the proposal being assessed, but other sources of stress acting upon the system. Stressors, pathways and the response of the environment may all change over time. Some effects may be felt after significant time and space lags: Ideally, an integrated monitoring program for each heritage area would provide information on an ongoing basis on both the accuracy of predictions in environmental assessments and the actual response of the environment, with a special focus on areas of uncertainty. It is important to integrate the results of the integrated monitoring program into the products of the *Natural Resources Management Process*.

**EXAMPLE 29.** The environmental assessment of the proposed long-distance hiking trail in La Mauricie National Park noted that the wolf population was adversely affected by numerous stressors, many of which originated outside the park. The trail would introduce a low-level human presence in the only large area of undisturbed backcountry still available to wolves. While it was determined that the proposed levels of use were highly unlikely to adversely affect the wolves, follow up was identified as important for three reasons. First, monitoring was required to ensure that predictions were correct. Second, follow up was important because, even though the relative contribution of the project was minor, the overall stress on the wolf population was high. The third reason came from the recognition that the trail could generate future demands for increased levels of service or use. The assessment stipulated that any increase in use levels must be accompanied by ample and sufficient demonstration that the wolf populations would not be adversely affected.

## 4.2 Feedback Requirements

### Identify feedback requirements to management plans, cumulative effects context studies or other appropriate feedback points

Documentation of cumulative effects of proposals extends beyond the preparation of a screening report. Because the cumulative effects themselves relate to the land base and not only to the proposal at hand, it may be necessary to ensure that the results of the analysis and evaluation get incorporated into products of the *Natural Resources Management Process* or the cultural heritage equivalents. For example, new information should be incorporated into park data bases and resource synthesis and analysis. Some recommendations may touch upon potential policy changes and should be incorporated into management plan reviews. New information may have been generated on trends of key environmental components,

cause-effect linkages or critical thresholds: this must all be incorporated into relevant documents such as ecosystem management plans or even integrity statements. The information must also be made available to assist in future environmental assessments of related projects or activities.

It is imperative that management be made aware of any key components which may be approaching critical thresholds or limits, or any targets which are clearly being missed because of human activities within or around the heritage area. Such information, which may be obtained in the course of an environmental assessment, must be highlighted; corrective measures should then be implemented especially at the management plan level.

It should also be noted that effective feedback will be instrumental in helping to avoid duplication relating to cumulative effects assessment. Any information on the overall context of cumulative effects, including past, present and future projects or activities leading to stress on the system, pathways of change and overall consequences, will be relevant to most assessments occurring within a given heritage area. Following the test case undertaken in La Mauricie National Park, it was strongly recommended that individual parks or sites maintain information relating to cumulative effects in a way that favours ongoing updating, for example, by recording information on a GIS system (Les Consultants Jacques Bérubé inc., 1996b). Such living documents would be used repeatedly for both project and plan level assessments within the heritage area.

## 4.3 Documentation

### Document relevant information (include in the screening form or report information on the significance of cumulative effects, public concern, monitoring requirements, etc.).

In documenting the environmental assessment, either through the departmental screening form or in an environmental assessment report, be sure to include all relevant information pertaining to cumulative effects. The following should be included in the documentation:

- the process which was used to consider alternatives or assess trade offs between various types of cumulative effects
- methods used
- the description of the environment: to include any key or critical features of the overall environment including any trends causing concern

- the identification of potential impacts: to include the contributions of the proposal to existing stressors especially regarding any critical limits or thresholds, as well as sources and levels of uncertainty
- any options or alternatives considered
- mitigation proposed, including rehabilitation proposals or corrective measures to reduce other sources of stress
- the significance of residual cumulative effects
- monitoring requirements, including a detailed monitoring plan where required
- future studies that may be required

Remember that the documentation process is part of the environmental assessment per se; cumulative effects assessment is part of, and integrated into, the EA. The *Procedures of the Department of Canadian Heritage for Complying with the Canadian Environmental Assessment Act* do not describe specific steps to be undertaken as part of an environmental assessment. However, expected endpoints are described within the Canadian Heritage Screening Form. Table 2 shows how the various steps outlined for assessing cumulative effects can be integrated into the Canadian Heritage Screening Form.

**Table 2 - Integration of Cumulative Effects Assessment into the Departmental Screening Form.**

| ***Canadian Heritage Screening Form* endpoints (Department of Canadian Heritage, 1996)** | **Steps for assessing cumulative effects (detailed approach)** |
|---|---|
| Small screenings do not always require **scoping**; however, even implicit scoping is helpful for assessing all effects, including cumulative effects. Elements of the scoping process may be integrated into project description (policy setting) and environmental setting (major issues and concerns). Scoping can also be included in the documentation when a screening report is prepared (particularly the geographical and temporal scales). | **Step 1: Scoping** - is explicit for cumulative effects. It is important to ensure consistency of the policy context for the proposal. Scoping will help determine whether the proposal involves issues of particular concern to cumulative effects, and what scale of assessment is appropriate to address those concerns. Geographical and temporal boundaries should be clearly identified. |
| **21 Project description:** remains the same. | No implications for assessing cumulative effects. |
| **22 Description of environmental setting:** integrate part of the analysis into this section. | **Step 2: Analysis -** identification of the sources of stress, pathways of change and overall effects which determine the current state of the environment and trends of key components. |

| *Canadian Heritage Screening Form* endpoints (Department of Canadian Heritage, 1996) | Steps for assessing cumulative effects (detailed approach) |
|---|---|
| **24 Nature and extent of adverse environmental effects, including cumulative effects:** integrate relevant parts of the Scoping exercise, as well as the analysis for cumulative effects. | **Step 2: Analysis** - relative contribution of the proposal to the overall impacts. |
| **26 Mitigation measures:** integrate any mitigation measures identified in the analysis for cumulative effects. | **Step 2: Analysis** - identification of mitigation measures for cumulative effects. |
| **27 Residual adverse environmental effects and their significance:** integrate all of the evaluation steps for cumulative effects. | **Step 3: Evaluation** - identify relevant objectives and targets, comparing these to current trends to determine the significance of residual impacts in terms of overall integrity and explicitly identifying the level of uncertainty. |
| **28 Project surveillance required:** integrate any surveillance requirements identified for cumulative effects. | **Step 4: Follow up, feedback and documentation** - identify surveillance requirements for cumulative effects. |
| **29 Follow up required:** integrate any follow-up requirements for cumulative effects. | **Step 4: Follow up, feedback and documentation** - identify follow-up requirements for cumulative effects. |
| **30 Agencies and individuals consulted**: as required, extra requirements may stem from public concern over cumulative effects issues. | No specific step identified; undertake public consultation as required. |
| **31 Reference documents used:** include any reference to cumulative effects documents used. | No specific step identified. |
| **32 Public concerns:** integrate any concerns relating to cumulative effects. | No specific step identified. |
| **34 Determination:** Consider results of all steps for cumulative effects in making a determination. | No specific step identified. |
| Documentation refers to screening form itself or any supporting EA report. | **Step 4: Follow up, feedback and documentation** - integrate into EA documentation |

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# A GUIDE TO ENVIRONMENTAL ASSESSMENTS: ASSESSING CUMULATIVE EFFECTS

## PLAN ASSESSMENT MODULE

## SPECIAL CONSIDERATIONS FOR ASSESSING CUMULATIVE EFFECTS

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## EXAMPLES

# INTRODUCTION TO THE PLAN ASSESSMENT MODULE

## About the Plan Assessment Module

This module provides an overview of the approach for assessing cumulative effects of plans and programs and focusses on those components which are specific to the planning level. Examples are provided throughout the module. Special reference is made to the assessment of management plans because of their immense potential for identifying and managing cumulative effects.

The approach is applicable, not only to management plans, but to other plans as well, including long-term development or service plans, as well as programs and area-specific policies. You will note, however, that general policies with broad applications which are not specifically linked to a particular geographical area (such as marketing policies, for example) will require a different approach.

## How to Use the Plan Assessment Module

This module follows the *step-by-step approach* discussed in the Detailed Approach Module. You are strongly advised to refer to the detailed approach to obtain more in-depth information on the steps involved in the assessment of plans. You are also invited to consult the Background Appendix for general information on cumulative effects and the conceptual framework.

## Links to Other Ecosystem-Based Management Streams

In implementing ecosystem-based management Parks Canada is adopting a more holistic perspective based on broader temporal and geographical scales. The assessment of cumulative effects of plans, programs and policies is a key tool in support of this approach, since it ensures that decision makers understand the overall consequences of their choices at the strategic level. Assessing cumulative effects will also provide constant feedback on the cumulative consequences of past decisions and how they are affecting current trends. For these reasons, strategic environmental assessment is a key component of sustainable development strategies. Assessing cumulative effects at the planning level complements, and is complemented by, other streams of ecosystem-based management, such as the development of State of the Parks reports and ecological and commemorative integrity statements.

# 1. WHY IS IT SO IMPORTANT TO ASSESS CUMULATIVE EFFECTS OF PARK OR SITE MANAGEMENT PLANS?

**The management plan provides the best opportunity for assessing cumulative effects.** Cumulative effects tend to occur locally but accumulate at regional or ecosystem levels. As a result, it is at the regional or ecosystem levels that assessing cumulative effects is most effective.

**SUMMARY OF SECTION 1**
While this module deals with the assessment of cumulative effects at the planning level in general, section 1 stresses the importance of assessing cumulative effects of the overall management and land use of heritage areas. The most effective way of accomplishing this is through a strategic environmental assessment (including cumulative effects) of management plans. The assessment must be proactive in identifying the major trends resulting from cumulative effects which require management attention. The EA must also propose mitigation for any negative effects resulting from the management plan and ways of enhancing potential positive effects which may result from the plan. Missing information must be identified. Cumulative effects assessment will become easier over time.

Because cumulative effects involve multiple sources, complex pathways and broader scales, it really helps to take a step back and analyse what is happening in the heritage area from the greater ecosystem perspective. This allows you to see where the impacts of human activities are overlapping or crowding in time or space, or where multiple impacts are nibbling at key resources. This is where you can best establish critical thresholds, limits or optimal targets**. In cumulative effects assessment, this is the bottom line**: you must have some way of knowing when "enough is enough", to avoid "destruction by insignificant increments".

At the park or site level, the main, comprehensive, legally required land management planning document is the park or site management plan. It establishes the overall goals, objectives, zoning, directions and management strategies for each park or site. It is non-sectoral; it covers both the conservation and use aspects of heritage areas, and establishes the appropriate balance between the two. It must be revisited and reviewed every five years. **All these characteristics make the management plan the most appropriate tool for managing cumulative effects within a heritage area**. The best vehicle for this is to undertake a strategic environmental assessment of the plan on a regular basis, as it is being revised and updated.

This will not be an easy task. One of the biggest challenges associated with assessing management plans is dealing with very general, concept statements. However, it is the role of the strategic EA to provide decision makers with information on the cumulative effects which result from the management package presented in the management plan. This involves more than identifying the potential impacts of all individual proposals included within the plan. It is critical to provide decision makers with information on what cumulative effects are currently occurring, what trends exist, and how those impacts can best be managed at the concept level. For example, in some national parks, cumulative effects associated with high levels of use may result directly from the lack of clear guidelines concerning appropriate levels of use for each zone or geographical sector in the park. This is an impact of the management plan and should be highlighted in the EA.

Two key tools can greatly assist concept-level assessments. The first are ecological and commemorative integrity statements. Parks Canada has formally adopted an ecosystem approach, which involves identifying measurable indicators and specific targets in ecological and commemorative integrity statements. The second tool is State of the Parks reporting. By providing common indicators for evaluating the state of heritage areas, this initiative will help in identifying whether heritage areas are moving towards or away from ecological or commemorative integrity. Taken together, the trends identified through State of the Parks reporting, and the indicators and targets that form the integrity statements, provide a solid basis for a strategic environmental assessment of heritage area management plans.

Effective planning-level assessments of cumulative impacts cannot happen overnight. It will take time; the first generation of assessments will consistently highlight missing information, including the need for more specific data on thresholds and targets. Over time, this information will become available and we will be in a much better position to assess and mitigate cumulative effects.

# 2. FOUR GOOD REASONS TO ASSESS PLAN AND PROGRAM PROPOSALS

One of the common criticisms of project assessments is that they are initiated *after* fundamental decisions are made and once the project planning is fairly advanced. Strategic environmental assessments involve the assessment of those fundamental decisions.

**SUMMARY OF SECTION 2**

**The environmental assessment of plans and programs is essential and it is critical to always consider cumulative effects at the planning level.** This is true for four main reasons:

1) it is federal policy (a non-legislated obligation) to carry out such assessments
2) it is a good way of assessing first principles early in the planning process
3) it provides a good, common-sense opportunity to enhance positive effects as well as avoid negative effects
4) a good planning-level EA will save time and money at the project level

## A Non-Legislated Obligation

> "An increasing number of countries require that certain major investments be subject to an environmental impact assessment. A broader environmental assessment should be applied not only to products and projects, but also to policies and programs, especially major macroeconomic, finance and sectoral policies that induce significant impacts on the environment". (WCED, 1987)

The *Environmental Assessment Process for Policy and Program Proposals* (FEARO, 1993) establishes a non-legislated requirement for the assessment of policy or program proposals including those considered by Cabinet and those considered by Ministers on their own authority. The Departmental Procedures have interpreted this requirement to apply to park management plans as well as to any programs and plans which could have environmental implications (Department of Canadian Heritage, 1996):

> *Any Canadian Heritage policy or program proposal which is to be submitted to Cabinet for its consideration must be reviewed for its environmental implications, where these are relevant, according to The Environmental Assessment Process for Policy and Program Proposals, which was prepared by FEARO in February, 1993, following Cabinet direction (section 107).*

*All proposed programs, policies and plans under the responsibility of Canadian Heritage will be reviewed for their environmental implications, where relevant (section 108).*

*The environmental assessment of Parks Canada Management Plans will be conducted according to The Environmental Assessment Process for Policy and Program Proposals and will include consideration of existing development and facilities as well as new strategic directions and their cumulative effects. The implementation of specific projects will be conditional upon subsequent assessment under the Act when there is an appropriate level of detail available (section 109).*

## Early Application Principle

Decision making occurs in a hierarchy, from policy to plans to programs to projects. Logically, therefore, environmental assessments should also be nested, with initial concepts and principles assessed at the policy level, while the assessments of plans and programs provide an opportunity to assess the concepts in further detail with links to the land base. Finally, project assessments are required to examine in detail the implications of a specific project at a specific location. The hierarchy of assessments does not involve duplication of effort but allows for the more effective scoping of issues to match the level of assessment at hand.

> "Strategic EIA: The application of EIA not only to individual projects, but to policies, plans, programs, activities, and regional land-use objectives. There is a growing conviction that matters cannot be completely resolved at project level when many matters have been decided already at a higher level. Matters difficult or impossible to settle at the project level relate to the cumulative effects of other projects within the same or related program; ... and to natural resource conservation and management." (Gilpin, 1995)

This concept has been referred to as "tiering" of assessments and is a central concept of strategic (concept-level) environmental assessments:

"The concept of "tiering" is used in the United States to determine the proper scope of programmatic environmental impact statements (PEIS). The Council on Environmental Quality (1985:34267) defines tiering in these words:

*Tiering of environmental impact statements refers to the process of addressing a broad, general program, policy or proposal in an initial*

*Environmental Impact Statement (EIS), and analysing a narrower site-specific proposal, related to the initial program, plan or policy, in a subsequent EIS.*

The second EIS then need not repeat the discussion in the first and can focus on the specific issues up for decision" (Bregha, *et al.*, 1990).

Plans and programs play an important role within this hierarchy of decision making by establishing the conceptual basis for projects and activities. The assessment of plans and programs ensures that a concept is evaluated in its early planning stages, before irrevocable commitments are made.

## Common-Sense Opportunity

Plan and program proposals present a common-sense opportunity to identify potential cumulative effects so that negative impacts can be avoided and positive impacts can be enhanced. A study by the *Federal Environmental Assessment Review Office* (1992) identified six compelling reasons why application of EA to policy and programs is vital to good public decision making. Such reasons apply equally to the environmental assessment of plans, which may include features of both policy and programs:

1) **"Environmental assessment at the policy and program formulation stage is needed to help determine the *fundamental feasibility* of public initiatives**", such as the overall acceptability of the background concepts to a plan. The management plan or long term development plan may be the most appropriate level at which to consider the fundamental feasibility of proposed developments. Furthermore, the concept-level assessment, by evaluating underlying principles, will help establish the feasibility of ensuing projects and thus provide essential background information to the project EAs.

2) **"Assessment at the policy and program stage represents the earliest (and sometimes best) opportunity to anticipate environmental problems and capitalize on opportunities that are likely to occur at subsequent implementation stages**". Early assessment means that environmental considerations can help shape options which otherwise could not be considered at the project level, and allows for a more proactive approach (it is easier to enhance potentially positive impacts as well as to avoid potentially negative impacts which could otherwise become more difficult to deal with).

3) **"Some important environmental opportunities and impacts can *only* be assessed at the policy stage, because there is no discrete program or project following directly on from the policy**." In the case of management plans, for example, the potential impacts of existing zoning cannot be evaluated at any other level.

4) **"The *cumulative* environmental effects and socio-economic consequences of a public initiative can sometimes best (and occasionally *only*) be assessed at the policy or program stage"**. Programs and plans allow for the collective assessment of a variety of discrete projects from an overall perspective, include the fundamental policy concepts which shape the projects.

5) **"Assessment at the policy stage can help identify and define issues to be assessed in detail at subsequent project implementation stages**". This is especially true for management plans where vulnerable key elements or critical trends may be identified.

6) **"The environmental assessment of policy helps bring environmental considerations into the mainstream of planning and decision making**". Identifying and understanding the environmental implications of fundamental orientations at the planning level will help ensure that concept-level decisions enhance and support ecological and commemorative integrity; this is all the more important in the current context of diminishing resources where difficult decisions must still be made.

## Saving Time at the Project Level

Assessing cumulative effects really means assessing a proposal within the context of existing human-induced stressors. An initial effort is required to identify and understand the existing stressors acting upon a park or site and the overall effects of those stressors. Once this information is available, assessments of new proposals can focus on how the proposal would change the cumulative effects context for a park or site, as long as the context information is kept up-to-date.

There are several possible ways of undertaking the initial effort to provide a context for cumulative effects assessment. In the Atlantic region, "*cumulative effects studies"* were undertaken for each of the national parks identifying the main issues and stressors relating to cumulative effects (Kalff, 1995; Keith, 1995, 1996). In Kluane, a study focussed on cumulative effects of projects on key wildlife species (Hegmann, 1995). The Banff-Bow Valley Task Force undertook an analysis of the cumulative effects acting upon a specific ecosystem of Banff National Park (Page,

*et al.*, 1996). A *"cumulative effects assessment framework"* based on monitoring questions, components, indicators and targets was established for the Bruce Peninsula National Park (Geomatics International, 1996). Within La Mauricie National Park, a partial analysis was undertaken for a project-level assessment; this was completed by compiling existing data from various sources to provide an overall analysis of park-wide cumulative issues.

> The La Mauricie study, which was instrumental in testing the approach described in this guide, strongly recommended that information relating to cumulative effects of each heritage area be compiled into a single document as it is gradually acquired through the environmental assessments of projects or management plans. This document, which could consist of maps and/or text, could be updated on an ongoing basis; it could also be used as a training tool between various heritage areas to share knowledge and experience relating to the assessment of cumulative effects. (Les Consultants Jacques Bérubé inc., 1996).

What we see emerging in the various parks and sites corresponds to this compilation of information on cumulative effects. Information is gained with every environmental assessment, either at the project or planning level. This same information can then be applied to the next environmental assessments.

What is the most effective use that can be made of this information? At the concept level, it should most certainly be used to assess park or site management plans. This will ensure that the backbone of all land-use and management proposals is environmentally sound.

As a result, all projects which occur under the direction of the management plan will respect the first principles outlined in that plan, including available targets or thresholds defined in response to major trends. This means each consecutive project will be easier to assess: the scope of the cumulative effects assessment can be defined more narrowly once many of the issues have been dealt with at a more appropriate level. **Simplifying the environmental assessments at the project level will save increasing amounts of time and money, especially in the longer term.**

# 3. WHAT DOES AN ASSESSMENT OF A PLAN OR PROGRAM INVOLVE?

**SUMMARY OF SECTION 3**
Strategic EA is a proactive process which must focus on enhancing positive effects and opportunities as well as avoiding or mitigating negative cumulative effects. You must ensure that the plan or program you are assessing adequately addresses all major cumulative effects within its scope. The EA should be a fundamental part of the planning process so that environmental considerations are integrated into ongoing decision making.

Assessing the cumulative effects of a plan does not mean undertaking a collection of assessments of individual proposals contained within that plan. It means:

- **verifying consistency with umbrella policies:** the purpose, goals and direction in the plan must be environmentally sound and consistent with environmental policy
- ensuring that the general directions and collective proposals contained within the plan or program respect and **support overall environmental policy** and are environmentally sound
- ensuring that the plan adequately **addresses the major concerns relating to the cumulative effects** which are acting upon the heritage area, including setting and/or respecting critical thresholds and targets
- **evaluating the overall implications** of the specific programs and proposals contained within the plan in terms of the existing context of the land base
- **assessing the implications of various alternatives** considered in the plan, to enhance positive effects and avoid or mitigate negative effects
- ensuring that the **potential trade offs and implications** (including both positive and negative residual impacts) of the overall plan **are understood and documented**

The above goals of a strategic environmental assessment describe a much more involved, proactive process than simply reacting to individual proposals contained within a plan. At the end of the process, the EA should have actively contributed to the development of a plan that effectively addressed the environmental concerns and preoccupations within its scope, including broad-scale cumulative concerns.

## An Integrated Application of Environmental Assessment

In theory, an EA should be initiated "as early as possible in the planning process". In practice, it is always a "chicken-and-egg" situation. Once you have clear concepts to assess, critical decisions have already been made.

