Ontario Parks Ecological Stress Identification

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Abstract

Ontario Parks has adopted a structured stress identification process used by other jurisdictions. This process relies on the knowledge of protected area staff to identify possible stressors on an individual protected area basis. Knowing what stresses are occurring in an individual protected area or across portions of the protected area system will allow Ontario Parks to identify future research and monitoring priorities. The report outlines the stress identification process in use by Ontario Parks.

Introduction

Ontario's Provincial Park system has grown over the past 100 years into one of the world's outstanding networks of protected areas. This protected area system includes more than 600 provincial parks and conservation reserves and 9.5 million hectares of lands and waters, almost 9% of the total area of the Province of Ontario.

Awareness of nature, wild spaces and the imperative to protect global biological diversity has increased tremendously, coupled with a growing demand for outdoor recreation. As human population and demand for natural resources grow, new pressures and issues will pose difficult challenges and demand innovative solutions. To meet these needs, Ontario Parks has developed a comprehensive approach to monitor ecosystem sustainability within the system of protected areas.

This approach recognises ecological integrity, social well being and economic health as fundamental aspects of healthy ecosystems and sustainable living. To maintain the ecological integrity of individual protected areas, and the protected areas system as a whole, the status of those protected areas needs to be monitored and assessed. Due to the complexity of ecosystems, sustainability cannot be measured or assessed using a single tool, so a number of tools will be required as part of an ecological monitoring toolkit.

One aspect of ecological monitoring to be considered is an assessment of the stressors acting on the protected areas, individually and collectively. A stress assessment is only one of a suite of tools in the ecological monitoring toolkit. Identifying the types and effects of stresses will increase awareness of the factors affecting the integrity of protected areas, will provide benchmark information for future assessments and will position Ontario Parks to determine the best course of action to mitigate those stressors.

Background

Protected areas throughout Ontario are subject to a variety of internal and external stresses, ranging from the numbers of hikers and campers within protected areas, to intensive agriculture or forestry on adjacent lands, and to the effects of climate change across the entire landscape. One tool used to identify and monitor stressors is a stress assessment, a tool that has already been used in Canada by Parks Canada (Parks Canada, 1994 and 1998) and British Columbia Parks (BC Parks, n.d.), and by Parks Victoria in Australia (Parks Victoria, 2000).

Ontario Parks staff have developed a similar approach for use in Ontario as part of the ecological component of a comprehensive monitoring program. Stress identification will increase awareness and knowledge regarding potential stressors causing ecological stresses on the protected areas, enabling Ontario Parks staff to identify areas of concern at a variety of scales, ranging from Provincial to the individual protected area.

Stress assessment is an adaptive process, a series of steps that involve both qualitative and quantitative approaches. These steps are:

1. Identify potential stressors;
2. Prioritise stresses;
3. Research and/or monitor stresses;
4. Mitigate stresses; and,
5. Assess response to stresses.

The first step is to identify the possible stresses. This is accomplished through structured interviews of knowledgeable protected area staff — an informed opinion approach common in social science research. The second step is to prioritise for further action (research, monitoring or management response) the stresses identified. Priorities are established based on uncertainty and risk. Uncertainty is associated with the quality of the information currently available about the stressor. The risk to resources is related to the current intensity of the specific stress and its trend. Risk to resources also differs among the various stressors. Therefore, priorities may vary from one protected area to another, and across areas of the Province. Third, conduct research, monitoring or other evaluations to determine if these possible stresses are indeed stresses within the individual protected area and the protected areas system, the magnitude of the stress and to develop a course of action to mitigate those stresses. Fourth, implement management practices to mitigate the stress. And finally, the fifth step is to assess the response to the stress (i.e., the mitigative management practice) to determine if it was effective. This final step facilitates an adaptive management approach to resource management within protected areas.

This paper addresses the first of five steps of stress assessment, stress identification. The following four objectives associated with stress identification relate both to individual protected areas and to the system of protected areas as a whole:

1. Identify possible stresses;
2. Determine Ontario Parks' responses to those stresses;
3. Identify possible research needs and priorities; and,
4. Identify possible monitoring needs and priorities.

In addition to helping to determine monitoring and research priorities, stress identification will contribute valuable information to efforts by Ontario Parks to report on the state of the protected areas system.