Tiering is one way of addressing this: each level of decision making is assessed sequentially. In practice, tiering is very effective in clarifying issues at the project level. However, planning usually involves the progressive consideration of various options from which a choice is made and then explored in greater detail. Trade offs and decisions are being made continually. Decisions involve the integration of multiple considerations including biophysical, economic, social and cultural issues. Often, the trade offs involved result in different sets of environmental advantages and disadvantages. Conflicts are not necessary between different sectors (such as environment versus economy); most often they are choices between short- and long-term imperatives.

Since the approach to planning usually involves sequential and ongoing decision making, strategic environmental assessments must be closely integrated into the planning process. Do not wait for an advanced draft version of a plan before initiating the environmental assessment. It is much more effective to initiate the environmental assessment as soon as the planning process begins. If you are conducting the environmental assessment, you should be a member of the planning team. **There should be regular feedback on the various choices and options contemplated throughout the planning process. The planning process should be one of integrated decision making throughout**. This is why strategic environmental assessments have been called "integrated assessments" (Bregha, *et al.*, 1990).

This approach, while clearly the most effective, presents some difficulties in terms of documentation. You may find at the end of the process that there is very little to record in the conventional sense of a screening report, since the final product (the plan or program) will have already incorporated the environmental considerations. It is important, however, to document the *process* used to arrive at this product: the trade offs considered, the various choices made and the environmental implications of the final product.

**Which plan and program proposals should be assessed within Parks Canada?**
To be effective, cumulative effects must be assessed consistently at all levels of the planning process; the levels of issues evaluated (and the levels of thresholds or limits linked to these issues) will also be tiered. Limits and thresholds may be set by policy at overall planning levels, while more specific plans may require more specific thresholds.

The following identifies the types of plan and program proposals which should be assessed within Parks Canada:

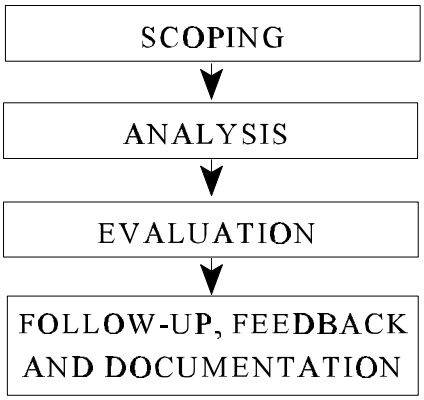
**Concept-level plans to be assessed as policies (not linked to land base):**
- business plans
- internal policies such as cost-recovery initiatives, marketing plans and tourism strategies
- Cabinet documents
- Treasury Board submissions

**Hierarchy of plan assessments (linked to land base):**
- park or site management plans
- park or site business plans
- visitor services plans
- park conservation plans
- site or area development plans
- back country plans
- community development plans

# 4. AN OVERVIEW OF THE APPROACH

**SUMMARY OF SECTION 4**

Information specific to plan assessments is provided for each of the four steps of the approach for cumulative effects assessment:




The conceptual framework for cumulative effects assessment is basically a cause-effect model to determine how multiple stressors are affecting key resources; the resulting trends are then evaluated based on established targets and goals. The process is supplemented by an integrated monitoring process. The detailed approach to implement this framework consists of four basic steps: scoping, analysis, evaluation and follow up/feedback/documentation. Both the concept and the approach apply to plans as well as projects. Since each step is described in detail in the Detailed Approach Module, the next sections of this module will focus on aspects of the steps which are specific to plan or program assessments.

Although the steps are presented in linear sequence, they are really highly iterative. This is particularly true at the strategic level. For example, scoping relevant issues will be linked to the analysis of cause-effect dynamics of existing stressors, even if they are described as separate steps.

# STEP 1 - SCOPING

Strategic environmental assessments will usually cover a broader scale than project-specific assessments. Effective scoping for strategic environmental assessment is therefore all the more important. The following points should be considered:

## Consistency with Overall Environmental Policy

Policies and plans must respect umbrella policies on environmental issues. Consistency must be reflected at two levels:

1) **the overall purpose and broad goals of the plan, program or policy.** What is the plan intended to do? Is this orientation in keeping with the existing environmental policy context? Where are the potential conflicts?

2) **the content of the plan/policy**. Not only must the content respect overall environmental policy, it must be supportive of it. Are all ensuing directions or projects consistent with overall environmental goals? Should the plan/policy include elements or directions that implement overall environmental policy? If it does not, why not?

It may also be helpful to ensure that plans and policies are consistent with the concept of sustainable development and broadly accepted environmental principles. In this sense strategic environmental assessment can be used as a tool in support of the departmental “Sustainable Development Strategy” (SDS).

## Sustainable Development: A Brief Overview

The term "sustainable development" was coined in the 1980 World Conservation Strategy (IUCN, *et al.*, 1980) and popularized by the World Commission on Environment and Development (WCED 1987) where it was defined as "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs"*. The WCED report specifies that inherent to the concept is the need for environmental considerations to be fully integrated into decision making, at the same time and on the same agenda as economic and other concerns. The report argues that a long-term view of issues is essential and states that there are ultimate limits to what the biosphere can support.

The 1991 World Conservation Strategy further examined and clarified the concept: "*The term [sustainable development] has been criticized as ambiguous and open to a wide range of interpretations, many of which are contradictory. The confusion has been caused because "sustainable development", "sustainable growth" and "sustainable use" have been used interchangeably, as if their meanings were the same. They are not. "Sustainable growth" is a contradiction in terms: nothing physical can grow indefinitely. "Sustainable use" is applicable only to renewable resources: it means using them at rates within their capacity for renewal. "Sustainable development" is used in this Strategy to mean: improving the quality of human life while living within the carrying capacity of supporting ecosystems.*" (IUCN, *et al.*, 1991)

The World Conservation Strategy defined principles of a sustainable society based on the premise that "humanity must take no more from nature than nature can replenish" (IUCN, *et al.*, 1991). These principles are:

**Respect and care for the community of life**: For ethical and practical reasons, development must not be at the expense of other groups or later generations and must not threaten the survival of other species. (The World Conservation Strategy includes "Elements of a World Ethic for Living Sustainably".)
**Improve the quality of human life**: Development must make our lives better; "economic growth is an important component of development, but it cannot be a goal in itself, nor can it go on indefinitely.
**Conserve the Earth's vitality and diversity**: "Conserve life-support systems; conserve biodiversity; ensure that uses of renewable resources are sustained".
**Minimize the depletion of non-renewable resources**
**Keep within the Earth's carrying capacity** "There are finite limits to the Earth's systems - to impacts that they and the biosphere as a whole can withstand without dangerous deterioration".
**Change personal attitudes and practices**: "Society must promote values that support the new ethic and discourage those that are incompatible with a sustainable view of life".
**Enable communities to care for their own environments**
**Provide a national framework for integrating development and conservation**: A national program for achieving sustainability.
**Create a global alliance:** "The ethic of care applies at the international as well as the national and individual levels".

## Identifying the Main Issues

Plans and programs are usually broad and cross-sectoral compared to projects. Identifying relevant issues of concern which should be addressed involves several elements:

1) The issues must reflect the major cumulative effects which are acting upon the relevant land base. Is the system gradually losing its integrity? How are cumulative effects shaping trends of key components? The issues of concern on which the assessment will focus are determined by past, existing and known future stressors acting upon the environment and the resulting environmental trends and directions. Documentation for the State of the Parks reports, particularly regarding stressors and trends, may be helpful in this regard.

2) The types of issues selected must take into account the natural dynamics of the heritage area. Consider the current state of the ecosystem, potential natural changes and fluctuations, natural cycles and potential catastrophic events.

3) The types of issues selected should be relevant to the purpose of the plan or program being assessed. In other words, all issues or concerns which should be addressed by park management are relevant to the assessment of a park management plan; all issues relating to resources affected by park services are relevant to the assessment of a park service plan; all issues relating to the broader ecosystem are relevant to a site plan.[1]

4) Issues are scale-sensitive. Local impacts may accumulate at ecosystem levels; therefore, effects can be insignificant locally but of great concern when viewed from an ecosystem perspective. It will be necessary to consider activities and projects occurring outside heritage area boundaries. Consider the greater park ecosystem. The nature of the issues identified will guide the selection of appropriate scales and boundaries. In turn, the selected scales and boundaries can provide a context for "double-checking" issues scoping.

5) Issues to be considered at the planning level may be more conceptual in nature than the concrete issues related to project assessment. After a preliminary identification of the main issues, it can be helpful to further define the issues by

[1] There is a corollary to this point. Issues selected must be relevant to the plan being assessed, but they do not necessarily need to be proposals contained within the plan. For example, effects such as habitat loss and species disturbance may stem from many sources involving high levels of visitor use in a given park. Therefore, overuse would be a legitimate issue to address in the environmental assessment of the park management plan, even if it is not referred to within the plan and even if there are no proposals within the plan which will increase levels of use. By including "overuse" in the scoping exercise, the assessment may then identify impacts stemming from past and present activities with unclear thresholds within the management plan. The management plan is the appropriate tool to deal with such issues.

phrasing questions which the assessment should answer. For example, issues scoping may identify fragmentation as a major impact stemming from multiple sources; wolves may be selected as an indicator since they require a fairly large undisturbed habitat. The assessment could focus on the following: "How large an undisturbed area is required for the long-term survival of wolves? Is this habitat available? What are the sources of disturbance and how can they be mitigated to provide adequate protection for the species?"

6) The elements listed above clearly show that an environmental assessment at the planning level is more than an assessment of the individual proposals contained within that plan. Still, any issues raised by individual proposals should also be included in the scoping exercise. For example, if a long-term development plan for a commercial ski area within a park lists a series of facilities to be developed over time, the plan provides the best opportunity to assess the cumulative effects of those facilities. Without such an overall perspective, it would be necessary to broaden the scope of project assessments to a point where it far outdistances the scope of the decision under review.

**EXAMPLE 1 - Long Term Development Plan for a Commercial Ski Area.** The cumulative effects to be considered would include, first and foremost, the **overall ecological thresholds for the site**, expressed in terms of maximum number of visitors per season and maximum footprint affected. Carrying capacity is difficult to determine; it may require the identification of several critical key elements which are the weakest link of the ecological system. For example, grizzly bear habitat requirements may define the ultimate limits to the number of visitors as well as the pattern of seasonal use (e.g. no summer use). It is important to define, qualitatively or quantitatively, overall limits beyond which change is unacceptable.

To establish overall thresholds, it will be necessary to analyse all proposals within the ski area from an ecosystem perspective. The starting point is to identify and analyse the effects of all existing and proposed developments or changes proposed in the plan, quantified in terms of maximum projected visitor use and footprints. The projections must be consistent; for example, parking facilities and chalet accommodation must be adequate for the projected level of use.

It is also necessary to consider **the implications of all these elements in terms of the broader regional context**. For example, what would the projected level of use mean for traffic conditions, accommodation needs outside the immediate commercial ski area (but perhaps still in the park), sewage disposal, visitor use levels in other areas of the park, etc. What other developments and activities could add to such implications (such as the presence of other commercial ski areas within the park or region, other attractions such as large conference facilities, new or existing transportation corridors, etc.). How do the various effects interact? **The scope of the assessment would include all past, existing and projected developments, projects and activities as well as the projected future growth which would occur within the relevant ecosystem**.

**EXAMPLE 1 (continued):**
This is not an impossible task! It will be necessary to use the best professional knowledge and the best available information. More than likely, it will be possible to focus on key components of the ecosystem, identifying, for example, overall habitat disturbance and fragmentation, overall effects on water and overall effects on critical species, all related to projected levels of use. The scoping exercise could be summarized in terms of the questions which the assessment should address:

- What are the overall targets for levels of use, how are these determined and how can they be demonstrated to support and complement the existing policy framework (e.g. ecological integrity)? Do the existing and proposed facilities respect these targets or would further growth be created? How will use levels be managed?
- What is the broader regional context? What other existing or planned activities and developments could interact with the anticipated effects?
- What are the key ecological elements and indicators of integrity that must be considered? What are the current issues and trends? Which elements are most susceptible to disturbance?
- What is an appropriate threshold of use for the area? Can it be demonstrated that the projected level of use will not harm those key elements? The precautionary principle must apply in cases of uncertainty.
- How does the proposed overall level of use compare to the threshold? (Quantify data: level of visitor use on a seasonal basis, total footprints, etc.)

Actual scoping questions would probably be more specific, asking what effects current levels of use are having on specific components, such as grizzly bear populations, for example. It would then be necessary to establish, as clearly as possible, cause-effect linkages and trends.

## Identifying Key Components

The key components will be intimately linked to the issues identified. As for project-level assessments, key components will be a function of the scale selected, the goals of the plan (ecological or commemorative integrity) and existing stressors or trends of concern. Key components should reflect the "weakest link" of the ecological system, such as the most vulnerable species, or species with broad habitat or territory requirements. Key components may also be selected as early warning indicators of environmental change. Often, key components will be identified in park management plans, resource management plans, ecosystem management plans or integrity statements. The challenge, especially at the planning or policy levels, will be to narrow the available list to a manageable number without losing relevant information.

## Identifying Appropriate Scales

Once the main issues and key components have been identified, the appropriate scales can be determined based on the scales of the potential cumulative impacts. Remember, this is an important step in ensuring that the assessment is manageable.

The geographical boundaries identify the study area for the environmental assessment. They may be based on relevant ecosystems, habitat of key species, watersheds or other ecologically relevant areas. They should be clearly identified in the scoping exercise. For a heritage area management plan, appropriate boundaries will usually extend beyond park boundaries to encompass the greater ecosystem.

Temporal boundaries identify how far back the assessment should consider baseline data and trends, and how far into the future potential impacts should be considered. How far back you go may be limited by available information. How far ahead you should look should be a function of the nature of the potential impacts, as well as practical considerations. It is clearly impossible to predict what will happen over the very long term. The assessment must focus on what can reasonably be considered.

Scoping appropriate temporal boundaries for the assessment of a historic site management plan can involve a somewhat different emphasis. There are usually specific dates establishing the commemoration period, and resources linked to this period or event of national significance are level 1 resources. Human-induced changes which occurred either earlier or later may still be culturally significant (level 2 resources). In some cases, however, both human-induced or natural changes may be sources of stress acting upon the level 1 resources. The scoping exercise must identify which stressors are being considered and within what time frame they will be examined. For example, in the Louisbourg test case, a commemoration period of 55 years begins with the initial settlement by the French in 1713 until the destruction of the town by the English in 1768. Farms and settlements established after that time contributed to the destruction of commemorative resources and were included in the broad assessment of cumulative effects even though some of these are level 2 resources (Kalff, 1996).

**EXAMPLE 2 - Scoping the Temporal Boundaries for the Environmental Assessment of the La Mauricie National Park Management Plan.**. The scoping exercise was greatly facilitated by the existence of previous work which proved highly relevant to the environmental assessment. In a 1993 workshop on the ecological integrity of La Mauricie National Park, participants identified a geographical framework which constituted the zone of influence for integrated resource management based on maintenance of regional biodiversity (Parks Canada, 1993). Selection criteria for this zone included ecological regions, ecological districts, areas required for viable populations of wide-ranging species, areas of dynamic equilibrium (50 or 100 times as large as the greatest disturbance, e.g. fire), and biophysical elements such as soils, physiography and drainage basins. Land jurisdiction criteria included public or private land use, municipal jurisdictions and wildlife reserve jurisdictions. As a result, the management zone of influence proposed included the national park, several neighbouring wildlife reserves and other areas, covering a total area of 6,319 $km^2$. (The park itself covers only 544 $km^2$.)

The area identified in the Ecological Integrity Workshop was retained for use by the environmental assessment. However, further subdivision of territory was necessary in order to develop matrices and focus more effectively on specific issues. Drainage basins and sub-basins were used for this purpose.

# STEP 2 - ANALYSIS

The second major step in cumulative effects assessment is the analysis. The analysis is really a cause-effect study where all the known sources of stress are linked, through pathways of change, to their overall effects which ultimately shape the state of the environment.

The first part of the analysis involves establishing the cumulative effects context specific to the heritage area. Once the main sources of stress, pathways and effects are understood, and the major trends identified, this broad analysis can be used as a baseline: the "one-time" effort discussed previously. Ideally, this information should be compiled and documented within a single report, consisting of maps, text or both. Increasingly, GIS is proving to be a highly useful tool for this type of analysis.

Once this context is established, the analysis will then focus on the potential changes brought about by plans or policies, including positive and negative changes. The analysis would assess the broad orientations and individual proposals, any alternatives or options to be considered, as well as mitigation measures.

The assessment of park or site management plans can be done on a regular basis, whenever the plans are reviewed or updated. Since the assessment involves a broad, comprehensive analysis of the entire heritage area from an ecosystem perspective, a sensible approach would be to analyse and update the cumulative effects context as a part of the assessment of the management plan review.

## Identifying All Potential Stressors Acting upon the Heritage Area

This step involves identifying all past, present and known future projects and activities, including those which are local, regional, outside park boundaries and global events. The aim is to identify all sources of stress affecting the area within the scoped geographical boundaries. There is little difference between how this step should be carried out for strategic environmental assessments and for project-level assessments. However, there may be a difference in terms of how this information will be used.

At the project level, the focus is on key components affected by the project being assessed. Other sources of stress affecting those key components will be considered, and the point of the analysis is to identify the relative contributions of the project within this existing context, what the overall, combined effects will be and whether these are acceptable.

Strategic-level proposals, on the other hand, are usually in a position to assess and modify the existing context. You will be assessing not only the relative contribution of the plan or program proposal to overall cumulative effects, but you will also be examining how acceptable the overall situation is and how it can be improved at the strategic level. For this reason, the list of past, present and future stressors should be as complete as possible at the strategic level, and fewer elements are likely to be excluded because they do not relate to the issues at hand.

The planning level offers an excellent opportunity to include future projects and activities when identifying all sources of stress, since plans generally include desired projections and future directions. In some cases, alternative futures may be presented; this will allow the assessment to compare the overall cumulative effects resulting from different options and select a preferred alternative. It is much easier to consider overall thresholds resulting from multiple projects at the strategic level, than it is through the assessment of a specific project.

Assessing growth trends is an important factor of the environmental assessment of a park or site management plan. Potential stressors identified outside park boundaries, such as adjacent development proposals, will be as important to consider as internal expansions.

Uncertainty will increase when dealing with future proposals. Some proposed projects may never actually occur; however, all proposals identified in a plan or program must be included as potential stressors. Follow-up activities can be used to update information on an ongoing basis.

In other cases, the plan may include only vague and imprecise information on proposed projects. It must be remembered, however, that planning level assessments focus on concept issues, not project-specific considerations. For example, it is not necessary to know the exact corridor of a proposed new trail in a wilderness zone in order to identify the overall stresses associated with a trail in such a zone. If the wilderness zone in question is already suffering from overuse, the potential impacts of the trail may be deemed unacceptable without ever knowing the precise corridor.

For example, the draft service plan for Louisbourg identified the possibility of a ferry service to access the reconstructed site, without providing details as to launch or landing sites. However, such details should not be required at the planning stage to assess the *concept* of a ferry service. Would it lead to higher level of use beyond the site's capacity? Would it reduce pressure on the existing road system? These are the types of issues to consider at the planning level. The strategic environmental assessment would then provide the framework for the project-specific assessment which would be required in the early stages of project planning should the concept materialize into something more concrete. The project assessment would assess site-specific impacts related to different launch and landing options. This example highlights the role of strategic environmental assessments in establishing the framework for subsequent project-level assessments.

## IDENTIFYING POTENTIAL EXTERNAL STRESSORS: USEFUL QUESTIONS

(Kalff, 1995)

**AIR:**

- Is the heritage area downwind of industrial centres or cities? Are the wind currents carrying concentrations of persistent chemicals, smog or acid?

e.g. Forests along the coastline of Fundy National Park are currently being stressed by ozone. Ground-level ozone created as far away as Boston moves up the eastern seaboard on a daily basis and causes stunted growth and stress in trees in Fundy National Park.

**SURFACE WATERS**:

- Do rivers within the heritage area originate beyond the heritage area boundaries? If so, are there resource extraction activities, industries, settlements, recreational activities upstream of the park? Do any of these activities cause effluents or sediments or other materials to enter the river?

e.g. White River in Puskasaw National Park will receive the treated effluent of a new gold mine being built upstream from the park boundaries.

**WILDLIFE**:

**Disturbance**

- Are there activities and land uses occurring in the area adjacent to the park which might disturb park wildlife? Do these activities interfere with the movement of wildlife in and out of the park?

e.g. The trail currently being set up across Canada runs along much of the perimeter of Terra Nova National Park. There is the potential that heavy use may interfere with the movement of wildlife species in and out of the park.

**Mortality**

- Are wildlife resource harvesting activities within the area adjacent to the park sustainable? What other sources of wildlife mortality may be affecting park populations? Are poaching, vehicle-animal collisions high?

e.g. Heavy trapping pressure on bobcat in the region around Louisbourg in the early 1980s depleted regional populations and likely caused a decrease in park populations since this species move in and out of the park.

**Habitat Loss and Fragmentation**

- Is habitat for certain species outside the park being destroyed or modified? Can wildlife species move easily to other habitat areas outside the park?

e.g. Land use, including towns, roads and cottage development adjacent to Point Pelee National Park inhibits the movement of species dependent upon the Carolinian forest from moving from the park to other patches within the region.

**SOIL & GROUNDWATER**:

- Are there any land use activities which may contaminate the soil and/groundwater that may move into heritage area lands?

e.g. A dump several metres from the boundary of Terra Nova National Park has released waste liquid into a pond straddling the park boundary.

## Identifying Pathways of Change and the Response of the System

The identification of pathways of change is essentially the same step as for project-level assessments. In practice, however, issues may be somewhat more complex to deal with at the strategic level because a broader range of stressors and key components will usually be retained, and regional scales will be adopted.

To simplify this step, focus on the major pathways of change. The purpose is to link cause to effects, so that overall avoidance or mitigation is possible. Usually, information on existing trends of key components will be available; both the State of the Parks reports and integrity statements will be helpful for providing an overall perspective.

Cause-effect linkages are difficult to establish. In the Kluane cumulative effects study (Hegmann, 1995), a series of hypotheses were developed to predict likely pathways based on several scenarios. Predictions were then analysed based on existing information, to the extent possible.

## Contribution of the Plan or Program to the Overall Context

Remember that at strategic levels of assessment it is important to not only avoid negative effects, but to promote or enhance positive impacts. The analysis should consider the effects of specific proposals which are listed in the plan, as well as how the plan or program responds to existing trends within the current cumulative effects context.

For example, a management plan must address all relevant issues in terms of cumulative effects. This will usually involve the consideration of critical thresholds and limits, perhaps linked to zoning. Are they known? Does the plan identify them? If it does not, does the failure to do so contribute to cumulative negative effects?

**EXAMPLE 3 - Assessing the Cumulative Effects of the Management Plan for La Mauricie National Park.** Several matrices were prepared to assess the proposals contained within the plan. These matrices, however, failed to assess whether the plan was proactively addressing key issues and concerns relating to cumulative effects.

To accomplish this, a matrix was prepared that systematically identified those concerns (including, for example, overuse, acid precipitation, habitat fragmentation and developments outside park boundaries). The other side of the matrix identified key management initiatives required to deal with these concerns. The management initiatives included guiding principles, zoning, rehabilitation programs and the identification of thresholds and limits.

The matrix illustrated that while many management endeavours proposed were effective in dealing with cumulative effects, several key management responses were yet to be developed. Chief among these were thresholds or limits, especially for areas where the levels of use are known to be very high.

## Identifying Mitigation for Plans or Programs

Mitigation is not as concrete a concept for plans and policy as it is for projects. Because in an ideal context, environmental considerations are being integrated throughout the strategic planning process, “mitigation” may simply involve the ongoing selection of best alternatives. However, some decisions will involve difficult choices where either option leads to environmental advantages and disadvantages; in such cases the opportunity to mitigate disadvantages will be an important consideration. Mitigation may also be required for residual impacts and can include rehabilitation or restoration of degraded sites, modification of existing forms of land use or other initiatives to reduce impacts from past activities. Mitigation may also serve to establish the framework for additional EAs as proposals move from the concept to the implementation stage.

# STEP 3 - EVALUATION

The evaluation of a plan or policy may occur throughout the process to help understand the significance of alternatives being considered. From a broad perspective, this means considering how different options will increase or decrease overall integrity.

Once the plan is completed, the EA must evaluate any residual cumulative effects and evaluate the significance of those effects in terms of established goals and targets. The actual steps involved are similar to project evaluations. However, the following points may be helpful.

## Identifying Relevant Targets and Thresholds

This is a central aspect of cumulative effects assessment and often the most difficult, since many targets or thresholds simply are not yet available. However, without some means of establishing what level of overall change is acceptable and at what level it becomes unacceptable, we will not adequately deal with cumulative effects.

Ideally, relevant thresholds and targets should be established at the management plan level, although this may take time. Thresholds or optimal levels of use should eventually be established for zones, sensitive areas and heavy-use areas. Targets should be established for key components experiencing decreasing integrity (such as many endangered species).

When targets are very difficult to identify, interim guidelines may be developed to provide management criteria until studies and/or monitoring programs provide the missing information. Parks policy suggests erring on the side of caution (see section on uncertainty below).

In some cases, guidelines can be helpful when thresholds are very complex to develop and interpret. For example, consider the stormwater outlets along the Trent Severn waterway. Thresholds for acceptable levels of residue from stormwater outlets may be developed to control the cumulative impact of these outlets along the entire waterway system. However, guidelines may also be required to assist in determining when and where prevention or remediation techniques should be applied.

## Significance of Residual Impacts

Once alternatives have been selected, and mitigation implemented, residual impacts of a plan must be identified and evaluated. At the planning level, both positive and negative impacts of the overall plan must be assessed (as discussed in various sections above). Consider the risks and uncertainties related to overall actions, directions and programs.

## Uncertainties and Risks

The levels of risk and uncertainty associated with cumulative effects increase at the planning level since, generally speaking, scales are broader and more sources of stress and key components will be considered. Because much of the needed information will only gradually be made available, the precautionary principle must guide overall strategic actions and decisions.

"**Principles of precaution:** As the name implies, these principles emphasize the need for care and precaution when changes to the natural environment are contemplated. This is particularly important when scientific understanding of a natural system is incomplete or when an area is unusually susceptible to damage. In national parks, set aside by Canadians for future generations, the principles of precaution are especially important.

A commonly accepted set of premises is the basis for the principles of precaution:

- nature is valuable in its own right
- governments must be willing to take action in advance of full, formal, scientific proof
- people proposing a change are responsible for demonstrating that the change won't have a negative effect on the environment
- today's actions are tomorrow's legacy
- all decisions have a cost. Exercising caution may mean some people must forgo opportunities for recreation or profit"

(Banff-Bow Valley Task Force in Page, *et al.*, 1996) (emphasis in bold added)

# STEP 4 - FOLLOW UP, FEEDBACK AND DOCUMENTATION

## Surveillance/Follow up

Surveillance monitoring helps ensure that mitigation methods are implemented as required and that the recommendations of the EA were carried out. Follow up establishes how the actual impacts contributed to overall stressors and provides the means to ensure that predictions are accurate and mitigation effective. Follow up may also identify the presence of unpredicted cumulative effects.

Follow up is especially important at the management plan level to buffer the many uncertainties which surround cumulative effects assessment. It is advisable to set up an integrated monitoring program within a given heritage area, based on priorities. Because of the multiple sources involved, a range of variables and indicators may be included to obtain missing information on the status of key components or issues. In some cases this may be combined with monitoring for specific project surveillance or follow-up needs. The rationalization of monitoring may also highlight ineffective programs which do not provide relevant and usable data.

## Feedback

Feedback ensures that the information resulting from the EA is integrated into the appropriate data bases and resource management processes. Similarly, feedback ensures that information stemming from the resource management process is available for future EAs. It links environmental assessments of cumulative effects and products of resource management processes.

Feedback is particularly important at the management plan level. When assessing the cumulative effects of proposed reviews to a management plan, it is necessary to consider existing trends that result from all previous decisions concerning the heritage area. To do so, the results of integrated monitoring programs and past environmental assessments must all be taken into consideration. Similarly, as various choices are made in the management planning process, it is important to document all uncertainties and ensure that appropriate follow up and validation of assumptions occur through the integrated monitoring program.

One way of managing relevant information to ensure that none is lost is by maintaining a single document to record all cumulative effects information as it is gradually obtained (Les Consultants Jacques Bérubé inc., 1996). This would ensure that a compilation of information is available for updating purposes, for future environmental assessments and for meeting resource management needs. Monitoring results could be integrated into this compilation, which could, in turn, assist in setting priorities for future monitoring requirements.

## Documentation

The importance of effective documentation has been discussed earlier in this module. Even where a large part of the EA involves participating in a planning committee to assess options as they are progressively considered, it is crucial to document the *process* involved. Be sure to include:

- any public concerns and consultations
- major cumulative effects, trends, and issues which were dealt with, and any outstanding issues
- records of major decisions affecting cumulative impacts
- mitigation
- the significance of residual impacts
- monitoring requirements
- information requirements

# 5. A SUMMARY OF THE DETAILED APPROACH

A summary of the detailed approach, as it applies to plans or programs, is presented below:

| A STEP-BY-STEP DETAILED APPROACH TO CUMULATIVE EFFECTS ASSESSMENT |
|---|
| **1. SCOPING**<br>**1.1** What is the **policy context** within the given area? Is the plan or program consistent with current policy and plans? Verify consistency with the decision-making level and environmental umbrella policies.<br>**1.2** What are the **main issues and concerns** stemming from the plan or program under review?<br>**1.3** What are the **key environmental components** involved?<br>**1.4** What is an appropriate **scale** of assessment? Include geographic and temporal boundaries, and ecosystem beyond heritage area boundaries as required. |
| **2. ANALYSIS**<br>**2.1** What are the **sources of stress** acting upon the key components or system?<br>**2.2** What are the major **pathways** involved?<br>**2.3** What is the response of the environment? Focus on **trends of key components and ecosystems**.<br>**2.4** What is the **overall contribution of the plan or program** to this overall situation? Consider proposed alternatives, impacts which may stem from proposals within the plan or program and relevant cumulative issues which the plan or program should address.<br>**2.5** What **mitigation methods** can be applied to eliminate or reduce the overall cumulative effects? |
| **3. EVALUATION**<br>**3.1** What specific **goals and management objectives** are relevant to the issues at hand? What are the relevant **targets or carrying capacity** that have been or should be established?<br>**3.2** What is the **significance of residual impacts** in terms of overall integrity? Will the plan or program bring the heritage area closer to its overall objectives? Will ecological or commemorative integrity be enhanced or diminished?<br>**3.3** What **uncertainties** and risks are involved? |
| **4. FOLLOW UP, FEEDBACK AND DOCUMENTATION**<br>**4.1** Identify overall **surveillance** and **follow-up** requirements and elements of an **integrated monitoring program**.<br>**4.2** Identify **feedback requirements** (to cumulative effects context studies or data bases, etc.).<br>**4.3** **Document** relevant information. |

# 6. SPECIAL CONSIDERATIONS FOR BROAD APPLICATION POLICIES AND PROGRAMS

The approach described above is specifically geared to plans and policies which relate to some specific geographical location. General policies or programs with broad applications which are not specifically linked to a particular area (such as marketing policies, for example) will require a modified approach. Since it is vital to understand the cumulative consequences of such policies, practitioners are invited to consult the document **"Strategic Environmental Assessment: A Guide for Policy and Program Officers"** (Shillington & Burns Consultants Inc., *et al.*, 1996).

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# A GUIDE TO ENVIRONMENTAL ASSESSMENTS: ASSESSING CUMULATIVE EFFECTS

# BACKGROUND AND CONCEPT APPENDIX

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# INTRODUCTION TO THE BACKGROUND APPENDIX

## About the Guide

Parks Canada has prepared a reference guide to assessing cumulative effects. The guide covers both theoretical and practical aspects of cumulative effects assessment. The overall approach is presented in three modules: the first module, which is geared to project screenings, provides a synopsis of the approach, the next module covers each step in greater detail, while the third module focusses on special considerations relating to the assessment of plans.

The modules are supplemented by a series of appendices, which provide background information and general working tools. The first appendix reviews background information to provide a better understanding of the theory of cumulative effects, and outlines the conceptual framework which guides the overall approach. A second appendix reviews pertinent authorities and references within the federal government and Parks Canada in particular. A third appendix provides guidelines for external consultants, while the last appendix showcases selected case studies and summarizes workshops which supported the development of the approach.

## How to Use the Background Appendix

One of the purposes of this appendix is to help you understand what cumulative effects are in order to recognize where there is potential for impacts to accumulate. You may wish to read the background material once, then retain it to consult occasionally when required.

# 1. WHAT ARE CUMULATIVE EFFECTS?

## A Definition of Cumulative Effects

It can be very challenging to describe the essence of a concept in a few words, and attempts at defining "cumulative effects" have sparked several controversies. The following definition, which is based on the definition used by the Canadian Environmental Assessment Agency (FEARO, 1994), is provided as a *starting point* only:

> The effect on the environment which results from effects of a proposal when combined with those of other past, existing and future projects and activities. These may occur over a certain period of time and distance.

Cumulative effects are what is happening in the real world. Impacts from all past human activities and projects combine with each other to shape the environment. Traditional environmental assessment looked at the potential effects of a single proposal abstracted from what was happening elsewhere; when assessing cumulative effects, however, the proposal is evaluated in the context of everything else that affects the environment.

**EXAMPLE 1 - Situations which Involve Cumulative Effects.**

- Construction of a national park visitor centre on the shore of a slow-moving river may lead to water quality deterioration through shoreline erosion. A campsite and beach area are also planned just upstream along the same river, which will add to the problem. Furthermore, the water quality is already adversely affected by a pulp mill located upstream just outside park boundaries. As a result of all these activities taken together, water quality may deteriorate sufficiently to fall below recreational quality norms.
- A small national historic site is located close to a busy highway which is being widened to accommodate an extra lane and additional traffic. Furthermore, blasting operations are occurring at a quarry some distance away; the cumulative effects of vibrations from increased traffic and blasting may adversely affect the structure of a historic building at the site.
- The department is participating in the development of a major exposition site on open space in a major urban centre. However, green space within the city has been rapidly disappearing over the last ten years and local residents feel a critical threshold has been reached and no further development is wanted.

## Attributes of Cumulative Effects

Attributes of cumulative effects are summarized in Table 1 below:

**Table 1: Attributes of Cumulative Effects by Issue Type**
(adapted from Sonntag, *et al.*, 1987)

| ISSUE TYPES | CHARACTERISTICS | EXAMPLES |
|---|---|---|
| **time crowding** | impacts which occur so closely over time that the recovery rate of the environment is exceeded | multiple disturbances occurring over the same day may cause overwintering deer to run repeatedly through deep snow, resulting in severe exhaustion |
| **space crowding** | impacts which occur so closely together that their effects overlap | multiple projects (roadways, buildings), within a given forest result in overall habitat fragmentation |
| **compounding effects** | effects from multiple sources which interact so that the overall significance is greater than the sum of individual effects, synergism | loss of habitat can reduce food availability for a given bird species, which, combined with noise from construction projects and disturbance by park visitors, will greatly reduce nesting success |
| **time lags** | delays in experiencing impacts | a native fish species may disappear from a lake several decades after an exotic game fish was first introduced |
| **space lags** | impacts occurring at a point distant from their source of origin | sulphur dioxide emitted thousands of kilometres can be carried to a national historic site where the acid precipitation dissolves stone work of a heritage building |
| **triggers and thresholds** | levels of impacts that fundamentally change system behaviour | overfishing eventually results in the collapse of the fish population |
| **indirect effects** | secondary effects resulting from a primary effect | a new trail can result in new fishing pressure on game fish, if the trail passes close to a previously inaccessible lake |
| **nibbling** | impacts which accumulate through insignificant increments | gradual loss of habitat through a series of small, unrelated developments |

As Table 1 suggests, cumulative effects may be **direct** (pollution resulting from discharges into waterways) or **indirect** (sedimentation resulting from erosion along a stream bed because of removal of vegetation). Effects may accumulate over **time and space**; hence cumulative effects involve broad time and space scales. Effects may accumulate through **additive or compounding** (synergistic) pathways. Usually, cumulative effects arise when impacts are **crowded** in time or space, beyond the capacity of the system to absorb them.

**Nibbling** effects are especially important for heritage areas. Nibbling has been defined as "destruction by insignificant increments" (the proverbial "straw that breaks the camel's back"). Because the effects of any individual project are so small, traditional EA has been ineffective in addressing them. Such individually insignificant effects may be "invisible", as people gradually accept such effects as "normal". For example, the size of sport fish caught in a given lake may have gradually decreased over time, until what is now considered "normal" would have greatly surprised a sport fisherman 100 years ago. Similarly, what is almost unthinkable today risks becoming "normal" over time through gradual insignificant increments. Because the individual contributions to the overall effect are indeed insignificant, it can be very difficult to convince project proponents of the need to mitigate the effect and to establish responsibility for dealing with the impacts.

Effects may accumulate beyond a critical point **(threshold or carrying capacity)**, so that the system may be irrevocably changed. For example, a new pulp mill along a river may meet all legislated requirements regarding pollutant discharges into the water. However, because of existing pulp mills along the river, the water simply cannot absorb even the legal discharge without exceeding accepted water quality norms. This illustrates why an environmental assessment must consider the effects of past projects and not just the project at hand. Thresholds can be very difficult to predict yet the concepts of limits is central to cumulative effects.

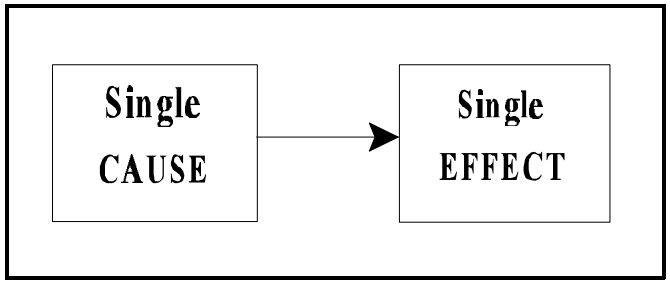
These attributes of cumulative effects all involve a broadening of scales (both geographical and temporal); this is reflected in the corresponding need to broaden the scope of environmental assessments involving cumulative effects.

# 2. CUMULATIVE EFFECTS AS A CAUSE-EFFECT MODEL

Cumulative effects can be better visualized as a *cause-effect model*. While the simplest of these models link a single cause to a single effect (see Figure 1), cumulative effects can be understood as many causes leading to an overall environmental effect or consequence. Thus, the basic model can be expanded somewhat.

The *causes* of cumulative effects are all the stressors acting upon the environment. Basically, these stressors stem from different sources, including past, present or even known future projects or activities, including those that are local, regional or global. Stressors may also include natural perturbations or catastrophes

**Figure 1**
**BASIC CAUSE-EFFECT MODEL**

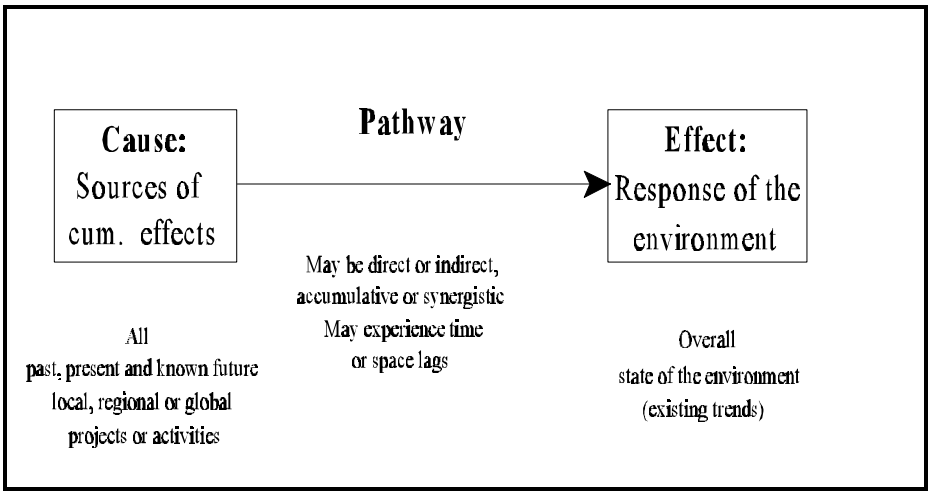



The *effects* are the response of the environment to those stressors. The response may occur at an ecosystem, landscape or global scale. The nature of the response to all stresses acting upon it will determine the state of the environment.

The links between causes and effects are the pathways of change. These pathways may be direct or indirect, can involve interactions and synergies, and may involve time or space lags.

Figure 2 emerges as a representation of cumulative effects, with three major components to the concept: the causes or sources, the pathways of change and the resulting effects.

**Figure 2**
**CAUSE-EFFECT MODEL FOR CUMULATIVE EFFECTS**




## The Causes: Sources of Cumulative Effects

It can be argued that ultimately all environmental impacts may accumulate and interact and, hence, that everything is a source of cumulative effects. However, sources of stress and change can be a part of the natural functions of ecosystems. Not all proposals have residual impacts which cannot be absorbed by the environment and which will accumulate and combine to lead to adverse impacts. This is fortunate, because not everything can be studied. It is important to identify and understand the sources of adverse cumulative environmental change and to "count what counts". (CEQ, 1996)

There are various combinations of causes which can lead to cumulative effects. Multiple impacts can occur from a single source, from multiple sources of the same type or from multiple sources of different types. Table 2 below illustrates categories of causes of cumulative effects.

**Table 2: Cumulative Effects Categorized by Nature of Perturbation**
(adapted from Duinker, 1994)

| SOURCE OF PERTURBATION | DESCRIPTION | EXAMPLES |
|---|---|---|
| **multiple causes** | several agents of change acting upon a single environmental component | a population of large predators within a national park may be affected by hunting outside the park, loss or fragmentation of habitat, noise disturbance and road kills |
| **multiple effects** | several responses of a key environmental component to a single change | wastes discharged into a lake may result in unacceptable water quality, fish mortality and increased aquatic plant growth |
| **nibbling in space** | similar individually insignificant events which may produce a significant overall effect | signs, a parking lot and street lamps added to a national historic site over several years changes the 18th century cultural landscape<br><br>multiple shoreline changes along a canal may result in significant loss of natural shoreline |
| **repeat offences** | similar individually insignificant events which occur repeatedly at the same place | salt damage to vegetation from repeated applications on a roadway in winter<br><br>recurrent visits by kayakers disturb seals in a marine conservation area |

## Pathways of Change

Pathways are among the most intriguing aspects of cumulative effects. They can be difficult to understand: establishing the cause-effect linkages is perhaps the most challenging part of an environmental assessment. However, it is a worthwhile endeavour: studies have shown that "cumulative effects that are a result of well-understood pathways have an increased chance of successful management" (Peterson, *et al.*, 1987). Essentially, pathways of change have been divided into two broad categories: additive and interactive.

**Additive pathways** are the result of persistent change which accumulates faster than the rate of absorption of the system. **Time or space crowding** are often features of additive pathways. For example, if several construction activities all generate noise at the same time, the resulting impacts will be crowded in time and may significantly disturb visitors or wildlife (as well as workers!). An example of space crowding would be the development of multiple trails within a natural community leading to persistent disturbance of wildlife; eventually sensitive species may abandon the area.

Additive pathways may result from a single persistent source or from multiple sources with similar effects. The progressive loss of habitat and the progressive increase of carbon dioxide concentrations in the atmosphere are examples of additive pathways.
A word of warning. Additive pathways can be tricky. Sometimes effects can accumulate to a critical point, when suddenly the behaviour of the system changes: this is the concept of thresholds or carrying capacity. For example, contaminants may accumulate additively in groundwater until suddenly seepage into surface water occurs and the contaminants are absorbed into the biological system. All sorts of unexpected changes may then occur.