Methodology

Stress Identification Procedure
The identification of stresses is accomplished though a structured interview process whereby qualified staff provide informed opinions concerning stressors on an individual protected area basis. This is a qualitative approach to information gathering common in social science research.

For non-operating parks and conservation reserves, protected areas for which there may be limited current information, the collection of standard data during site visits is recommended.

The suite of potential stressors is standard for all protected areas. Questions are standardised across all stressors and a range of possible responses is identified and defined for each question, with the exception of two open-ended questions where additional detail can be provided.

Interviews are conducted on an individual protected area basis with the park superintendent and other staff knowledgeable about the specific protected area, led by zone representatives (planners and ecologists) and by main office staff.

Criteria for setting priorities on a zone basis include:

- Park superintendent has recently retired, is about to retire or is about to change parks — to get the most from their experience;
- Protected area is thought to be under considerable stress at this time — to document those stresses; and,
- Protected area has current or pending planning needs — to respond to program priorities.

Discussion sessions generally require one to four hours to complete, depending on the amount of information currently available for each protected area. Information gathered during these discussions is recorded in a Microsoft ACCESS™ database during the sessions.

It is emphasised at the beginning of each session that stress identification is directed at ecological impacts associated with the protected area — impacts on the quality of the experience of users of the protected area (other than ecological) are not to be considered. Social and economic aspects of protected area use and user experience are currently dealt with through other survey mechanisms within Ontario Parks. Ultimately, there are linkages between ecological, social and economic aspects of protected areas that will need to be considered and addressed.

Who Should Be Involved?
Each stress identification session involves a zone representative, the protected area team and possibly a main office representative. The protected areas team usually includes the Park Superintendent, and others knowledgeable about the specific protected area. Examples of *"other"* knowledgeable participants include Assistant Park Superintendents, Natural Heritage Education staff, zone, protected area or district planners and ecologists, other zone, protected area or district staff and representatives from other organisations such as *"Friends of …"* groups, naturalist groups and staff from the Nature Conservancy of Canada. Information on who is involved in the sessions and when and where the discussions occur is recorded in the database for each protected area.

Stressors

Fifty-four potential stressors have been identified for assessment. These stressors fall within the follow-

ing eight categories: commercial; fish and wildlife management; lands and waters management; mortality; problem species; recreation; toxins and pollutants; and, vegetation management (Table 1). The list of stressors was derived from the list of permitted activities, approved management actions and recommended possible stressors to be investigated (OMNR, 1992 and NSEI, 2001). The identification of additional stresses specific to a particular protected area is encouraged.

Table 1. Stressor categories and associated stressors considered for stress identification in regulated protected areas in Ontario.

Commercial	
outfitting services	resorts/lodges
outpost camps	restaurants/concessions
Fish and Wildlife Management	
fish stocking	wildlife population management
fish habitat management	wildlife habitat management
Lands and Waters Management	
aggregate extraction	mineral exploration/extraction
agriculture	water level control
hydro generation	
Mortality	
commercial baitfishing	scientific collecting
commercial fishing	traditional/Aboriginal collecting
hunting	trapping
poaching	vehicle kills
Problem Species	
exotic aquatic fauna	exotic terrestrial flora
exotic aquatic flora	hyper-abundant species
exotic terrestrial fauna	
Recreation	
aircraft landing	mountain biking
all terrain vehicles	rock climbing/scrambling
boating	sailing/sailboarding
camping – car	skin/scuba diving
camping – interior	snowmobiling
canoeing/kayaking	snowshoeing
crosscountry skiing	spelunking
hiking	swimming beaches
horseback riding	
Toxins and Pollutants	
	air quality
	soil contamination
	noise pollution
	water quality

Commercial Activities
Four commercial activities may be permitted within protected areas are — outfitting services, outpost camps, resorts/lodges and restaurants (including food concessions). Specific activities are determined initially by the classification of the protected area and further refined during the management planning process (OMNR 1992 and 1994). In some cases, these activities may be situated in the protected area, while in other instances the base of the activities may be outside the protected area, while making use of the protected area and its resources.

Fish and Wildlife Management
Four management practices are identified in two categories, habitat and populations. These activities are fish stocking, fish habitat management, wildlife habitat management and wildlife population management (enhancement or reduction). Stresses could result from activities internal or external to an individual protected area.