**Interactive pathways** involve some sort of synergy in the accumulation process. Effects interact to produce a new effect which is greater than the sum of the individual components. Biomagnification is a simple example of an interactive process from a single but persistent source. Compounding effects can occur though biological or chemical interactions. For example, different chemicals may interact so that the resulting product is more toxic than the sum of the original contaminants. The pesticide DDT caused a breakdown in steroid hormones of predatory birds, interfering with egg shell formation. These compounding effects prevented the successful reproduction of the species without killing individual birds (Peterson, *et al.*, 1987). Another classic example of synergism is photochemical smog, which is much more toxic in the presence of ultraviolet radiation in sunlight

than in its absence. Crowding in time or space may also be interactive; for example, smog caused by vehicle emissions may be much worse in the townsite of Banff at the height of visitor season.

Pathways of change may be characterized by important **time lags**. For example, the levels of mercury in Swedish lakes increased even though mercury emissions from industrial sources had decreased significantly two decades earlier. This was linked to changes in the buffering capacities of soils and sediments as they were exposed to increasing acidity: the soils were no longer able to retain contaminants they had accumulated over 20 years previously (Stigliani, 1988). **Space lags** are also a common feature of cumulative effects pathways: the effects of acid rain, ozone depletion and global warming are all examples of global-scale space lags.

## Response of the Environment: the Importance of Key Components

Different systems will respond to stress in various ways, depending on factors such as the existing levels of stress, and the resilience, nature and complexity of the systems. The actual impacts on the environment will be the end result of the response of that system to the cumulative stresses acting upon it. The state of the environment is a factor of the overall response of the environment to all sources of stress acting upon it.

In reality, of course, “environment” is a broad, comprehensive term that can’t possibly be understood in its entirety. We can’t study everything; hence the need to focus on key components of the environment. Key environmental components are those features of the environment which are important for ecological, scientific or societal reasons. Key components are scale-sensitive; the scale of the cumulative effects will determine the appropriate scale of key components. This illustrates the importance of selecting an appropriate suite of key components for the assessment at hand.

Key components may be selected as indicators of ecosystem functions: for example, the presence of top predators such as wolves may be an indication that predator-prey relationships are functioning well. Key components may also be selected as early-warning indicators: a decrease in the population of certain amphibians may indicate a change in ph brought about by acid rain. Sensitive species can also be useful key components: the reproduction rate of loons is adversely affected by human disturbance. Finally, key components may be selected because of the need to follow how trends are evolving; in some cases direct measurements of the components may be needed.

It will not usually be necessary to "invent" key components for the purpose of cumulative effects assessment; most heritage areas already have a suite of such components identified in monitoring programs, integrity statements, management plans, ecosystem conservation plans and other documents. The challenge will usually be to select the most appropriate components from the wide range available; if too many are selected the assessment will become unmanageable, whereas too few will result in insufficient or biassed information.

# 3. EVALUATING THE OVERALL RESULTS

Once an analysis of cause-effect dynamics has been undertaken for a heritage area, the next question to ask is "so what?". What do the overall changes mean? How important are they? What does it mean if we have 10% less mature forest in a park, or a cumulative loss of 12% of the level 2 archaeological resources in a historic site? In terms of cumulative effects, the answers may not always be obvious.

Evaluations cannot be effectively carried out in the absence of a reference point: some sort of statement of values or overall objective is necessary. Within Parks Canada, the overall objective is integrity. This provides an excellent reference point because it is comprehensive rather than sectoral. More importantly, Parks Canada is currently developing ways of measuring and monitoring integrity. This will be one of the most precious assets in assessing and managing cumulative effects.

## Ecological and Commemorative Integrity as a Reference Point

Integrity is a concept that applies to both natural and cultural heritage areas. The definitions of ecological and commemorative integrity are as follows:

Ecological integrity has been defined as the "*the condition of an ecosystem where 1) the structure and function of the system are unimpaired by stresses induced by human activity, and 2) the system retains resilience in that biological diversity and supporting processes are likely to persist*" (Parks Canada, 1994). In other words, an ecosystem with integrity will maintain its natural structure and function so that its natural range of species diversity can be maintained.

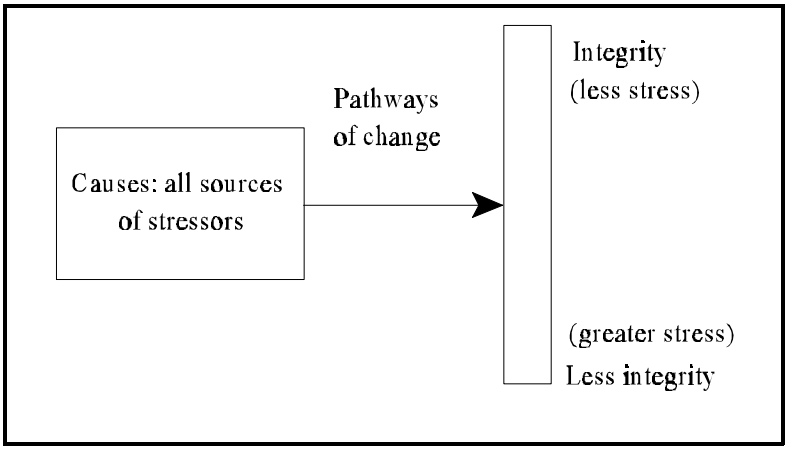
Commemorative integrity means "*ensuring that the resources that symbolize the significance of a historic site are not impaired or under threat, that the reasons for the site's national historic importance are effectively communicated, and that the site's heritage values are respected*." (Parks Canada, 1994).

The concept of integrity is currently being explored in greater detail within each heritage area. Specific components are being identified to help measure integrity and, in many cases, targets or objectives are being provided for those components. This sets up an ideal framework in which to evaluate the effects of cumulative change.

## A Gradient of Environmental Integrity

It can be useful to visualize the state of the environment as situated along a gradient. One end of the gradient represents system integrity, while the other end represents a highly stressed system with impaired integrity. Most heritage areas will be situated somewhere along this gradient. The location along the gradient will be determined by the response of the environment to the collective stressors acting upon it (Figure 3).

**Figure 3**
**EVALUATION OF CUMULATIVE EFFECTS: A GRADIENT MODEL**




Consider a new project proposal. The project will generate environmental effects; new sources of stress will therefore be added to the overall load of stressors. The cause-effect pathways may change as new impacts interact with existing stressors. As a result, the overall effects will also change, leading to an altered state of the environment. The environment will therefore reposition itself along the gradient between integrity and stress. If the changes bring the environment closer to a state of integrity, the overall impacts of the project can be considered positive. On the other hand, if the changes result in an increasingly stressed system, the cumulative effects of the project are negative.

The trick lies in understanding when a system is moving closer to (or away from) integrity. It can be very difficult to assess the overall system as a whole. Again the targets and objectives identified in the ecological and commemorative integrity statements, as well as those identified in resource management plans or ecosystem conservation plans, will be precious assets in evaluating the significance of overall change.

# 4. A CONCEPTUAL FRAMEWORK FOR CUMULATIVE EFFECTS ASSESSMENT

Why organize the various elements of cumulative effects into a conceptual framework? One of the main reasons is that cumulative effects is so broad a concept that without some guiding structure, the assessment of cumulative effects simply would not be manageable. Many assessments of cumulative effects have numerous elements in common, although the approach descriptions and terminology used may vary considerably. Assessments have used a cause-effect or input-output model with key components and indicators to focus the assessment, perhaps considering existing trends for those components. Some level of analysis has usually been used to predict future changes brought about by the proposal under review, and to evaluate those changes based on targets or objectives.

The conceptual framework presented in Figure 4 is designed to serve a practical purpose, to help organize the relevant information into a practical, manageable concept which can guide environmental assessments. The framework is based on the attributes and models discussed in the preceding sections. It is not a prescriptive approach to cumulative effects assessment; it is intended to be a flexible organizing concept which can serve as a starting point for the assessment and management of cumulative effects in heritage areas throughout Canada.

The environmental assessment of cumulative effects is **triggered by a proposal**, which may be a plan, policy, program or project. The potential impacts of that proposal will combine with the impacts of all past, present and known future proposals including those which are local, regional or global in origin. The new proposal will therefore change the overall combination of stressors acting upon the environment.

The **analysis** of the changes brought about by the new proposal will involve a study of the cause-effect linkages. This means that three elements must be analysed: the stressors, the pathways of change and the response of the environment to those stressors. Essentially, the changes brought about by the proposal will lead to a new state of the environment.

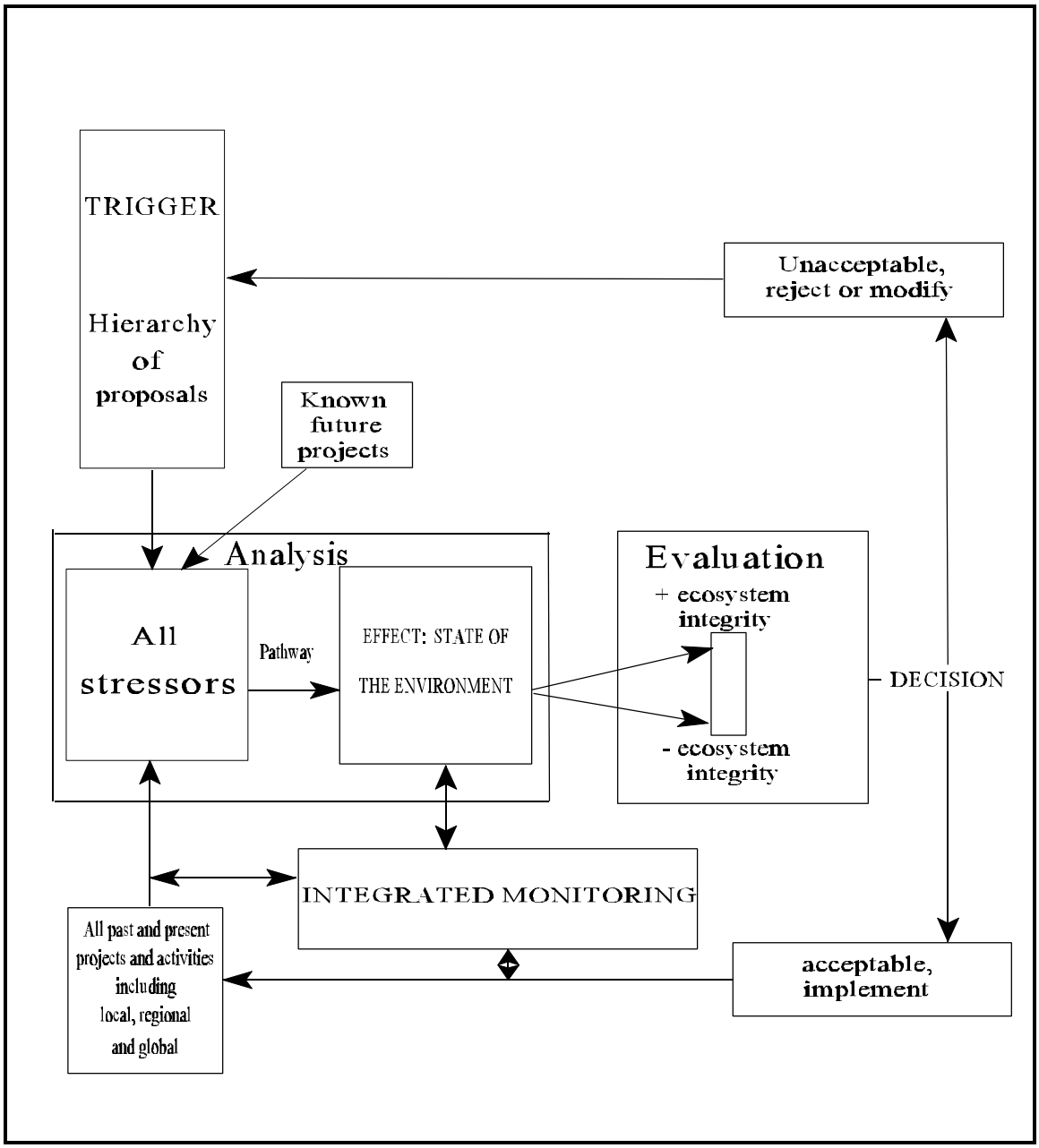
The scale at which this analysis must occur will change depending upon the scale of the potential cumulative effects. The analysis may therefore be very involved or fairly simple depending on the context.

The potential changes brought about by the proposal will shift the state of the environment along the continuum, either towards or away from ecological integrity.

**Evaluation** involves understanding this new position in terms of existing overall objectives, targets or goals. This will provide the context for a decision, which can be rejection of the proposal (or modification and re-assessment), or acceptance of the proposal, with or without mitigation. When a proposal is accepted and implemented, all residual impacts become part of the existing stressors and as such will need to be considered when the next proposal is evaluated.

Obviously, both the analysis and evaluation will be subject to high uncertainty. Integrated monitoring is an important component of this framework. Monitoring will occur for specific proposals as well as for overall environmental change. Information from the monitoring program will provide valuable input to the analysis of the next proposal.

**Figure 4**
**A CONCEPTUAL FRAMEWORK FOR CUMULATIVE EFFECTS ASSESSMENT**



## A Systems Framework

While cumulative effects assessment is triggered by individual proposals, cumulative effects themselves tend to accumulate at a regional or landscape level. Therefore, many of the same issues will keep coming up within a given system, shaped by the specific stressors acting upon it. As a result, the framework is essentially a systems concept. This means that as information is acquired for a given region, ecological or heritage area, it can be compiled so that future assessments can be built on past assessments. Over time, information on the cumulative effects context within a particular area will become more complete and accurate with input from monitoring and various studies.

## A Framework that Applies to all Levels of Decision Making

Most environmental assessments evaluating cumulative effects are triggered by projects: physical works or activities as defined by the *Canadian Environmental Assessment Act* (Statutes of Canada, 1992). In fact, the *Act* constitutes a legal requirement to assess cumulative effects at the project level. The *"Procedures of the Department of Canadian Heritage for Complying with the Canadian Environmental Assessment Act*" (Department of Canadian Heritage, 1996) also directs managers to assess the environmental implications of projects and activities which may have negative effects on the environment, even in the absence of triggers under the *Canadian Environmental Assessment Act*.

**However, to be effective, the cumulative effects framework must be applied not only to projects, but to policies and plans as well,** since this is where many cumulative effects originate. **In fact, the most opportune level for cumulative effects assessment is the land-use planning level**. Within Parks Canada, this corresponds to the park or site management plans and all supporting plans which provide greater overall direction to the management of the lands within those heritage areas. This does not imply that assessments will be duplicated; what it suggests is that strategic issues must be assessed at a strategic level, and concrete, design issues must be assessed at a project level. The two are complementary, but not identical. The geographical and temporal scales will usually be broader for planning level assessments, and may be narrower and more focussed at the project level.

## Strategic EAs will Help Keep Project-Level Assessments Manageable

Generally speaking, plans and policies involve groups of proposals and broad scales. Since cumulative effects involve multiple sources, complex pathways and broader ecosystem scales, it is possible to assess them without excessively broadening the scope of the EA. At the project level, the opposite is true. If, to assess the cumulative effects of a project, you must analyse the effects of every other project affecting the system, the EA can become bigger than the project under review. Consider the example of stormwater outfalls along a historic canal. The scope of the assessment of a single proposed outfall would be greatly broadened if every other source of water pollution along the entire canal must be considered within every individual outfall assessment.

However, if a management plan has examined the current context and provided specific guidelines or thresholds for stormwater outfalls, this information can be used at the project level without duplicating the initial analysis. The project EA can then focus on specific issues relating to the preferred physical location, acceptable levels of residue and similar issues, without neglecting cumulative effects. This results in overall savings of time and money.

No new demands are being created by promoting planning-level assessments. The environmental assessment of policy and programs is required by the *Environmental Assessment Process for Policy and Program Proposals* (FEARO, 1993). The "*Procedures of the Department of Canadian Heritage for Complying with the Canadian Environmental Assessment Act*" (Department of Canadian Heritage, 1996) states that the department will review any Canadian Heritage policy or program proposal which is to be submitted to Cabinet for its consideration, as well as all proposed programs, policies and plans where environmental implications may be relevant. Such plans specifically include Parks Canada management plans.

In summary, then, once the existing cumulative effects context is understood for a given heritage area, that information can be applied in all environmental assessments, avoiding duplication of effort. The best level at which to establish the overall context of cumulative effects is the land-use planning level. At this more strategic level of decision making, specific thresholds or limits can be identified and standards can be set for all project assessments which respect the directions outlined in the plan. For this to function effectively, however, it is imperative that feedback occur between the different levels of decision making (i.e. from policy to plan to projects); information from a project assessment will also be valuable for other project assessments and as feedback and input to strategic decision making

levels. Cumulative effects assessment will work best when used in conjunction with the *Natural Resources Management Process*, to compile information from existing processes and help guide the collection of future data through effective monitoring.

## Integrated Monitoring: A Vital Component

Cumulative effects always involve greater uncertainty: predictions must cover more variables and over greater physical and temporal scales. Cause-effect linkages can be difficult to establish. Time and space lags may lead to unexpected impacts. Natural changes in the ecosystem, including surprise or catastrophic events such as fire or insect infestations, may further complicate the issue.

The importance of monitoring and follow up is obvious when faced with these levels of uncertainty. Monitoring will help identify unexpected impacts or faulty predictions. Monitoring will also provide updates on how residual impacts of recently implemented proposals affect the overall context of cumulative impacts acting upon a heritage area. Since cumulative effects stem from multiple initiatives or activities, follow up provides data on many aspects of the overall cumulative effects context for a heritage area. This is why an integrated monitoring program for a given heritage area is preferable to individual, specific monitoring initiatives. Integrated monitoring has also been identified as a requirement in support of State of the Parks reporting.

# 5. BUILDING ON EXISTING PROCESSES

Cumulative effects assessment is supported by all processes which are designed to collect, analyse, interpret, monitor and integrate information relating to the ecosystem. The close links between cumulative effects assessment and the *Natural Resources Management Process* have given rise to concerns that implementing cumulative effects assessment will duplicate existing processes. In fact, the opposite is true: the activities and products for managing natural resources are complementary and can work in tandem, mutually supporting each other through effective feedback mechanisms.

Parks Canada's responsibility as land manager presents several advantages for addressing cumulative effects. Parks Canada retains full jurisdiction within the boundaries of heritage areas and this will greatly facilitate cumulative effects assessment and supporting processes such as integrated monitoring. However, multi-jurisdictional issues will arise due to the effects of developments and activities outside heritage areas, and increasingly land managers must explore ways of influencing such activities to limit negative impacts within heritage areas. Similarly, activities within parks or sites will affect surrounding areas and stakeholder input will be important in many cases.

The *Guiding Principles and Operational Policies* clearly establish the mandate for maintaining ecological and commemorative integrity and the use of an ecosystem approach. Management plans are viewed as instrumental in establishing the objectives and "measurable benchmarks of ecological and commemorative integrity" needed for cumulative effects assessment. Products of the *Natural Resource Management Process*, such as the ecosystem conservation plan, resource management plans, park resource description and analysis, and heritage area data bases, will provide valuable background information and general direction for cumulative effects. Results of cumulative effects analyses and assessments should be fed into existing integrated monitoring programs for follow up and updating heritage area information systems. Evaluation of cumulative effects may also supply important insight into potential thresholds, targets and issues within heritage areas which require attention.

Ecological and commemorative integrity statements will provide overall, comprehensive goals as well as targets and objectives which will help measure integrity thereby providing immeasurable support to the evaluation of cumulative effects. Linking this concept with State of the Parks reports will strengthen this role and provide additional information for cumulative effects assessment.

Finally, the availability of data bases is a major strength within Parks Canada. The park resource description and analysis, park data bases, ecosystem conservation plans and park or site management plans all form a rich source of information which is essential to cumulative effects assessment. While further information will often be required for specific assessments, existing data bases are a precious resource for the cumulative effects assessment framework.

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A GUIDE TO ENVIRONMENTAL ASSESSMENTS:
ASSESSING CUMULATIVE EFFECTS

# AUTHORITIES AND REFERENCE APPENDIX

# CUMULATIVE EFFECTS ASSESSMENT WITHIN PARKS CANADA

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## TABLES



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# 1. THE BENEFITS OF CUMULATIVE EFFECTS ASSESSMENT

There are several compelling reasons for undertaking cumulative effects assessment. First and foremost, **CEA is a necessary component of EA**, if EA is to support more effective decision making and sustainable development. Duinker (1994) has referred to cumulative effects assessment as "EA done right"**.**

> *"The environmental effects of concern to thinking people are, simply put,* ***not*** *the effects of a particular project; they are the cumulative effects of everything. Hence, it is essentially logical to address cumulative effects if one wishes to consider the effects of development projects . This, and not the regulatory requirement, is the intellectually defensible reason for requiring cumulative effects assessment." (Ross, 1994)*

Cumulative effects have been recognized internationally as being of considerable importance in support of sustainable development and other environmental goals, and as such have been formally recognized in legislative and policy documents.

# 2. FEDERAL AUTHORITIES AND REFERENCES PERTAINING TO CUMULATIVE EFFECTS ASSESSMENT

## 2.1 The *Canadian Environmental Assessment Act* and Regulations

For the first time, the Act clearly establishes a legal requirement for the assessment of cumulative effects. Specifically, the Act requires that:

> "*Every screening or comprehensive study of a project and every mediation or assessment by a review panel shall include a consideration of the following factors:*
>
> *(a) ...any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out*
>
> *(b) the significance of the effects referred to in paragraph (a)*" (section 16.1)

## 2.2 The Environmental Assessment Process for Policy and Program Proposals

A non-legislated environmental assessment process is required for federal policy and program initiatives under a 1993 Cabinet Directive. Announced as part of the federal environmental assessment reform package, the process complements the legislated requirement for the environmental assessments of projects through the *Canadian Environmental Assessment Act*. The objective of the process is to systematically integrate environmental considerations into the planning and decision-making process for policies, programs and plans.

## 2.3 A Reference Guide for the Canadian Environmental Assessment Act - Addressing Cumulative Effects

The Canadian Environmental Assessment Agency has prepared a reference guide on assessing cumulative effects. The reference guide defines cumulative effects as:

> *The effect on the environment which results from effects of a proposal when combined with those of other past, existing and future projects and activities. These may occur over a certain period of time and distance*. (FEARO, 1994).

The guide interprets the requirements of the CEA Act in terms of assessing cumulative effects.

## 2.4 Strategic Environmental Assessment: A Guide for Policy and Program Officers

This guide, currently in preparation, provides practical advice for meeting the requirements of the 1993 Cabinet Directive on policy and program assessments. It defines Strategic Environmental Assessment and places it within the broader context of the federal government's decision-making process and sustainable development agenda. The assessment of cumulative environmental effects of proposed policies and programs is identified as one of the primary benefits of Strategic Environmental Assessments (Shillington and Burns, *et al*., 1996).

# 3. NATIONAL PARKS AUTHORITIES AND REFERENCES PERTAINING TO CUMULATIVE EFFECTS ASSESSMENT

## 3.1 National Parks Act. R.S., c. N-13, s. 1

The legislative background is the highest authority establishing the importance of protecting natural and cultural heritage. The *National Parks Act* confers a legal obligation to maintain ecological integrity under section 5. (1.2) which specifies that:

> *Maintenance of ecological integrity through the protection of natural resources shall be the first priority when considering park zoning and visitor use in a management plan.* (Government of Canada, 1985)

This need to protect ecological integrity constitutes an additional requirement to assess cumulative effects.

The Act requires that a management plan be prepared and tabled in Parliament within five years after the proclamation of a park. A review of the management plan is required every five years and any amendments must be tabled in Parliament. Public participation at the national, regional and local levels is required as appropriate. The Minister is also required to report to Parliament on the state of the parks and on the status of the establishment of new parks.

The Act provides for the establishment of a series of regulations governing resource management and protection, land use, administration and enforcement.

## 3.2 Parks Canada Guiding Principles and Operational Policies

Second only to the legislation, the Department of Canadian Heritage has developed "*Guiding Principles and Operational Policies*" (Canadian Heritage, 1994a) which provides direction to program initiatives and establishes a framework for heritage program delivery and responsible decision making. Hence, this policy document is instrumental in providing a context for cumulative effects assessment.

The purpose statement of Parks Canada establishes the importance of ecological and commemorative integrity throughout all sectors of activity of the department:

> *To fulfill national and international responsibilities in mandated areas of heritage recognition and conservation; and to commemorate, protect and present, both directly and indirectly, places which are significant examples*

> *of Canada's cultural and natural heritage in ways that encourage public understanding, appreciation and enjoyment of this heritage, while ensuring long-term ecological and commemorative integrity.*

The policy clearly states that "the first priority for Parks Canada is always to ensure long-term ecological and commemorative integrity of heritage areas", which involves considering the larger ecosystem and striving for a condition where the structure and function of the ecosystem are unimpaired by stresses induced by human activity and are likely to persist.

With regards to environmental assessments, the National Parks Policy (Canadian Heritage, 1994a) states that:

> *Parks Canada will be exemplary in the implementation of federal legislation pertaining to environmental assessment and review in national parks. In addition, all programs, policies and plans will be subject to environmental assessment. Parks Canada is committed to making the results of all environmental assessments available to the public*. (section 3.2.13)
>
> *Parks Canada will participate in environmental impact assessments for proposed developments outside national parks that may affect park ecosystems*. (section 3.2.14)

Section 3 of the National Parks Policy also establishes the importance of ecosystem management:

> *Ecosystem management provides a conceptual and strategic basis for the protection of park ecosystems. It involves taking a more holistic view of the natural environment and ensuring that land use decisions take into consideration the complex interactions and dynamic nature of park ecosystems and their finite capacity to withstand and recover from stress induced by human activities. The shared nature of ecosystems also implies that park management will have effects on surrounding lands and their management.* (section 3.0)

Parks Canada has developed guiding principles and operational policies covering its seven program elements: National Parks, National Historic Sites, Canadian Heritage Rivers, National Marine Conservation Areas, Historic Canals, Federal Heritage Buildings and Heritage Railway Stations. Each of these operational policies may be helpful in establishing a specific context for cumulative effects assessment.

## 3.3 Department of Canadian Heritage Sustainable Development Strategy

Recent changes to the Auditor General Act now direct all federal departments to prepare and table before Parliament sustainable development strategies by December 1997. The SD strategies set out the various goals, action plans and initiatives undertaken by departments to implement sustainable development. A Cabinet policy entitled *A Guide to Green Government* (1995) provides direction for the development of sustainable development strategies.

The Department of Canadian Heritage Sustainable Development Strategy will commit the department to meet or exceed federal environmental statutes and regulations, and to emulate best professional practices. The sustainable development strategy recognizes the role of environmental assessments and supports best professional practice within the EA process. One of the important aspects of a sustainable development strategy is the incorporation of environmental considerations into broad departmental policies and programs; strategic environmental assessment is recognized as the principle tool to achieve this goal.

## 3.4 The "Procedures of the Department of Canadian Heritage for Complying with the *Canadian Environmental Assessment Act*"

The "Procedures of the Department of Canadian Heritage for Complying with the *Canadian Environmental Assessment Act*" (Department of Canadian Heritage, 1996) states that the department will review for its environmental implications any Canadian Heritage policy or program proposal which is to be submitted to Cabinet for its consideration, as well as all proposed programs, policies and plans where environmental implications may be relevant. Such plans specifically include Parks Canada Management Plans:

> *"The environmental assessment of Parks Canada Management Plans will be conducted according to the Environmental Assessment Process for Policy and Program Proposals and will include consideration of existing developments and facilities as well as new strategic directions and their cumulative effects. The implementation of specific projects will be conditional upon subsequent assessment under the Act when there is an appropriate level of detail available." (Department of Canadian Heritage, 1996)*

The "Procedures" (Department of Canadian Heritage, 1996) also confer an obligation to assess other proposals which are not triggered by the Act, including proposals external to heritage areas:

> *110. Proposals may arise which could have adverse effects on natural and cultural resources within national parks, national park reserves, national historic sites, historic canals, or other lands administered by Parks Canada but for which there is no environmental assessment obligation under the Act or under the Environmental Assessment Process for Policy and Program Proposals. In this event, if they are proposals for which Parks Canada has a decision-making responsibility, the Manager must ensure, in order to meet obligations arising from the Parks Canada mandate, that an environmental assessment is completed and taken into account before the proposal proceeds.*
>
> *111. Proposals may also arise for projects to be located outside national parks but which are likely to have adverse effects within. Section 3.2.14 on page 36 of the Parks Canada Guiding Principles and Operating Policies states that "Parks Canada will participate in environmental impact assessments for proposed developments outside national parks that may affect park ecosystems." If there is no trigger under the Act, this may involve participation as an intervenor or stakeholder in a provincial or regional environmental review process..."*

## 3.5 Parks Canada Environmental Management System

As directed by the Departmental Sustainable Development Strategy, Parks Canada is in the process of developing an Environmental Management System (EMS). The EMS covers operational aspects of implementing sustainable development, in areas such as recycling, procurement, construction and operation of buildings, fleet management, land utilization and the rehabilitation of contaminated sites.

In keeping with the commitment to meet or exceed federal statutes, regulations and environmental policies, the EMS will provide a compilation of relevant standards and policies consistent with ISO 14000, which will provide valuable guidelines and information to be integrated into operations-level environmental assessments.

# 4. ECOSYSTEM-BASED MANAGEMENT: COMPLEMENTARY STREAMS

## 4.1 Ecosystem-Based Management

The term “ecosystem approach” or “ecosystem-based management” describes a comprehensive approach to planning and management which focusses on natural units, usually at broad spatial and temporal scales, to consider natural fluctuations and cycles. The approach typically investigates the major attributes of the system rather than single sectors, and emphasizes connections and linkages, including humans, as part of the ecological system (CCME, 1996; Environment Canada, 1996) .

An ecosystem management approach for protected areas was proposed as early as 1932 by the Ecological Society of America (Shelford, 1932, in Woodley and Freedman, 1995). Recent interest in the concept has resulted in various applications, integrating the concepts of biodiversity, ecological integrity and sustainability.

The key characteristics of the ecosystem approach are generally recognized as follows:

- a flexible, adaptive process
- ecological (rather than institutional) boundaries, recognizing that boundaries are contextual
- the consideration of a range of management issues (rather than individual sectors) including the integration of biophysical, social and economic concerns, and the integration of science and management
- focus on the interrelationships and linkages between elements
- broader time and space scales, usually focussing on the long term and large scale (although multiple scales may be involved)
- multi-agency cooperation, with multi-stakeholder participation
- a focus on clear values, goals and objectives, often using health or integrity as an endpoint
- the use of indicators to measure the achievement of those goals
- directed research and monitoring programs

Parks Canada's has incorporated ecosystem-based management within its *Guiding Principles and Operational Policies* (Canadian Heritage, 1994a). Relevant policy requirements include:

- the development of measurable goals and management strategies to ensure the protection of ecosystems (section 3.2.1)
- scientifically based decision making on internationally accepted principles (section 3.2.2)
- management with minimum interference to natural processes (section 3.2.3)
- the development of integrated programs for the collection, storage, analysis and interpretation of data (section 3.2.7)
- the development of collaborative management agreements to find solutions to transboundary concerns (section 3.2.9)

Parks Canada has recently developed a set of principles and standards to make the concept of ecosystem-based management operational (Geomatics International, 1996).

Cumulative effects assessment is a way of thinking that involves taking on a broader perspective and adopting wider temporal and spatial scales. It falls within the overall stream of ecosystem-based management and, hence, complements and is complemented by other initiatives developed to support the ecosystem approach. By providing information on the cumulative consequences of potential proposals to the overall ecosystems affected, cumulative effects assessment promotes effective and responsible decision making. Assessing cumulative effects provides constant feedback on the cumulative consequences of past decisions and how they are affecting current trends. In turn, the framework for assessing cumulative effects is supported by initiatives such as integrated data base and monitoring programs.

## 4.2 State of the Parks Report

Preparing a *State of the Parks report* (SOP) is a formal requirement of the *Guiding Principles and Operational Policies* as well as a legislated requirement under the *National Parks Act*. A report is prepared every three years; a process is being developed to provide a consistent framework and approach for implementing SOP through the identification of stressors and the use of indicators.

The *Guiding Principles and Operational Policies* further directs National Parks to prepare an integrated data base:

> *An integrated data base will be developed and kept up to date for each national park to provide, along with research and environmental monitoring, the baseline information required to protect and maintain park ecosystems and contribute to State of the Parks reporting to Parliament. In defining information needs, the spatial and temporal dimensions of park ecosystems and ecosystem processes will be a primary consideration. Therefore, data requirements will extend beyond park boundaries.* (section 3.2.6)

## 4.3 Ecological Integrity

The concept of integrity has frequently been used as a common objective or endpoint for the various parties involved in ecosystem-based management. As such, it becomes important to define the concept as clearly as possible. For national parks, "integrity" has been defined as "completeness, soundness and unity - for both ecosystems and historic places" (Parks Canada, 1994). Ecological integrity has been defined by Woodley (1991):

> *"Ecological integrity is defined as a state of ecosystem development that is optimized for its geographic location, including gross energy input, available water, site nutrient capital and colonization history. For national parks, this optimal state has been referred to by such terms as natural, naturally evolving, pristine and untouched. It implies that ecosystem structures and functions are unimpaired by human-caused stresses and that native species are present at viable population levels. Ecosystems with integrity do not exhibit trends associated with stressed ecosystems. National parks are part of larger ecosystems and determinations of integrity in national parks must consider their larger ecosystems."*

The 1994 State of the Parks report provided a similar definition: "*Ecological integrity is defined as the condition of an ecosystem where 1) the structure and function of the system are unimpaired by stresses induced by human activity, and 2) the system retains resilience in that its biological diversity and supporting processes are likely to persist*" (Parks Canada, 1995).

The *Strategic Framework to Sustain the Integrity of Ecosystems* (Environment Canada Parks Service, 1992) provides guiding principles for management within an ecosystem approach, defined as:

- *adopting a holistic view of the natural environment*
- *considering complexities and interactions*
- *taking into account the dynamic nature and finite capacity of ecosystems*
- *encouraging collaboration among all those whose activities influence the park's ecosystems*

The framework also defines a "priority actions strategy" and expected results, which include activities such as the identification of threats, the establishment of park Scientific Advisory Boards and describing criteria for quantifying and reporting on ecological integrity.

The framework recommends the development of new methods to develop and manage cumulative impacts affecting ecological integrity.

To complement the framework for ecological integrity, an approach for monitoring key diagnostic indicators of ecological integrity was proposed (Woodley, 1991, 1993). The proposed approach recommends the selection of a suite of indicators of ecological integrity beyond the traditional threat-specific monitoring; the approach is based on the inherent hierarchical nature of ecosystems and uses key diagnostic elements representing recognized characteristics of integrity. The suite of indicators of ecological integrity can also be used for State of the Parks reporting. Table 1 outlines generic classes of key components which will be selected on a park-specific basis to guide the development of ecological integrity statements and to serve as a basis for State of the Parks reporting. Such key components may be directly applicable to cumulative effects assessment; others may provide important feedback which can assist in the analysis in environmental assessments even when they are not used directly as part of the CEA framework.

**Table 1 - Assessing Ecological Integrity for State of the Parks Reporting**
(Woodley, 1996)

| **Biodiversity** (characteristic of region) | **Ecosystem functions** (resilience, evolutionary potential) | **Stressors** (unimpaired systems) |
|---|---|---|
| **Species richness**<br>❖ changes in species richness<br>❖ numbers and extent of exotics<br><br>**Population dynamics**<br>❖ mortality/natality rates of indicator species<br>❖ population viability of indicator species<br><br>**Trophic structure**<br>❖ size class distribution of all taxa<br>❖ predation levels | **Succession/retrogression**<br>❖ disturbance frequencies and size (fire, insects, flooding)<br>❖ vegetation age class distributions<br><br>**Productivity**<br>❖ remote (e.g. satellite) or by site<br><br>**Decomposition**<br>❖ by site (litter bags)<br><br>**Nutrient retention**<br>❖ Ca, N by site | **Human land-use patterns**<br>❖ land use maps, roads, buildings, etc.<br><br>**Habitat fragmentation**<br>❖ patch size, inter-patch distance, forest interior<br><br>**Pollutants**<br>❖ sewage, petrochemicals, etc.<br>❖ long-range transport of toxics<br><br>**Climate**<br>❖ weather data<br>❖ frequency of extreme events<br><br>**Other**<br>❖ park specific issues |

## 4.4 Commemorative Integrity

Commemorative integrity is used to describe the health or wholeness of a national historic site. "Commemorative integrity means ensuring that the resources that symbolize the significance of a historic site are not impaired or under threat, that the reasons for the site's national historic importance are effectively communicated and that the site's heritage values are respected." (Parks Canada, 1995)

The commemorative integrity statement (CIS) may be described as follows: "The CIS provides the accountability framework for the management of any national historic site including those situated within national parks. Ideally a management plan is developed for each national historic site based upon the CIS. At a minimum the objectives outlined in the CIS should be reflected in the national park management plan and strategies developed for the management of the national historic site

Existing mechanisms may be utilized to provide strategies and accountability for their management. The management strategies would include, as in the case of the natural environment activities, identification of threats and describing criteria for

reporting on commemorative integrity. This is determined by applying indicators. For example the key components used to measure stress on the natural environment may often be used to measure similar stresses on the cultural environment.

Conservation disciplines (such as archaeology or artifact and building conservation) have developed resource monitoring systems that can be expanded and adapted to monitor commemorative integrity." (Nadon, 1997)

# 5. MANAGEMENT PLANNING: THE CORE MANAGEMENT ACTIVITY FOR HERITAGE AREAS

The principles and practice of management planning are described in the management planning process, defined in Parks Canada's *Guide to Management Planning* (Canadian Heritage, 1994b). The planning framework defined in this process includes the scoping document, the park management plan, implementation (business) plans and work plans, which should all be subject to environmental assessment (FEARO, 1993; Department of Canadian Heritage, 1996) including cumulative effects assessment. All provide information required for cumulative effects assessments.

It is a requirement to develop a management plan for each national park or historic site to define more specifically the objectives of that heritage area within the context of existing laws and policies. The management plans establish how ecological and commemorative integrity may be achieved by specifying a clear statement of purpose for the heritage area, providing a long-range vision, providing direction related to protecting, presenting and managing the ecosystems and cultural resources, including information pertaining to zoning, future activities, opportunities for visitors and so on. *"A management plan provides strategic direction for the management and operation of a park or historic site and provides a framework for subsequent business and work planning. This includes ecosystem conservation plans, community plans, service plans, interpretation plans, conservation plans, public safety and risk management plans."* (Canadian Heritage, 1994b). Management planning must also provide "*measurable benchmarks of ecological and commemorative integrity*" (Canadian Heritage, 1994b).

The management plan is the most important management document for the heritage area objectives. It provides direction and background information for the CEA framework, as well as a first opportunity to assess the cumulative effects related to management of the heritage area from a park- or site-wide perspective, through the EA of the management plan when it is first prepared or when it is reviewed on a five-year basis.

The following information resulting from management planning is essential for cumulative effects assessment:

- statement of purpose and objectives for the heritage area
- information on past and future activities and projects to identify the total stress load
- information on management activities which can mitigate the total stress load
- measurable benchmarks of ecological or commemorative integrity

Management planning gives rise to two implementation processes: the *Natural Resources Management Process* and the *Visitor Activities Management Process*. Both are discussed in the following sections.

## 5.1 Natural Resources Management Process

*Natural resources management* involves all activities directed towards the maintenance or modification of the biotic and abiotic resources; a model for such activities is provided in the *Natural Resources Management Process Manual* (Natural Resources Branch, 1992). This is the most relevant framework for cumulative effects assessment and will provide important links to CEA.

The *Natural Resources Management Process* (Natural Resources Branch, 1992) constitutes the backbone for resource management within national parks and the products of this process provide essential information for environmental assessment. As such the various steps in the process will be examined to clearly establish the links and contributions of the process to cumulative effects assessment on the one hand and the recommended feedback mechanisms on the other.

The management of natural resources involves compiling a “Basic Resource Inventory”, with information frequently maintained on a computer data base and GIS system. Information is then analysed through a “Resource Description and Analysis” which forms a comprehensive evaluation of park ecosystems. Based upon the management guidelines identified in the park management plan, the ecosystem conservation plan is the “driving force” behind the *Natural Resource Management Process* (Natural Resources Branch, 1992). It develops specific goals for the maintenance of ecological integrity and the protection and management of the parks ecosystems. The ecosystem conservation plan may identify requirements for the development of specific resource management plans to address specific issues and concerns. Monitoring is an essential component of the process, to obtain and integrate new information into the basic resource inventory and ecosystem conservation plan.

Relevant aspects of the *Natural Resource Management Process* are discussed in Table 2 in terms of links to cumulative effects assessment and feedback requirements following CEA activities back to the resource management and planning process.

## 5.2 Visitor Activities Management Process (VAMP)

The management process for visitor activities describes management requirements for visitors at each stage of the park management process.

Just as the core of the *Natural Resources Management Process* is the ecosystem conservation plan, the park service plan is the central document linking management objectives to park operations in the field of visitor services. The preparation of service plans is described in*: Getting Started: A Guide to Service Planning* (Environment Canada, 1988).

## Table 2
## Links Between the Resource Management Process and CEA

| ELEMENTS FROM THE RESOURCE MANAGEMENT PROCESS | LINKS TO CUMULATIVE EFFECTS ASSESSMENT | FEEDBACK TO RESOURCE PLANNING AND MANAGEMENT |
|---|---|---|
| interim management guidelines | ❖ provides management goals and objectives<br>❖ provides information on future projects or activities to determine total stress load<br>❖ provides information on zoning, activity thresholds for certain zones, etc. | ❖ triggers an environmental assessment and provides an opportunity for cumulative effects assessment at the park-wide level<br>❖ he ensuing EA will provide the broader context for project-level assessments |
| basic resource inventory | ❖ fundamental data base | ❖ integrate new information resulting from any studies required for CEA |
| resource description and analysis | ❖ provides the main data base including identification of key components such as rare species, special habitats, etc.<br>❖ identifies key components (VECs) and associated targets and indicators<br>❖ provides initial list of potential and known stressors to identify total stress load | ❖ integrate new information resulting from any studies required for CEA<br>❖ may identify new key components, adjust targets or indicators, etc.<br>❖ may identify new stressors |
| resource management plans | ❖ provides objectives, problem solving<br>❖ provides specific information on resources including indicators, targets, thresholds where applicable | ❖ may update such information |
| resource management studies | ❖ provides specific information on resources including indicators, targets, thresholds where applicable | ❖ may update such information |
| monitoring | ❖ provides up-to-date information on key components, stressors, through indicator monitoring | ❖ monitoring plan designed to follow up on specific issues as identified in the EA; may be integrated with regular monitoring |
| ecosystem conservation plan | ❖ provides a synthesis of information relating to stressors, targets, indicators, etc. | ❖ information about existing and predicted total stress load, targets, indicators, thresholds, should be incorporated into ecosystem conservation plan |
| park data base | ❖ provides basic information required for the assessment<br>❖ usually computerized data (GIS) which is especially useful for analysis of CEA issues | ❖ information generated may be incorporated into the data base |

# 6. OTHER SOURCES OF INFORMATION ON CUMULATIVE EFFECTS ASSESSMENT

For additional information on cumulative effects assessment, you may wish to consult the Canadian Environmental Assessment Agency home page (http://www.CEAA.gc.ca). The Agency provides a comprehensive annotated bibliography on cumulative effects. The Agency is also in the process of preparing two manuals on assessing cumulative effects based on input from an international working group. The first manual will provide guidance on methods and tools for CEA while the second one will target decision makers.

Remember that relevant information can be found in references on ecological or commemorative integrity, ecosystem-based management and other related topics.

A Case Studies Appendix is included at the end of this guide to provide examples of the assessment of cumulative effects within EAs.

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# A GUIDE TO ENVIRONMENTAL ASSESSMENTS: ASSESSING CUMULATIVE EFFECTS

# GUIDELINES APPENDIX

# SPECIAL GUIDELINES FOR EXTERNAL CONSULTANTS

# GUIDELINES FOR EXTERNAL CONSULTANTS

This section is intended to provide guidance to external consultants by clearly outlining the requirements and expectations of Parks Canada for the assessment of cumulative effects. These guidelines may be included as an appendix to terms of reference for environmental assessments. For additional information consult the *Detailed Approach Module* in the *"Guide to Environmental Assessments: Assessing Cumulative Effects"*.