Lands and Waters Management
Five lands and waters management activities are considered, three terrestrial and two aquatic — aggregate extraction, agriculture, hydro generation, mineral exploration and/or extraction and water level control (other than for hydro generation). These activities can occur either inside or outside of protected areas.

Mortality
The impacts on populations of flora and fauna by activities associated with protected areas are considered in nine activities — commercial baitfishing, commercial fishing, hunting, poaching, scientific collecting, sport fishing, traditional/Aboriginal collecting, trapping and vehicle kills. While impacts from activities occurring internal to the protected area are most relevant, impacts from activities occurring externally are also considered. While the majority of these activities are related to fish and wildlife management practices regulated through the *Fish and Wildlife Conservation Act* (Government of Ontario, 1997), some activities are controlled by policies of Ontario Parks.

Problem Species
The impact of populations of flora and fauna on the protected area environment is considered in five categories. Four of these categories, broadly classed as exotic and possibly invasive species, include exotic aquatic fauna, exotic aquatic flora, exotic terrestrial fauna and exotic terrestrial flora. The remaining class is hyper-abundant species. Impacts originating both internally and externally are considered.

Recreation
Seventeen recreational activities are considered. The list of activities for a specific protected area (see Table 1) is determined initially by the classification of the protected area and further refined during the management planning process (OMNR, 1992 and 1994). These activities are considered primarily as internal to the protected area, although exceptions are possible [e.g., All Terrain Vehicle (ATV) access to a protected area by way of forest access roads along the periphery of the protected area].

Toxins and Pollutants
A number of toxins and pollutants within the three categories of air quality, soil contamination and water quality are to be considered to promote discussions. However, specific toxins and pollutants are not necessarily recorded as individual stressors (provide details in the Comments). Noise is considered from the perspective of the impact that it may have on the protected area environment, and not the impact of noise on the quality of the experience for protected area users. While some noise may be inconvenient for users, the impact may not be detrimental to the protected area environment. Sources of toxins and pollutants both inside and outside the protected areas are included.

Air pollutants to consider include: carbon dioxide (CO_2); ground level ozone (O_3); nitrogen dioxide (NO_2);

smog; sulphur dioxide (SO_2); and, suspended particulates. The following possible stressors are considered to promote discussions concerning soils: erosion (human induced); heavy metals; herbicides; mine tailings; pesticides; petrochemicals; sewage; and, solid wastes (dumps). Water quality concerns include: acid precipitation; bacterial contamination; heavy metals; herbicides; mercury; polychlorinated biphenyls (PCBs); pesticides; petrochemicals; and sewage.

Vegetation Management
Six vegetation management practices have been identified — insect/disease suppression, fire suppression, forestry, herbicide spraying, lawn/roadside mowing and prescribed burning. These are largely suppressive activities that may be occurring internal or external to individual protected areas.

Stressor/Stress Information

Sixteen to nineteen questions are asked about each potential stressor, depending on the category of the stressor. These questions are intended to provide a comprehensive picture about each possible stressor and the associated stress. The questions and possible responses are standardised across all stressors to aid data recording and analysis. Descriptions of the questions and the possible responses follow. Not all questions will be answered in all cases. For instance, if the activity does not occur inside or outside the protected area, then stress cannot be occurring and answering all questions would be meaningless. However, there is a minimum number of questions that do need to be answered for all stressors.

Is this activity permitted in the protected area?
This question *applies to recreational stressors only and must be answered for all recreational activities for each protected area* and is intended to identify the list of permitted recreational activities associated with the individual protected area. This information, in combination with the following question will help determine what activities are occurring in protected areas that are not permitted by policy or planning.

Possible responses include:

- *yes:* activity is permitted;
- *no:* activity is not permitted;
- *may:* activity may be permitted, dependent on future management planning; and,
- *NA*: not applicable — this activity is not physically possible, opposed to not being permitted in the protected area (e.g., boating cannot occur if there are no water bodies or water courses in or adjacent to the protected area; however, if caves exist but spelunking is not permitted, then the answer would be *"no"*, and not *"NA"*).

If the response to the question is *"NA"*, then questioning about this stressors may be essentially complete, unless it is an activity occurring outside the protected area that could have an impact on the protected area environment. It is recommended to answer the first three questions.