## Definition

Parks Canada uses the following definition of cumulative effects, based on the definition of the Canadian Environmental Assessment Agency (FEARO, 1994):

> *The effect on the environment which results from effects of a proposal when combined with those of other past, existing and future projects and activities. These may occur over a certain period of time and distance.*

In practical terms, this definition means that an environmental assessment must consider the effects of a proposal within the context of its environment, taking into consideration both the existing stressors already acting upon that environment and future stressors which are likely to occur. Existing stressors include the effects of all past and current local, regional and global projects and activities. Future stressors are those which would arise from known or reasonably anticipated projects or activities, whether or not they have been approved.

Parks Canada uses the term "environment" in its broader sense to include the biophysical environment as defined in the *Canadian Environmental Assessment Act*, as well as the cultural/heritage environment.

# GUIDING PRINCIPLES

1) All environmental assessments undertaken for the Department of Canadian Heritage will include an assessment of cumulative effects. The assessment of cumulative effects is considered an integral part of the environmental assessment and not a separate process or add-on. The steps described for assessing cumulative effects must be fully integrated into the environmental assessment, and documentation of cumulative effects must be incorporated into the screening or EA report.

2) All steps and procedures required for environmental assessment must be followed. The requirements outlined in these guidelines are for assessing cumulative effects and do not replace any EA requirement.

2) Cumulative effects must be assessed at all levels of decision making. It is important to demonstrate that there is consistency between levels of decision making prior to initiating an assessment.

3) Objectives, goals, targets and thresholds identified at planning levels (including: park or site management plans, ecological or commemorative integrity statements, resource conservation plans, etc.) must be incorporated into the environmental assessment.

4) Cumulative effects involve a broadening of the scope of the assessments. The appropriate scale will be determined by the scale of the potential cumulative effects. The appropriate geographical scale should reflect ecosystem rather than park/site/political boundaries. The appropriate time scale should reflect the probable duration of cumulative effects.

5) The consultant should strive to provide quantitative data wherever possible. However, it is recognized that in some cases this may be impossible. The consultant must use the best available information and the best professional judgement. Uncertainties, assumptions and levels of risk must be clearly stated.

## GENERAL APPROACH

The consultant must identify the potential for cumulative effects. Scoping guidelines, which can help identify the presence of cumulative effects, are presented in Table 1.

The general approach adopted by Parks Canada for the assessment of cumulative effects involves four steps: scoping, analysis, evaluation and follow up/feedback/documentation.

Since effective assessment of cumulative effects acting upon a heritage area requires the application of environmental assessments beyond the project level, establishing the consistency of the proposal with existing plans and policy is essential. The scoping exercise should refer to this policy context. Scoping also involves identifying the major issues and concerns and determining an appropriate scale of assessment based on the scale and severity of the potential cumulative effects.

The analysis is based on a cause-effect model. Analysis therefore involves identifying all stressors acting upon the environment, the establishment of pathways of change, and identifying the response of the environment to those stressors. The analysis should consider any options or alternatives and mitigating measures should be identified.

The evaluation involves identifying the relative contribution of the proposal under review to the overall stress load. Overall consequences to the environment must be evaluated in terms of ecological and commemorative integrity based on established standards, targets, known thresholds and carrying capacity. In the absence of established targets, the consultant must use the best available information and the best professional judgement.

Clearly document any assumptions made and the level of uncertainty involved. Any monitoring requirements, including follow up or surveillance, must also be documented, as well as recommended feedback into the resource management processes, integrated monitoring programs or integrated data bases.

**Table 1**
**SCOPING GUIDELINES**
**WHEN CAN A PROPOSAL LEAD TO CUMULATIVE EFFECTS?**

All environmental assessments require that the potential impacts of a proposal be identified. **When there are no potential impacts, insignificant or otherwise, there can be no cumulative effects**. **Document the findings; no further steps are required.**

**When potential effects have been identified in the screening, it is important to determine whether those impacts may interact with existing impacts stemming from other past, current or known future projects, including local, regional or global projects**.

To do so, consider the following:

- Are the potential impacts of the project, as well as other existing stressors, occurring so closely over time that the recovery of the system is exceeded?
- Are the potential impacts of the project, along with other stressors from other sources, occurring so closely together within a given geographical area that their effects overlap?
- Could the impacts from the project interact among themselves, or interact with other existing or known future stressors, either additively or synergistically?
- Do the potential impacts of the project affect key components of the environment? Have those components already been affected by other stressors from the same or other projects, directly, indirectly or though some complex pathway?
- Is the project one of many of the same type producing impacts which are individually insignificant but which affect the environment in such a similar way that they can become collectively important over the longer term? (nibbling effect)

**If the answer to any of these questions is yes, the potential for cumulative effects exists and must be investigated further.**

**Table 2**
**A Step-by-step Approach to Cumulative Effects Assessment**

**1. SCOPING**

**1.1** What is the **policy context** within the given area? Is the proposal consistent with current policy and plans? Verify consistency with the decision-making level and established plans and policies**.**

**1.2** What are the **main issues and concerns** stemming from the proposal under review?

**1.3** What are the **key environmental components** involved?

**1.4** What is an appropriate **scale** of assessment? Include geographical and temporal boundaries.

**2. ANALYSIS**

**2.1** What are the **sources of stress** acting upon the key components or system?

**2.2** What are the major **pathways** involved?

**2.3** What is the response of the environment? Focus on **trends of key components.**

**2.4** What is the **relative contribution of the proposal** to this overall situation? Consider any proposed alternatives to the proposal. How do the potential impacts that may arise from the proposal affect overall context and trends?

**2.5** What **mitigation methods** can be applied to eliminate or reduce the overall cumulative effects?

**3. EVALUATION**

**3.1** What specific **goals and management objectives** are relevant to the issues at hand? What are the relevant **targets or carrying capacity** that have been or should be established?

**3.2** What is the **significance of residual impacts** in terms of overall integrity? Will the changes brought about by the proposal bring the heritage area closer to its overall objectives? Will ecological or commemorative integrity be enhanced or diminished?

**3.3** What **uncertainties** and risks are involved?

**4. FOLLOW UP, FEEDBACK AND DOCUMENTATION**

**4.1** Identify **surveillance** and **follow-up** requirements.

**4.2** Identify **feedback requirements** (to management plans, cumulative effects context studies or other appropriate feedback points).

**4.3 Document** relevant information (include in screening form or EA report).

# A GUIDE TO ENVIRONMENTAL ASSESSMENTS: ASSESSING CUMULATIVE EFFECTS

# CASE STUDIES APPENDIX

# INTRODUCTION

This appendix presents a collection of case studies of environmental assessments which have incorporated the assessment of cumulative effects. New case studies or examples of particularly relevant screenings may be added as required.

The appendix also includes a summary of the various workshops held to develop an approach to cumulative effects assessment.

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# SECTION A - WORKSHOPS AND PARTICIPANTS

Several internal workshops were held in order to assess the information needs in the area of cumulative effects assessment, develop the overall approach and prepare the modules. The discussions, advice, comments and examples which resulted from these workshops were invaluable. Thanks are extended to all participants.

**Workshop 1: Headquarters Workshop**

**Held**: Hull, October 30th, 1995
**Purpose**: to gain input from Parks Canada headquarters staff as well as representatives from the first two test cases (Louisbourg and Bruce Peninsula)
**Participants:**.

Luce Charron, HQ
André d'Entremont, Atlantic Region
Paul Grigoriew, Ontario Region
Sarah Kalff, consultant
Louise Kingsley, HQ
Nik Lopoukhine, HQ
John Ramsay, HQ
André Savoie, HQ
Ila Smith, HQ
Bill Stephenson, Ontario Region
Stephen Woodley, HQ

**Summary of main findings:**

- process must be simplified and presented in a concise format
- concept of VECs must be further developed; use of key components rather than VECs proposed; common set of indicators for parks may be provided as an example
- establish links with the existing management planning process; make the iterative nature of the process more explicit
- specific areas requiring further clarification were identified, including the role of coherence testing; need to identify appropriate scales as a first step; need to use a "reasonable set of goals"; role of scoping
- eliminate park-specific "cumulative effects study" as recommended in the background document; it was suggested that rather than identify a park CEA study, the framework should present a checklist of required background information which could be obtained in various ways.

### Workshop 2: Louisbourg Workshop

**Held**: Fortress of Louisbourg National Historic Site, November 2, 1995
**Purpose**: to gain operations-level input into the proposed approach for cumulative effects assessment, including the applicability of the framework to cultural resources; to initiate the Louisbourg test case through an initial identification of issues, stressors, VECs, goals and targets of relevance to CEA in Louisbourg.
**Participants:**

Sharon Baillie-Malo, HQ
Charles Burke, Fortress of Louisbourg
Andrée Crepeau, Fortress of Louisbourg
Sarah Kalff, consultant
Louise Kingsley, HQ
Sandy McLain, Fortress of Louisbourg
LeeAnne Reeves, Fortress of Louisbourg

**Summary of main findings:**

- approach requires simplification; overall it can be applied to cultural heritage but some areas are not comparable; cultural heritage as non-renewable resources
- the importance of sound goals and objectives was stressed
- there was great difficulty in identifying which resources had the greatest priority: the term VEC was rejected because of the implication that non-VECs are not valued; it would be erroneous to identify all level 1 resources as VECs and all level 2 resources as non-VECs; the concepts of landscape and symbolism were also identified as resources
- another difference between natural and cultural heritage is that deterioration of cultural resources is a natural and unavoidable process and a high level of intervention may be required to counter such processes
- issues related to inventory/knowledge of resources were raised: archaeological resources are not visible and inventory is expensive; completion of data base identified as a primary goal
- while major stressors were easily and quickly identified it was much more difficult to identify potential VECs; the absence of a completed management plan hindered the process of identifying goals

**Workshop 3: Regional EA Coordinators Meeting**

**Held**: Vancouver, November 27, 1995
**Purpose**: to gain regional-level input on the draft approach.
**Participants:**

Luce Charron, HQ
André d'Entremont, Atlantic Region
Robert Harrold, Historic Sites
Sarah Kalff, consultant
Louise Kingsley, HQ
Bruce Leeson, Alberta Region
Simon Lunn, Rideau Canal
Steve Oates, Pacific and Yukon Region
Grant Peregoodoff, Gwaii Haanas
John Ramsay, HQ
Ila Smith, HQ
Suzanne Therrien-Richards, Prairie and Northwest Territory Region
Mark Yeates, Ontario Region

**Summary of main findings:**

- pertinence of EA of the park management plan as a central focus for CEA was questioned due to the increasingly strategic nature of PMPs; it was suggested that ecosystem conservation plans and visitor management plans be included and that the overall approach remain flexible to allow for regional differences
- the general availability of background information needed for CEA is still uncertain
- approaches used in several regions were discussed, including the Twinning of the Trans-Canada Highway, Kluane, Waterton Lakes, Banff, Rideau Canal and Atlantic region; It was suggested that information on approaches be pooled and a national workshop be held to share information
- it is important to consider trends for species or VECs
- importance of making decisions based on the best professional judgement
- controlling the nibbling effect still requires good data management

## Workshop 4: Cultural Heritage Resources

**Held**: Hull, January 15, 1996
**Purpose**: to obtain input on the application of the proposed approach to cumulative effects assessment of cultural heritage resources.
**Participants:**

Ghassan Attar, HQ
Sharon Baillie-Malo, HQ
Rosemary Bray, HQ
Luce Charron, HQ
Paul Couture, Ontario Regional Office
Lyle Henderson, HQ
Sarah Kalff, consultant
Daniel Laroche, HQ
Louise Kingsley, HQ
Simon Lunn, Rideau Canal
Wendy Robinson, HQ
André Savoie, HQ
Christopher Sergeant, HQ
Ila Smith, HQ
Terry Smythe, HQ

**Summary of main findings:**

- need to define terms and review language to consider cultural heritage (e.g. change term "ecosystem" to "environment" which is more all-encompassing)
- proposed framework has value and can be adapted to include cultural heritage
- importance of commemorative integrity statements emphasized (does not apply to individual resources which still have value or "health"); commemorative integrity statements will identify context, key elements and indicators, help establish values and significance of impacts
- framework should focus on what Parks can manage or change (the "so what" issue) especially for transboundary impacts
- in some cases transboundary effects can be addressed: an example is the Burritt's Rapids subdivision application which was turned down at the OMB (Ontario Municipal Board ) hearing when Parks staff testified on the importance of cultural landscape
- differences in adapting an "ecosystem" approach to cultural heritage: ecosystems evolve but cultural heritage resources may evolve in some cases (e.g. human ecosystem of Rideau canal) but not in others; natural deterioration may destroy cultural resources and intervention may be required; however, a "natural" rate of degradation may be identified (limits of acceptable change?)
- conflicts may occur between cultural and natural resources

- it may be desirable to distinguish between natural and human stressors
- attribution of value to resources may be challenging
- importance of monitoring
- management plans viewed as ideal to get an area-wide picture: the example of the Fort Wellington Management Plan was cited
- tools for practitioners are needed

**Workshop 5: Calgary Meeting**

**Held**: Calgary, March 7, 1996
**Purpose**: cumulative effects and the proposed approach were discussed in the course of the Alberta Region Environmental Assessment Coordinators Meeting to gain park-level input.
**Participants:**

Bill Browne, Mount Revelstoke
Shawn Cardiff, Jasper
Ross Chapman, Elk Island
Luce Charron, HQ
Roger Eddy, Mt. Revelstoke Glacier
Louise Kingsley, HQ
Bruce Leeson, Alberta Regional Office
Denis Madison, Elk Island
Brian Reader, Alberta Region
Ron Tessolini, Banff
Brian Shean, Kootenay
Derek Tilson, Waterton Lakes

**Summary of main findings**:

- the meeting involved a presentation of the approach developed so far, rather than an active workshop on CEA; however, some discussion was involved
- there was a general discussion of the approach
- application at the project level was discussed (example of Trans-Canada Highway twinning, specific examples in various parks)
- need for training
- need for emphasis on scoping

### Workshop 6: Warden's Workshop

**Held**: Hull, March 21-22, 1996
**Purpose**: to discuss the proposed guide, with a special focus on the actual implementation of CEA at the project level; participants were from all regions of Canada and had experience in implementing EAs in their respective park(s).
**Participants:**

Roger Eddy, Mount Revelstoke
Sarah Kalff, consultant
Louise Kingsley, HQ
Fred Michano, Point Pelee
Joan Radman, Trent-Severn Waterway
Charlie Ristau, P.E.I.
Ila Smith, HQ
John Snell, Prince Albert
Ron Tessolini, Banff

**Summary of main findings:**

- all projects have the potential to cause cumulative effects; provide examples to determine when CEA should be incorporated into EA and at what level
- in the case of numerous, repetitive projects which are individually insignificant, cumulative effects may be an issue which cannot be dealt with at the individual project level (e.g. Trent Severn dredge and fill requests, Banff land use permits)
- even when some issues are identified at the project level, some cannot be dealt with at that level; require a park-wide perspective, especially for setting thresholds
- external consultants require template to understand what is required relative to CEA; many are concerned because CEA appears open-ended
- proponents will not expand the scope of their assessments to include past projects for which they feel no responsibility; often information is not available
- the issue of growth-inducing potential must be dealt with; this may require clear guidelines on carrying capacity which often are not available; guidance is required here
- the context of privatization and cost-recovery has potential for concern
- importance of cumulative effects assessment must be communicated to senior management
- scoping presents special challenges; specific examples were discussed where the scope of the project and assessment were unclear (e.g. a new chairlift at a downhill ski centre will result in overall growth of the centre, need for more parking, etc.; are these to be considered cumulative effects to be included in the EA of the chairlift?)

- ❖ monitoring and follow up are currently not effective; effective feedback is needed
- ❖ the importance of training emphasized, especially for scoping; some practitioners feel isolated and an exchange network is needed; workshops present a good opportunity for this
- ❖ ecological integrity projects can provide essential information for CEA
- ❖ exercises focussing on specific examples were carried out

**Workshop 7:**

**Held**: La Mauricie National Park, September 26, 1996
**Purpose**: brainstorming session to complete an environmental assessment of a proposed long-distance hiking trail by identifying potential cumulative effects; the project was used as a test case for the guide.
**Participants:**

Monique Béland, consultant
Luce Charron, HQ
Louise Kingsley, HQ
Daniel Landry, La Mauricie
Denis Masse, La Mauricie
Michel Plante, La Mauricie
André Savoie, HQ
Albert Van Dijk, La Mauricie
Denis Veillette, Quebec Regional Office
Jean-François Villemure, La Mauricie

**Summary of main findings:**
The brainstorming session was a very effective way of identifying potential stressors, some cause-effect linkages and major issues associated with cumulative effects. A list of stressors was developed linked to visitor activities, infrastructure, park activities, park surroundings, previous activities before the creation of the park, recreation, economic development and global issues.

Appropriate geographical boundaries were selected based on the greater park ecosystem, using maps prepared in the coarse of an Ecological Integrity Workshop. Temporal boundaries were linked to the creation of the park. Several main issues and key components were identified including potential effects on wolves, bears, loons and vegetation. Some data requirements and monitoring needs were identified.

# SECTION B - CASE STUDIES

**LA MAURICIE NATIONAL PARK**

**Long-distance hiking trail**

# CUMULATIVE EFFECTS ASSESSMENT

**Produced by: Monique Béland**

FINAL REPORT

**December 12, 1996**

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## LIST OF MAPS AND TABLES

## 1.0 BACKGROUND

The managers of La Mauricie National Park are planning to build a long-distance hiking trail in the Park's northern sector (La Mauricie National Park, 1995). This project, whose location is illustrated on Map 1, is part of the Revised Management Plan of 1991. In the spring of 1996, screening for this project was carried out in accordance with the *Canadian Environmental Assessment Act* (Les Consultants Jacques Bérubé inc., 1996). The present document, which examines the cumulative effects of this project, is intended to complement the screening report.

## 2.0 METHODOLOGY

The cumulative effects examination was carried out using the methodology proposed in the draft version of the "Guide to Environmental Assessment: Assessing Cumulative Effects" (Department of Canadian Heritage, 1996). The analysis was complemented by a cumulative effects project assessment during two workshop sessions, attended by all concerned stakeholders, including representatives of the development, environmental assessment and resource conservation sectors of La Mauricie National Park, representatives from the Department's Headquarters and a representative of the consulting firm that produced this report. The list of workshop participants appears in Appendix 1.

In accordance with the approach proposed in the Guide prepared by the Department of Canadian Heritage (see Appendix 2, checklist), the first step was to identify the long-term objectives of La Mauricie National Park to verify whether the project being assessed is compatible with the established policies. On the basis of the project's impacts, identified in the screening report, as well as the regional context, the major issues associated with the project were identified, which made it possible to identify the key resources, scope the cumulative effects assessment and set the geographical and temporal boundaries to be considered. Through an analysis of the total stress load acting upon the key resources, it was then possible to assess the cumulative effects attributable to the project as such.

The results of these various steps are described in the sections below, followed by a description of the mitigation measures, a list of elements to be integrated into the monitoring program, and a series of recommendations.

Map 1 Setting for the hiking trail

Legend

600 m corridor

Trail

Parkway

Campground

# 3.0 CONFORMITY WITH PARK OBJECTIVES

The first step in the Cumulative Effects Assessment Guide proposed by the Department consists in verifying whether the project conforms with the park's long-term policies and objectives. Although the analysis of this conformity was in fact carried out when the project was first designed, the highlights are reproduced below.

## 3.1 Objectives and management plan of La Mauricie National Park

Mission of National Parks

The *National Parks Act* describes the mission in the following terms: "To protect for all time representative natural areas of Canadian significance in a system of national parks, and to encourage public understanding, appreciation, and enjoyment of this natural heritage so as to leave it unimpaired for future generations" (*An Act to amend the National Parks Act*, Parks Canada 1988).

National Parks Policy

Section 4.1.3 of the *National Parks Policy* states the following: "Only outdoor activities which promote the appreciation of a park's purpose and objectives, which respect the integrity of the ecosystem, and which call for a minimum of built facilities will be permitted" (Department of Canadian Heritage, 1994).

Management Plan for La Mauricie National Park

The Management Plan for La Mauricie National Park (Canadian Parks Service, 1991), currently being revised, identifies the following major objective: "maintaining the ecological integrity of the Park's ecosystems as well as the natural processes necessary to their unimpeded evolution". We should bear in mind that the creation of a long-distance hiking trail has been included in the Management Plan for La Mauricie National Park since 1979, without ever having been carried out until now. It is entirely consistent with the following objective, identified in 1991: "Offer opportunities that keep with the new outdoor recreation trends" (Canadian Parks Service, 1991).

Zoning in La Mauricie National Park

With regard to zoning, it should be pointed out that the site for the long-distance hiking trail is located in a "wilderness" zone, where only very rudimentary facilities are permitted and access by motorized vehicle is forbidden.

## 3.2 Conformity analysis

Canada's national parks have a dual mission, which is to ensure conservation of natural areas while encouraging public understanding, appreciation, and enjoyment of this natural heritage. Between these two apparently contradictory objectives lies the entire complexity of developing park management plans. While certain park areas must be accessible and open even to intensive use, others must be set aside for a high level of conservation. In this regard, La Mauricie National Park poses certain challenges for its managers, given its relatively small size and the large public demand--due to the Park's proximity to the most populated area of the province.

The long-distance hiking trail project calls for light facilities, with little effect on the environment, as shown by the screening that was carried out (Les Consultants Jacques Bérubé, 1996). The trail can be built in the wilderness zone, since it meets the applicable criteria for this portion of the Park. The project is also in keeping with the Park objectives, since the idea for a long-distance hiking trail has been mentioned for several years in the management plan. Furthermore, the trail will offer the public a high-quality nature experience and, in so doing, keep with the national objectives and the mission of La Mauricie National Park.

Thus, in an overall sense, the long-distance hiking trail is compatible with Park objectives and policies.