Does this activity occur in the protected area?
This question *applies to all stressors in all categories and must be answered in all cases, with the exception of Problem Species and Toxins and Pollutants.* This question will demonstrate those activities that occur in the protected area. In association with the previous question (recreational activities only), this question will also reveal those activities occurring that should not be occurring in the protected area.

Possible responses include:

- *yes:* activity is occurring;

- *no:* activity is not occurring; and,
- *unknown:* unknown if the activity is occurring in the protected area.

Does this activity occur outside the protected area?
This question applies to all stressors in all categories and must be answered in all cases, with the exception of Problem Species and Toxins and Pollutants. This question will demonstrate those activities that occur outside the protected area.

Possible responses include:

- *yes*: activity is occurring;
- *no:* activity is not occurring; and,
- *unknown:* unknown if the activity is occurring outside the protected area.

If the responses to this and the preceding question are *"no"*, then questioning about this stressor is complete, and questioning about the next stressor on the list can begin.

Is ecological stress occurring in the protected area?
This is the most important question about the stressor, setting the tone for the remaining discussions. For that reason, it needs to be made very clear to all participants that only ecological impacts are to be considered. Since any activity will cause some amount of stress within the natural environment, it must be emphasised that only stresses beyond those anticipated by the use or activity need to be considered, since it is stresses beyond those planned that may not be sustainable. For example, campgrounds are designated within development zones in some parks. The development of a campground results in a level of stress that is deemed acceptable within the development zone. Therefore, the presence of a campground is not considered a stress. However, if the use of the campground does have ecological impacts that are beyond those considered to be acceptable, then the use of campgrounds could be considered a stress within that portion of the development zone. This would not necessarily be, however, a stress upon the protected area as a whole.

Possible responses include:

- *yes:* stress is occurring;
- *no:* stress is not occurring;
- *unknown:* uncertain if stress is occurring — used in situations when it is unknown if a stress is occurring or when a stress is known to occur, but currently not affecting protected area environment; and,
- *legacy*: source removed, but stressor continues to stress protected environment.

If a stress is occurring, there is a legacy stress, or it is unknown if a stress is occurring, proceed with the remainder of the questions. If no stress is occurring, move on to the next stressor.

What are the observed ecological impacts?
This question addresses impacts on protected area resources from specific stressors. Examples of stresses would include such things as changes in population size or community structure, erosion, siltation and the development of social trails. While all protected area resources are to be considered, pay specific attention to species at risk. Try to capture the impact in simple terms or phrases and provide additional details in the comments section.

What is the intensity of stress?
What is the level of stress associated with the stressor? This question is one measure of the risk to protected area resources associated with the particular stressor and will assist in the setting of priorities for further study (research and/or monitoring) or management action.

Possible responses include:

- *low:* little or no impact on protected area environment — unlikely to impair sustainability of the specific resource in question;
- *moderate:* some impact on protected area environment — possibility that sustainability of resources may be impaired;
- *high:* major impact on protected area environment — sustainability of resources in jeopardy; and,
- *unknown:* impact on sustainability unknown or poorly understood.

What is the trend of the stress?
What trend is observed regarding the impact of the stressor on protected area resources? This question is another measure of the risk to protected area resources associated with the particular stressor and will also assist in the setting of priorities for further study (research and/or monitoring) or management action. This question may be answered to reflect the trend in the activity as a surrogate for the impact on the resource.

Possible responses include:

- *increasing:* activity and/or associated stress increasing;
- *decreasing:* activity and/or associated stress decreasing;
- *stable:* activity and/or associated stress stable; and,
- *unknown:* trend of activity and/or associated stress unknown.

What is the quality of data/information used (to make the assessment)?
How good is the information about the stressor and the possible stress that may be occurring? This question addresses the quality of the information available to assess the stressor, providing an indication of the uncertainty associated with the impact of the activity. This information will also assist in setting priorities for further action (research, monitoring and/or management action).

Possible responses include:

- *poor:* no data or information available or anecdotal information only;
- *intermediate:* incidental observations only — non-standardised methods; and,
- *good:* systematic – based on established protocol.

What is the source of the data (answered for good quality data only)?
Since the previous question provides a first assessment of the source of the data, this question only applies to those cases where 'good' quality data is available. The source of the information should be indicated, whether from protected area reports, research paper, etc.