# 4.0 SCOPE OF THE ASSESSMENT

## 4.1 Major issues

Strictly speaking, the development and presence of the long-distance hiking trail will very likely have only minor effects on the environment. The construction period will be short and generate only minor impacts, once the proposed mitigation measures are in place. The trail will have only light facilities and, over the long term, in view of the "quota" system for hikers and the information with which they will be provided, the potential effects of its use will also be minor.

However, looking at the broader context, the major issue surrounding the long-distance hiking trail project involves opening up for public use an area that has remained inaccessible since the creation of the Park. This opening up, albeit on a small scale, takes on special meaning within the regional context, where only small areas remain in their natural state, relatively inaccessible to human activity. La Mauricie National Park is surrounded by areas in which human activity is omnipresent: the regions to the north and west are widely used for logging and hunting, while the areas to the south and east are given over to farming, resorts and urban development.

Map 2, shown on the following page, illustrates the regional context of La Mauricie National Park. To the south and east of the Park lie heavily used sectors, dominated by farming, urban, resort and recreational activities. To the northwest, the Chapeau-de-paille “controlled harvesting zone” (*zone d’exploitation controlée*, or ZEC) also constitutes a heavily used sector, where natural resource development and recreational activities coexist: logging, hunting, fishing, snowmobiling, off-road vehicles, seasonal or year-round resorts, accommodation, etc. Two wildlife reserves are also located near the Park: the Mastigouche wildlife reserve to the west and the Saint-Maurice wildlife reserve to the north. In these reserves, human activities are also present across almost the entire area, although not as densely as in the ZEC: logging is localized, and recreational activities are far more restricted.

In La Mauricie National Park itself, it must be pointed out that use is very high; the rate of use in terms of visitor-days is over 400,000. The scenic corridor and the routes accessible by canoe, including Wapizagonke and Lac des Cinq, enable visitors to access almost the entire territory of the Park. Only two small sectors remain relatively inaccessible, located in the northeast and northwest areas of the Park. Based on the information currently available, we are unable to confirm whether similar zones, relatively inaccessible and little-used, are present in the Park's surrounding regions (aside from the Marie-Jean-Eudes ecological reserve, located inside the Mastigouche wildlife reserve, but only 8.5 $km^2$ in size).

We must ask ourselves, therefore, about the effects of opening up these areas to the public. While such an opening-up would not in itself be of major import, given the narrowness of the trail, the light infrastructure involved and the low level of use, it could have a significant impact on the environment when viewed in a regional context, in terms of the cumulative effects. Effects could be detected on animal species found over a vast area, such as the black bear and the timber wolf, as well as on species dependent on specific sites, such as the common loon in relation to the lakes to which the trail will provide access.

## 4.2 Geographical and temporal boundaries of the assessment

Since the issue at hand involves species with a vast home range, such as the timber wolf, it must be examined at the regional level, beyond the boundaries of the Park itself. The areas adjoining La Mauricie National Park, shown on Map 2, must therefore be considered when analysing the issue.

As for the temporal boundaries, given the average duration of the life cycles, it does not seem necessary to go farther back than the creation of the Park, a period of not more than 25 years. Consideration must also be given to short- and medium-term forecasts regarding the potential development of La Mauricie National Park and the surrounding areas.

Map 2 Regional context of La Mauricie National Park

# 5.0 RELATIVE CONTRIBUTION TO TOTAL STRESS LOAD

## 5.1 Identification of key components to consider

### 5.1.1 Resources affected

The long-distance hiking trail will in itself have only a small effect on the environment, given its narrowness and the system of hiker "quotas". Looking at the question from the point of view of cumulative effects, however, the trail constitutes an additional facility in an environment where the level of existing facilities and visitor use is already fairly high. Thus, for example, the trail will have a cumulative effect on the Park's vegetation, since it will require a corridor and service areas to be cleared. However, since the trail will be narrow and camping areas and lookouts will be limited, an area measuring not more than 10 ha will require deforestation, a minor addition when viewed against the total size of the deforested areas within the Park's limits. It must also be pointed out that the width of the trail will not be sufficient to cause a break in the vegetation cover; consequently, there will be no edge effect or significant change to the habitats in the areas surrounding the trail.

However, use of the trail will increase the size of the area in which there is a risk of introducing undesirable plant species. This risk, the extent of which is unknown at this time, must be viewed as one of the issues raised by this project.

As mentioned previously, opening up a previously inaccessible territory constitutes a major issue insofar as the cumulative effects of this project are concerned. Although the narrow width of the trail means that there will be no break as such in the ground cover and, thus, no "physical" habitat fragmentation, the trail could lead to a "technical" fragmentation of the sectors frequented by animal species sensitive to the presence of humans, through disturbances caused by the noise, smells and presence of the hikers on the trail and on the camping sites. The species most vulnerable in this regard are those which, in addition to being sensitive to disturbances, have vast home ranges or frequent only a small number of specific sites. This category includes such large animals as the timber wolf, moose and black bear, predators such as the lynx, fisher and marten, and waterfowl such as the common loon, as well as birds of prey, such as some species of buzzard and the Northern goshawk. For these species, avoiding certain areas might prove harmful because the disturbances caused by hikers will mean that the trail will cut off access to certain specific habitats, and because of the shrinking size of the sectors not frequented by humans in this region.

The species most affected by this "fragmentation" of the area is probably the timber wolf, which frequents the northern portion of the Park. Indeed, it appears that this animal tends to avoid sites frequented by human beings, a fact borne out by observations that have been made in the Park since its creation. Thus, the presence of humans in these sectors could lead the wolf to avoid them, at least during the period when the trail is in use (summer and fall). Since this portion of La Mauricie National Park constitutes one of the last areas in the region where humans venture little if at all, the effect on the Park's wolf packs could be significant. And when one considers that La Mauricie National Park is Canada's easternmost national park to harbour a population of wolves, this issue takes on added importance.

The black bear could also be affected by the presence of hikers, either because it will tend to move away when they are passing through the area or because it will be attracted by their supplies or garbage, especially during periods or years when food is scarce. This attraction could in turn lead to an increase in bear-visitor conflicts, with all the consequences which that implies.

The moose, on the other hand, is unlikely to be disturbed in any significant way by hikers during the summer or fall period. The effect could be greater, however, it the trail were to be used during the winter period.

The trail will provide access to small, previously inaccessible lakes which, at the regional level, are likely to harbour the last remaining habitats not to be frequented by humans. The frequent presence of humans in the areas surrounding these lakes could reduce the nesting success of the common loon, a species very sensitive to disturbance by humans (Alvo, 1995).

The current data on the other species identified as being vulnerable, be they mammals (lynx, marten and fisher) or birds (buzzard, goshawk), are very fragmented and partial. While it is impossible at this time to clarify the status of these species in the Park (number of individuals, distribution areas), it can be assumed that, as with the timber wolf, the opening up of a new sector could have a detrimental effect on these species if trail use had the effect of driving them away.

Lastly, the presence and use of the long-distance hiking trail could generate indirect cumulative impacts through a ripple effect on the public, possibly resulting in the creation of new needs and requests being made of Park officials: the request for more intensive use, winter use, new trails, authorization to fish in the lakes made accessible by the trail, etc.) Any new use of the trail or any additional infrastructure developed in this context could generate additional impacts, ultimately attributable to the presence of the trail currently being planned.

### 5.1.2 Components retained for analysis

Thus, in view of the above-noted observations and looking at the project as proposed, the cumulative effects assessment will focus mainly on:

- the effects on the **timber wolf** attributable to territorial fragmentation, which would be caused not by the physical break in the vegetation cover but by the use of the trail by hikers;

- the effects on the **black bear**, associated with the presence of hikers and the potential increase in bear-visitor conflicts;

- the effects on the **common loon**, due to adults and/or broods being disturbed on lakes currently inaccessible to the public.

These environmental components, which will integrate the effects of the project, may also be considered, from a monitoring perspective, as indicators of the cumulative effects on other components of the ecosystem. Data on the wolf may apply to a certain extent to the other large predators discussed earlier (lynx, marten, fisher), just as information on the black bear is an indicator of the potential for wildlife conflicts involving other species. Lastly, the data on these three species will together provide indications as to the potential effects on all the other species groups (birds of prey and others).

It should be pointed out that the effects on vegetation, as regards the risk of undesirable species being introduced, have not been retained for subsequent analysis of the cumulative effects, on account of the uncertain nature of these effects. Indeed, the extent of these effects is difficult to determine at this point, since it will depend on the actual effects that will be

generated, i.e. species which will actually be introduced once the trail is in use. What this represents, in point of fact, is a risk of impact, which can be greatly influenced by the protection and monitoring measures that will be put in place to counter it. Thus, since it involves an impact which is partially manageable, the component "vegetation, risk of introducing species" will not be retained as such for the cumulative effects analysis, but will nevertheless constitute an important element in terms of monitoring, one that can be used to minimize the eventual effects.

Lastly, with regard to the cumulative effects assessment, special attention has been paid to the trail's long-term potential effects in terms of creating new needs among the Park's present and future users. Potential changes in trail use could have effects which differ from those discussed here: for example, winter use would have effects on the moose, fishing would affect fish populations, etc.

## 5.2 Stressors in La Mauricie National Park

Since the creation of La Mauricie National Park, its resources have been subjected to a number of development-related environmental stresses, including logging, hunting and trapping. However, other stressors continue to be present or are being introduced, relating either to the development and use of the Park (roads, presence of visitors, canoe-camping, etc.) or to the management of the territory (absence of natural processes of forest regeneration, such as fire or insect infestations), or those generated by causes originating outside the Park (acid rain, climatic warming, etc.).

### 5.2.1 List of the sources of environmental stress in La Mauricie National Park

Table 1 provides as complete a picture as possible of the sources of environmental stress affecting the resources retained for analysis (timber wolf, black bear and common loon), while taking into account the geographical and temporal boundaries of the cumulative effects analysis.

The table shows that the resources identified as indicators are affected by many different sources of environmental stress. It is obvious, however, that these sources of stress affect the resources in question to varying degrees and in varying ways. The analysis and integration of these sources of information allowed the "big picture" to emerge, summarized in the sections to follow.

**Table 1 List of the sources of stress affecting the timber wolf, black bear and common loon, inside and outside La Mauricie National Park**

| SOURCE OF STRESS | PERIOD* | COMPONENT AFFECTED | | | | | |
|---|---|---|---|---|---|---|---|
| | | Timber wolf | | Black bear | | Common loon | |
| | | Inside | Outside | Inside | Outside | Inside | Outside |
| **Recreation (activities and facilities inside the Park)** | | | | | | | |
| Domestic animals | p - c - f | | • | • | • | • | • |
| Swimming / Picnicking | p - c - f | | • | • | | | • |
| Camping | rp- c - f | | | | | | |
| Canoeing / Rafting / Kayaking / Pleasure boating | rp -c - f | | • | | | | • |
| Hunting / Trapping / Poaching | p - c - f | | • | • | • | • | • |
| Automobile traffic / Cycling | rp- c - f | | • | • | • | | |
| Air traffic | p - c - f | | • | • | • | | |
| Picking | p - c - f | | • | • | • | | |
| Ecotourism / Observation / Photography / Tourism | rp- c - f | | • | • | • | • | • |
| Horseback riding | rp- c - f | | | | | | |
| Fishing / Underwater diving | p - c - f | | | | | | • |
| Hiking / Cross country skiing | rp- c - f | | • | • | • | • | • |
| Off-road vehicles | rp- c - f | | • | • | • | • | • |
| **Park management activities** | | | | | | | |
| Drinking water | rp- c- f | | | | | | |
| Wastewater | rp- c- f | | | | | | |
| Landscape maintenance | rp - c- f | | | | | | |
| Wildlife management | rp - c- f | | | | | | |
| Waste management | p - c - f | | | | | | |
| Fire management | rp - c- f | | | | | | |
| Restoration | rp - c - f | | | | | | |
| Roads (presence & maintenance) | p - c -f | | • | • | • | | |
| Trails and paths | p - c - f | | • | • | • | • | • |
| Hydrocarbon transportation | rp - c- f | | | | | | |
| **Activities outside the Park** | | | | | | | |
| Agriculture | p - c - f | | • | • | • | | |
| Logging | p - c - f | | | • | • | | |
| Sugar bushes | p - c - f | | | • | • | | |
| Waste management | p - c - f | | | | | | |
| Wildlife management | p - c - f | | • | • | • | • | |
| Infrastructure and maintenance | p - c - f | | • | | | | |
| Water management | p - c - f | | | | | | • |
| Tourism | p - c - f | | | | | | |
| Resorts | p - c - f | | | | | | |
| Urban areas | p - c - f | | | | | | |

* DATE : p: past (prior to and after the Park's creation)
(pp: past, prior to the Park's creation; rp: recent past)
c: current f : future

**Table 1 (cont'd)**

| SOURCE OF STRESS | PERIOD* | COMPONENT AFFECTED | | | | | |
|---|---|---|---|---|---|---|---|
| | | Timber wolf | | Black bear | | Common loon | |
| | | Inside | Outside | Inside | Outside | Inside | Outside |
| **Activities within Park limits, but prior to the Park's creation** | | | | | | | |
| Forestry activities | pp | | | | | | |
| Seeding / Introduction of species | pp | | | | | | |
| Wildlife harvesting | pp | | | | | | |
| Residual infrastructure | pp | | | | | | |
| Plantings | pp | | | | | | |
| **Large-scale effects** | | | | | | | |
| Economic context | c | | • | • | • | • | • |
| Political context of the Park | c | | | | | | |
| Ozone layer depletion | c | | • | • | • | • | • |
| Income generation | c | | • | • | • | • | • |
| Regional integration | rp - c - f | | | | | | |
| Isolation of the Park | rp - c - f | | • | • | • | • | |
| Airborne pollutants | rp - c | | • | • | • | • | • |
| Acid precipitation | rp - c | | • | • | • | • | • |
| Global warming | rp - c | | • | • | • | • | • |

* DATE : p: past (prior to and after the Park's creation)

(pp: past, prior to the Park's creation; rp: recent past)

c: current

f : future

### 5.2.2 Summary of environmental stressors acting on the timber wolf

#### A- State of the population

The timber wolf is a species that frequents La Mauricie National Park habitually, since individuals and presence indicators (tracks, feces, cries and signs of predation) are observed in certain sectors of the Park each year. Two different packs have been identified in different sectors, one north of Lac du Fou and the other in the area around lakes Anticagamac and Waber. The wolf's status in the Park is precarious, however. The pack observed occasionally in the Lac Fou sector was not seen between 1989 and 1993, and its presence has become more sporadic since then, despite a sizable increase in the moose herd (from 3.9 to 5.2 moose /10 $km^2$) (Masse, in preparation-A).

In La Mauricie National Park, moose and beaver are a big part of the wolf's diet. In fact, the sectors frequented by wolves overlap the areas harbouring the largest concentrations of beaver colonies and the wintering grounds most frequented by moose (Masse and Bordeleau, 1989). The data collected on Park wolves indicate that the size of the packs varies from three to six individuals. The Park, which has a moose population of over 300 animals (5.2 moose/10$km^2$), could easily sustain two wolf packs, since the ratio is generally 1 pack to 123 moose. However, wolves are far-ranging animals. They do not confine themselves to the area within the Park's boundaries; they use the adjacent areas regularly. It is possible that the eastern pack also uses the ZEC, the Saint-Maurice wildlife reserve and the public lands east of Rivière Saint-Maurice. The western pack, while using the Park more regularly, also frequents the Mastigouche wildlife reserve and the Chapeau de paille ZEC.

When they frequent the areas adjacent to the Park, the wolves are vulnerable to outside pressures. For example, the recent opening of a trapping area in the Mastigouche wildlife reserve, in the sector located west of Lac Anticagamac, has made the western pack vulnerable. Thus, depending on the year, the trapping of individuals outside the Park affects the packs' presence inside the Park.

#### B- Main stressors

The wolf has long been vilified and feared. Over the years, it has been subjected to eradication campaigns and intensive trapping, so much so that its status is considered precarious in several parts of its distribution area. In Quebec, agricultural development, urbanization and controls placed on the wolf population to counter the damages caused to animal farmers have caused this species to disappear once and for all from the south shore of the St. Lawrence. The wolf is also absent from a wide strip on the north shore, between Montreal and Quebec City. Elsewhere in the province, the wolf is present--at times, abundantly so--in areas rarely frequented by humans and areas where its prey abounds.

Needless to say, the wolf is protected from hunting and trapping throughout the Park but, as mentioned in the previous section, the packs associated with the Park also roam the adjacent areas, where they are subjected to harvesting by humans.

In addition to the direct effects of hunting and trapping, wolves are being affected by a decrease in the populations of their prey, caused either by a loss of portions of their habitats to human development (farming, logging and water development; degradation of these habitats caused by acid precipitation and other airborne pollutants; etc.) or by human harvesting of these species through hunting and trapping (moose, beaver).

Furthermore, wolves seem to be affected by the mere presence of human activity, since it has often been noted that they tend to avoid areas frequented by humans. In La Mauricie National Park, the data on the sectors most frequented by the two wolf packs clearly indicate that the wolves tend to avoid developed areas, in particular the scenic corridor when it is open. The Park's southern sector is not used by this species, except on rare occasions in winter. The data on reproduction sites also indicate that the wolves set up their dens in sectors where visitors do not venture (north of Lac Fou, north of Lac Suré, the area west of Lac Houle and the area west of Lac Anticagamac). Thus, at the regional level, the use of roads, trails, paths, rivers and lakes by all sorts of vehicles (automobiles, snowmobiles, off-road vehicles, watercraft, etc.) and humans' penetration into the forest through all these means have relegated the wolf packs to confined areas.

It should also be pointed out that for a number of years, the wolf has been feeling the effects of a competition with the coyote, whose distribution area is expanding. This expansion is due to the fact that the coyote is more easily adaptable to open habitats, directly associated with human development, whereas the wolf is essentially a forest species at this latitude. Moreover, a recent study (Wayne *et al*, 1992) showed that the wolf is becoming less and less resistant to the pressure exerted on it by control programs and the expansion of the coyote's distribution area. Indeed, an analysis of the genetic baggage showed that in areas where there is an increase in coyote density and in the possibility of contacts between coyotes and wolves, the wolves lose their genetic integrity. This fact is corroborated in three wildlife reserves in southern Quebec, where all the wolves that have been examined have turned out to be hybrids.

Lastly, the fact that timber-floating on the Saint-Maurice has given way to trucking has meant a heavy flow of trucks on the road running alongside the river to the east of the Park, as well as a marked increase in noisy water activities (motor boats, Sea-Doos, etc.). These major changes to the noise environment in this part of the Park could also have an effect on the wolf's use of the areas affected.

In terms of the cumulative effects on the wolf, human development in the area has taken a heavy toll. As things stand today, the wolf is still being affected by trapping outside the Park and by a fragmentation of the territory, associated with human use of the forest areas. In all the sectors surrounding the Park (Mastigouche wildlife reserve, Chapeau-de-paille ZEC, Saint-Maurice wildlife reserve, and *aires communes* 41-01 and 41-02), visitors, hunters, trappers and fishermen have access to almost all the woodlands. Heavy pressure associated with the presence of humans in the region is thus being exerted on the wolf, and the areas where humans do not venture are becoming smaller and smaller.

### C- Increase in total stress load attributable to the long-distance hiking trail

Use of the long-distance hiking trail, which will cut across the northern sector of the Park, could drive away the packs which frequent the area and, in so doing, add to the fragmentation of a region that is already pretty much criss-crossed by roads and access routes.

## 5.2.3 Summary of environmental stressors acting on the black bear

### A- State of the population

The black bear is omnipresent in La Mauricie National Park. Its population in the Park is relatively abundant and stable, estimated at between 100 and 125 bears (approx. 2 bears/10 $km^2$) (Samson, 1995).

### B- Main stressors

Like the wolf, the bear has been affected by heavy harvesting at the hands of humans, combined with a loss of portions of its habitat to farming and urbanization. Hunting has been prohibited in La Mauricie National Park since its creation, but two types of perturbation can still influence the Park's bear population. The first involves the inherent problems associated with the cohabitation of bears and visitors, which can result in bears being removed from the Park or, in certain extreme cases, put down.

The second type involves the effects felt by the bears when they exit the Park. Indeed, telemetric monitoring has shown that the Park cannot meet all the habitat requirements of this species (Samson, 1995). During the summer, bears look for food in habitats undergoing regeneration, where they find quantities of small fruits. These habitats are increasingly rare in the Park due to the aging of its forests. Thus, most of the bears leave the Park at some point during the summer to forage in sections just outside the forest's boundaries (Samson, 1995). In the fall, the bears also feed on beech nuts which they find in mature maple trees located in the Park and on its periphery. It has even been noted that females' reproductive success depends on the annual production of beech nuts (Samson, 1995), which means that the felling of beech trees in sugar bushes around La Mauricie National Park could have a significant effect on the Park's black bear population.

Once they leave the boundaries of the Park, the bears are in a position to be affected by hunting, trapping, depredation control around homes and farm areas, and logging. It should be pointed out that the practice of hunting and trapping bears is growing, with the increasing popularity of this type of game. Bear hunting is becoming increasingly well organized and planned, the result being that kills are on the rise.

#### C- Increase in total stress load attributable to the long-distance hiking trail

The main issue surrounding the long-distance hiking trail in relation to the black bear is the potential increase in bear-visitor conflicts. This effect is on top of the other environmental stressors acting on the black bear population in La Mauricie National Park.

### 5.2.4 Summary of environmental stressors acting on the common loon

#### A- State of the population

Loons generally use lakes measuring over 5 ha, containing vast expanses of fairly deep open water. In La Mauricie National Park, several years of monitoring have shown that 25 of the area's 150 lakes still harbour breeding pairs (Masse, in preparation-B). These lakes are generally large (over 10 ha), deep, irregularly shaped, oligotrophic and low in alkalinity, and include islands. Monitoring of the common loon in La Mauricie National Park has shown a decrease in breeding pairs between 1987 and 1996, as well as a decrease in nestlings. According to current estimates, the population of common loons in the Park ranges between 13 and 20 breeding pairs, depending on the year (Masse, in preparation-B).

## B- Main stressors

Common loons are very wild, particularly when brooding and raising their young. They tend to place their nests near deep waters, where the sitting parent can quickly dive when disturbed. Thus, reproductive success can easily be compromised by repeated disturbances during incubation. Similarly, the survival of young nestlings can be affected by frequent disturbances, because when confronted by the presence of humans, the nestlings--like their parents--dive repeatedly, surfacing only briefly (Alvo, 1995). In La Mauricie National Park, over half of the lakes used by loon breeding pairs are frequented by canoeists (15 out of a total of 25). The presence of humans on these lakes, especially during incubation and raising, can compromise the success of loon reproduction.

Since 1987, a monitoring program conducted by the Park's Natural Resources Conservation Service has shown that a conflict exists between loon reproduction and visitor use of certain lakes. Since 1980, lakes Wapizagonke and Édouard, used by large numbers of canoeists, have been completely abandoned by the loon, despite their nesting potential. In fact, the monitoring has demonstrated that reproductive success is considerably lower on lakes used by over 15 people per hectare per year.

Artificial control of water levels can also be a major stressor on loons. Their nests, located very near the water, are very vulnerable to large increases or decreases in the water level during the incubation period. Even when occurring naturally, such as during years of heavy precipitation (e.g. the summer of 1996), these changes lead to poor reproductive success.

In addition, common loons are affected by the dwindling populations of the fish on which they feed, mainly attributable to the effects of acid precipitation and fishing (decrease in populations, introduction of species, etc.). They are also sensitive to the effects of water pollution, emanating either from nonpoint sources, as is the case of airborne and automobile pollutants, or from point-specific sources, as is the case of wastewater or leads used for fishing. These effects act not only on lakes used for reproduction but also on all lakes used for feeding during summer or migratory periods. Thus, of the 25 lakes in La Mauricie National Park where loons still nest, eight are on the way to becoming acidified (pH between 5.5 and 6.0) and two are already, with a pH below 5.5. Reproductive success for loons on these lakes is significantly lower (Masse, in preparation-B).

Lastly, it should be pointed out that since the common loon is a migratory species, it can also be affected on its wintering grounds, on the Atlantic coast, where the sources of pollution are numerous and the risks of contamination high.

### C- Increase in total stress load attributable to the long-distance hiking trail

The effect of the proposed long-distance hiking trail will be to increase the number of lakes that are accessible to the public and on which breeding pairs of common loons will be disturbed.

# 6.0 CUMULATIVE EFFECTS ANALYSIS AND ASSESSMENT

## 6.1 Existing trends and objectives

### 6.1.1 Timber wolf

The timber wolf populations in the La Mauricie National Park region are currently in a precarious state. At the present time, in view of the growing development taking place in the region, it is difficult to foresee a recovery or even a stabilization in the wolf populations over the short or medium term.

The wolf is an important link in the chain constituted by the ecosystem of the St. Lawrence Lowlands, a link that La Mauricie National Park is interested in preserving. A wilderness symbol, spectacular for its biology and habits, this animal attracts a great deal of visitor interest.

There is no conservation objective as such in terms of numbers of wolves within the Park's boundaries. However, because of the interest this species attracts, timber wolves are protected and monitored there. In fact, one of the management objectives of La Mauricie National Park is to "*follow the evolution of animal species found within the Park, with particular emphasis on species that are representative of the region, threatened or in conflict with human activity, as well as those that reflect the dynamics of the natural environment*" (Canadian Parks Service, 1991). Since the timber wolf meets all these criteria, it seems imperative to ensure the survival of the packs observed within the Park.

### 6.1.2 Black bear

Since the Park's creation, the black bear population has increased in response to the prohibition on hunting within the Park. It is difficult at this time to determine whether the population has reached the area's carrying capacity. The Park's minimum objective in this regard is to ensure that current population levels are maintained.

The Park's bears are somewhat vulnerable to the hunting and trapping that take place outside its boundaries, since they tend to leave the Park in search of food (see section 5.2.3). Because of the increased interest in bear hunting and trapping and because the black bear is sensitive to excessive hunting and harvesting due to its low rate of population growth, its population numbers are being monitored in the Park.

### 6.1.3 Common loon

Current studies seem to show that the population of common loons is declining in La Mauricie National Park (Masse, in preparation-B). Since 1987, several measures have been taken to encourage loon reproduction: arrests on prohibited islands, activities aimed at rehabilitating certain islands, reduced use of certain lakes, delay in the opening of the fishing season in the spring, creation of sanctuaries, signage, etc.

Since the common loon is a species that is representative of the region's freshwater lakes and its population is considered to be fragile, the Park's management plan (revised) calls for its protection and a reduction in visitor-loon conflicts. The conservation objective for common loons in La Mauricie National Park is to maintain a breeding population, reproducing more or less regularly, on the Park's 25 bodies of water recognized for their potential in relation to the loon.

## 6.2 Cumulative effects and mitigation

### 6.2.1 Cumulative effect on the timber wolf

Use of the hiking trail, although limited to two seasons (summer and fall) and a relatively small number of hikers at any one time (plans call for a maximum "quota" of 50 hikers), could lead the wolves to avoid the trail corridor. The extent to which the wolves will actually be affected is difficult to assess, however, since it will depend on the degree of avoidance: will the wolves stay away from the area surrounding the trail only when hikers are present, or will they completely refrain from crossing the trail at all times?

If the first scenario holds true, the effect would be relatively minor. If the second scenario, situated at the other extreme, comes to pass, the effect of the trail would be to fragment the area frequented by the wolf packs in the Park's northern sector. Since it is recognized that the packs observed within the Park frequent the wildlife reserves and the ZEC found to the north and east, the fact that they would no longer be able to cross the trail corridor could ultimately drive them almost completely away from the territory of the Park, since the proposed trail winds around the northern portion of the Park (see Map 1). The actual effect, however, will probably lie somewhere between these two extremes; i.e. the wolf packs' territory will be altered, mainly during the summer and fall.

It is important to realize that the greater the number of hikers and the greater the frequency of the hikes, the greater the likelihood that the effect on the wolves will be significant. It will be necessary to clarify, through monitoring, the extent of this impact and, if possible, determine an acceptable threshold of use. Until this threshold can be established, it is recommended that trail use be limited to the quotas that have already been set, unless studies show an absence of impact on the wolf packs. Similarly, the Park must not allow the trail to be used during the winter, for such use could increase the impact on the wolves, as well as affecting moose which winter in the Park.

### 6.2.2 Cumulative effect on the black bear

According to studies carried out in La Mauricie National Park (Samson 1995) and field observations, the bear population seems to be uniformly distributed across the territory, with densities of about 2 bears per 10 $km^2$. The opening of a new trail will lead to a potential increase in bear-visitor conflicts.

This impact can be minimized through mitigation measures, such as equipping all campsites with bear-proof facilities and developing a hiking education program to sensitize hikers to the importance of not feeding the animals, of bringing back their garbage, of hiding their food in bear-proof facilities, etc. When conflicts are reported, appropriate measures should be taken: intervene with the hikers and put up adequate signs; consider relocating or closing the trail; capture and relocate the animals involved; and, as a last resort, put these animals down.

Thus, in a general sense, the potential increase in bear-visitor conflicts--identified as the trail's main effect on the bear--will be a minor addition to the cumulative effects felt by this species in the region.

It should also be pointed out that the trail monitoring program should review all such reported incidents in order to enhance the effectiveness of activities aimed at resolving bear-visitor conflicts and improve the preventive measures in place.

### 6.2.3 Cumulative effect on the common loon

The cumulative effect of trail use on the common loon populations involves providing visitors with access to previously inaccessible lakes. While the human presence generated by the trail will be very low in absolute terms and the overall effect on the loon will probably be minor, the current state of the loon populations in the Park and the importance of this species as a wilderness symbol are such that every effort must be made to minimize the risks of loon-visitor conflicts.

Of the Park's 150 or so lakes, only 25 are still used by breeding loons. Of the 25, 15 are used by visitors and 10 are considered to be in the process of becoming acidified. Special attention must be paid to the 12 lakes that remain inaccessible to the public; they represent a control group of lakes on which loons can reproduce, free from any human disturbances.

The plans for the trail call for campsites to be set up around the lakes to meet the hikers' needs. No conflicts are anticipated in the eastern sector, because the campsites will be located around lakes which are not used by breeding loons (lakes Omand, Aux Gadelles, Du Rocher, Du Rapide and Chevreuil). In the western sector, however, the initially proposed route provides access to certain lakes which are used by breeding pairs.

Lakes Brier and Godendart are of particular interest, in that they constitute the two smallest lakes used by breeding pairs of loons. Consequently, the Park must avoid at all costs making these lakes accessible to the public. Lakes Houle, des Cinq, Isaïe-Ouest, La Pipe and du Portage are also used by loons during the nesting season. However, because of the large size of these lakes and the fact that campers will not have boats to access the periphery, setting up campsites there is acceptable, provided that they are confined to areas far enough away from known nesting grounds. Lastly, building campsites around lakes Grappin, Laizeau, Magny, Jodon and Moucheté does not pose any problems with regard to loon nesting.

On the basis of these observations, it is recommended that some of the campsites be relocated so as to minimize the potential effects on loon breeding pairs. Meetings between the various stakeholders associated with La Mauricie National Park led to the following lakes being selected for campsites in the western sector of the trail: Lac du Portage (on the shore opposite a known nesting ground); Lac Théode; Lac Isaïe-ouest (in the northwestern sector, far from a known nesting ground); and Lac La Pipe (northern shore).

In addition, mitigation measures can be taken to reduce the potential effects. Efforts must be made to minimize the disturbance caused by the presence of hikers, by keeping the trail as far away as possible from the lakes requiring protection for loon nesting (Petit lac des Cinq, Lac Brier, Lac Cauché, Lac Godendart and Lac Hamel-ouest) and, in the case of campsites located near lakes used by breeding pairs (Portage, Isaïe-Ouest and La Pipe), by increasing the distance between the access points to the lakes and the campsites. Also, hikers must be made aware of the importance of not disturbing the loons when they are brooding or raising their young. Hikers could be advised of this during information sessions before they set off on the trail.

In view of the relocation of the trail and the introduction of these mitigation measures, use of the trail will probably not lead to any significant additional impact on the loon. Once the trail is in use, however, the access points to the lakes should be included in the annual monitoring of developed areas and in the monitoring of the loon population, in order to assess the actual impacts of the use of these sites and to intervene where required in an effort to minimize these impacts. If this monitoring showed a significant impact on the breeding success of the loon, consideration would have to be given to limiting the use of the sites in question by reducing the use of the bodies of water by other visitors (canoeists and fishermen), temporarily closing sensitive sites during the breeding season or relocating them on a different body of water, one that is not used by loons. Consideration would also have to be given to prohibiting all other activities on bodies of water made accessible to hikers by the building of the trail.

# 7.0 MITIGATION, MONITORING AND RECOMMENDATIONS

## 7.1 Summary of proposed mitigation

Several mitigation measures were identified in the previous chapter, their aim being to minimize the cumulative effects of the long-distance hiking trail. These measures are presented below.

For the protection of the timber wolf:

No specific mitigation measure has been identified for the timber wolf. This is mainly due to the unknowns which persist concerning the current state of the wolf packs in and around the Park. Nevertheless, certain recommendations are offered in section 7.2, and section 7.3 identifies elements that should be included in the monitoring program for this species.

For the protection of the black bear:

The proposed mitigation for the protection of the black bear is aimed at minimizing the risks of potential conflicts between bears and visitors:

- equip all campsites with bear-proof facilities;
- hold sessions with the hikers prior to their departure, sensitizing them to the importance of not feeding the animals, of bringing back their garbage and of hiding their food in the bear-proof facilities;
- take appropriate measures when conflicts are reported: intervene with the hikers and put up adequate signs, consider relocating or closing the trail, capture and relocate the animals involved and, as a last resort, put these animals down.

For the protection of the common loon:

The measures proposed below are aimed at minimizing the effects associated with the perturbation of loon breeding pairs during the breeding season:

- relocate the trail so that campsites can be set up near the following lakes in the western sector of the trail: lakes Du Portage, Théode, Isaïe-Ouest and La Pipe;
- increase the distance between the access points to the lakes and the campsites in order to minimize the risks of disturbing breeding pairs;
- move the trail farther away from lakes considered fragile in relation to loon nesting (Petit lac des Cinq, Lac Brier, Lac Cauché, Lac Godendart and Lac Hamel-ouest);
- hold sessions with the hikers before they set off on the trail to sensitize them to the importance of not disturbing the loons when they are brooding or raising their young.

The application of these measures will minimize the potential effects of the long-distance hiking trail, such that this facility will make only a minor contribution to the cumulative effects.

## 7.2 Recommendations

In addition to the aforementioned mitigation, the following recommendations can be formulated in light of the cumulative effects analysis. Their aim is to ensure that the cumulative effects of the long-distance hiking trail in La Mauricie National Park remain at their lowest possible level.

- Limit the numbers of hikers and the frequency of the hikes to the proposed figures.
- As planned, limit the use of the trail to the summer and fall periods to avoid disturbing wolves and moose during the winter.
- Do not authorize the trail to be used in any manner which differs from that proposed in the current project (La Mauricie National Park, 1995), unless the necessary monitoring or studies have first been carried out showing the absence of significant additional effects on the Park's key species.

- Consider prohibiting all other activities on the bodies of water made accessible by the trail.

- Gather more thorough data on the Park's timber wolf populations, as well as its populations of lynx, fishers, martens and key species of birds (goshawks, certain species of buzzards, etc.). Keep informed of studies carried out elsewhere in Canada concerning these species and the effects of public use.

- Remain vigilant as to the potential effects of the trail's use on species whose status in the Park is precarious or undetermined, such as the lynx, marten, fisher and some species of birds (goshawks, some species of buzzards, etc.) Use the information gathered for the species selected as indicators of the quality of the environment.

- Seek to maintain potential habitats for key species, even if monitoring and inventories show a momentary absence of these species. Conservation of rare or key species must be aimed at ensuring their long-term survival through the preservation or rehabilitation of their habitats rather than the immediate survival of their individuals.

- To limit the implementation of new facilities in the vicinity of the trail to the short or medium term, amend the zoning so as to prevent any development and legislate where necessary to make the changes that are required to protect the environment.

- Include in the Park's management plan information on the area's carrying capacity in a wilderness zone for various types of activities, so as to prevent negative cumulative effects. In so doing, consider both land-based and aquatic uses.

## 7.3 Environmental monitoring

Certain unknowns remain, however, with regard to the eventual effects of the trail's use, especially on the timber wolf and common loon. The integration of certain components into the existing monitoring programs in La Mauricie National Park will make it possible to clarify these unknowns and, eventually, to provide valid answers to the questions that persist. Adequate monitoring will allow for optimal management of the long-distance hiking trail and of the consequences of its use on the environment by making it possible to ensure that the short-, medium- and long-term effects remain at their lowest possible level. For the purposes of the monitoring, the timber wolf, black bear and common loon should be considered as indicators of the quality of the environment and of ecological integrity. With regard to vegetation, the monitoring will make it possible to minimize the risks of introducing undesirable species in order to preserve the integrity of the existing plant communities.

It should be pointed out that the long-distance hiking trail project itself encompasses elements of environmental monitoring, which had been taken into account during screening. Furthermore, the Park's regular management activities also include monitoring programs aimed at keeping watch over the degradation of developed areas and monitoring changes in breeding loon populations. The monitoring components presented below were identified during the cumulative effects assessment. Their integration into exiting programs or the establishment of additional programs will make it possible to dispel the remaining doubts concerning the actual cumulative effects and, if need be, to take appropriate measures to ensure that the long-distance hiking trail does not add any significant negative effects to the total environmental stress load acting on the natural resources of La Mauricie National Park.

- Integrate all the trail components (paths, campsites and lookouts) into the annual **developed areas monitoring program** to measure the impacts of the area's use across the board (destruction of vegetation, soil compaction, changes in drainage, introduction of undesirable species, etc.) and to be in a position to intervene if necessary.

- Carry out **monitoring of the effects on the wolves** following the opening of the trail, by **integrating all the other sources of stress** faced by the Park's wolf packs. The objective of such monitoring should be twofold: to determine the actual effect of the hikers' presence on the wolf pack's use of the sector; and to determine acceptable thresholds for the number of hikers and frequency of the hikes. In the event that a significant impact is observed, Park authorities should be prepared to take the necessary measures. These could range from tightening the quotas (reducing the number of hikers, the frequency of the hikes or the length of the hiking season--e.g. shortening the season, closing the trail every other week or every other year--etc.) to closing the trail completely.

- Include in the monitoring program all reported incidents of **bear-visitor conflicts**, so as to enhance the effectiveness of activities aimed at resolving the conflicts and improve the preventive and corrective measures in place.

- Increase the **annual monitoring of loons** on lakes around which campsites will be set up, so as to assess the effects of the use of these sites and to intervene where required to minimize these effects; as part of the annual monitoring efforts, pay special attention to lakes made accessible by the trail, with a view to preventing the detrimental effects on breeding pairs using these bodies of water.

- If monitoring shows an impact on the breeding success of the loon, ensure that **measures are adopted** to limit the use of the sites in question: limit or prohibit the use of these bodies of water by other users (canoeists and fishermen); temporarily close the sites for the duration of the critical period or for the entire length of the breeding season; close the sites for good and relocate them to bodies of water not frequented by the loon; etc.

- Include in the monitoring all information on **other species** that can act as indicators of the quality of the environment (fisher, lynx, marten, goshawk, etc.).

- As part of the monitoring activities, pay special attention to the potential introduction of **unofficial trails**, emanating from outside the Park and hooking up with the official hiking trail. Such trails, in addition to increasing the rate of use of the official trail, could make monitoring very difficult.

## 8.0 SUMMARY AND CONCLUSION

The analysis of the cumulative effects of the proposed long-distance hiking trail in La Mauricie National Park shows that this facility, although light, raises certain questions concerning the opening of a sector that had remained inaccessible to the public since the Park's creation. The potential impacts of this opening are in addition to the existing environmental stress load acting on certain resources that appear sensitive to the presence of humans, including the timber wolf, the black bear and the common loon.

While the relative impact on the black bear and the common loon can be minimized through mitigation, the use of the trail could prove to be enough of a stressor to contribute to the fragmentation of the area frequented by the timber wolf, a key species that is sensitive to the presence of humans. Although this potential impact is not enough to call into question the validity of the trail project, there is a need to clarify, as part of the environmental monitoring process, the effects of the trail's use on the presence of the wolf in this region of the Park.

On the whole, it seems unlikely that the proposed trail will compromise native diversity in the Park nor, for that matter, the area's ecological integrity. It is recommended, however, that use of the trail be limited to the levels proposed in the current project (La Mauricie National Park, 1995) and that any associated development in and around the trail or in the same sector be banned over the short and medium term. It is also recommended that components which will eventually make it possible to clarify the actual effects on the timber wolf, black bear and common loon and to minimize the risks of introducing undesirable plant species be added to the environmental monitoring provided for in the project. Proper environmental monitoring will make it possible to intervene effectively, where required, to maintain the eventual effects of the project to their lowest possible level.

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# APPENDIX 1
# List of participants in the workshops

**Workshop on September 26, 1996**

**From La Mauricie National Park:**
Mr. Daniel Landry
Mr. Denis Masse
Mr. Michel Plante
Mr. Albert Van Dijk
Mr. Jean-François Villemure

**From the Department of Canadian Heritage, HQ:**
Ms. Luce Charron
Ms. Louise Kingsley
Mr. André Savoie
Mr. Denis Veillette

**From Les Consultants Jacques Bérubé inc.:**
Ms. Monique Béland

**Workshop on October 22, 1996**

**From La Mauricie National Park:**
Mr. Daniel Landry
Mr. Denis Masse
Mr. Michel Plante
Mr. Jean-François Villemure

**From the Department of Canadian Heritage, HQ:**
Ms. Louise Kingsley

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Ms. Monique Béland

# APPENDIX 2

## Cumulative effects assessment procedure

**based on**

**A Guide to Environmental Assessment: Assessing Cumulative Effects**
**1996**

**Department of Canadian Heritage**

# CUMULATIVE EFFECTS CHECKLIST
## for project-level assessments
(June 1996, draft version)

**1. SCOPING:**

1.1 What is the **policy context** within the given area? Is the project consistent with current policy and plans? Ensure consistency with the decision-making level and established plans and policies.

1.2 Define the **scope of the assessment** as it relates to the scope of the project under review:

1.3 What are the **appropriate geographical boundaries** for the assessment (i.e. ecosystem, community, greater park ecosystem, etc).

1.4 What are the **temporal boundaries** to be considered?

1.5 What are the **main impacts** stemming from the project under review?

**2. RELATIVE CONTRIBUTION TO THE TOTAL STRESS LOAD:**

2.1 What are the **key components** of the environment affected by the potential impacts?

2.2 What is the **total stress load** acting upon those key components? To identify this, consider all past, present, and future activities or projects and their cumulative impacts upon the key components and ultimately upon ecosystem and commemorative integrity.

2.3 How do the potential impacts arising from the project interact to form a new **predicted stress load**? (copy to item 24 in screening report).

**3 .ANALYSIS**

3.1 What are the **existing trends** related to the key components (i.e. progressive loss of integrity, gradual rehabilitation, etc).

3.2 What specific **goals and management objectives** are relevant to the issues at hand? What are the **targets or carrying capacity** established for these components? (i.e. target number of species, % allowable disturbed area within a given zone, may be qualitative or quantitative etc)

3.3 What **alternatives or options** should be considered?

3.4 What changes or **mitigation** could avoid or reduce the cumulative impacts? (copy to item 26 in screening form)

3.5 What is the **significance of the residual impacts** on the key environmental component(s) in question? (copy to item 25 in screening report)

**4 .EVALUATION**

4.1 Based on the above analysis **evaluate** how the change to the total stress load will affect overall ecosystem or commemorative integrity and what this means in terms of shifting the environment either closer to or away from stated objectives.; prepare recommendations.

**5.FOLLOW-UP REQUIREMENTS AND FEEDBACK**

4.1 Identify the required **follow-up plan** including both monitoring and surveillance requirements**.**

4.2 Ensure **information feedback** so that any pertinent information from this EA gets integrated into the park data base or appropriate product of the natural resource management process.