Where does the stress originate?
Does the stress originate internally, or is it external to the protected area? Stresses associated with permitted recreational activities will generally originate within the protected area. All other potential stressors could originate internally, externally or both.

Possible responses include:

- *internal:* activity causing stress originates inside the protected area;
- *external:* activity causing stress originates outside the protected area (although it may occur in the protected area); and,
- *both:* activity causing stress originates both inside and outside the protected area.

Where in the protected area is the stress occurring?
This question indicates in a general sense where in the protected area the stress is occurring. Locations are identified as the protection portions and the recreation portions of the protected area. In the case of provincial parks, this will depend on within-park zoning, while in the case of conservation reserves, they are classed as protection only. Protection portions include the following zones: nature reserve, natural environment, wilderness and in some cases, historical. Recreation portions include the following zones: development, access and in some cases, historical.

Possible responses include:

- *protection:* activity causing stress occurring in protection zones of the park or throughout a conservation reserve;
- *recreation:* activity causing stress occurring in recreation zones of the park (does not apply to conservation reserves); and,
- *both:* activity causing stress occurring in both protection and recreation zones of a park.

What is the extent of stress?
What is the spatial extent of the stress? How this question is answered will depend, in part, on the stressor. In many cases, the stress may be restricted to the locality where the activity occurs. For example, stresses associated with hiking may be restricted to the trail and the immediate vicinity of the trail (localised), whereas aerial spraying for insect or disease control could affect a large area of the protected area (widespread). Some activities with a localised impact may be occurring throughout the protected area (e.g., proliferation of ATV trails throughout a park zone or the entire protected area). In these instances, the activity could be classed as widespread.

Possible responses include:

- *localised:* stress occurring in a relatively small area immediately adjacent to the location of the activity causing the stress — activity not widespread through the protected area; and,
- *widespread:* stress occurring throughout the protected area, or if associated with a small area immediately adjacent to the activity, activity is occurring throughout the protected area.

In what season(s) does the stress occur?
When does the stress occur? While occurrences could be cyclic and/or periodic, this question is looking for the period within a year that stress is occurring and compliments the following question on the frequency of the stress. Possible answers include individual seasons, combinations of seasons and year round stresses.

How frequently does the stress occur?
This question looks at the frequency of the stress (i.e., how often it occurs) and compliments the previous question regarding the timing of the stress.

Possible responses include:

- *occasional:* the stress occurs infrequently;

- *periodic:* the stress occurs with some frequency, but is not an annual event; and,
- *annual:* the stress occurs annually.

Recommended Management Action(s)

What action is recommended to mitigate the stress? This is an opportunity to describe what is being done or what could be done in response to the stressor. These ideas may form the basis for further action (research, monitoring or management).

How long to mitigate the stress?
What time would be required to mitigate the stress? In other words, if the recommended management actions were implemented, how much time would be required to remove the stress, or to reduce its impact? This information may assist in setting priorities for further action.

Possible responses include:

- *immediate:* mitigation would occur within 1 year;
- *short-term:* 1- 5 years;
- *medium term:* 5-10 years;
- *long-term:* > 10 years; and,
- *ongoing:* requires ongoing action.

How long to recover from the stress?
Once the stressor was removed (i.e., recommended action implemented and stress mitigated), how much time would be required for the protected area environment to recover?

Possible responses include:

- *immediate:* recovery would occur within 1 year;
- *short-term:* 1- 5 years;
- *medium term:* 5-10 years;
- *long-term:* > 10 years; and,
- *ongoing:* recovery will be coincidental with ongoing mitigation.

Comments
This is an opportunity to record additional details and any comments that the protected area staff feel are pertinent or that may provide additional clarification regarding the stressor, its impacts on protected area resources or actions to address the stressor and its impact.

Additional Information

These sections are intended to provide additional information about the protected area and activities occurring within the protected area that are related to the protected area environment. This information needs to be considered for each protected area.

Development and Infrastructure
In developing and managing a protected area, managers may require buildings, access and facilities for users of the protected area. This section is intended to represent a measure of that 'footprint' on the protected

area environment, and simply provides an inventory of a number of aspects of that footprint.

Research and Monitoring

A number of ecological monitoring activities occur on the Ontario landscape and some of those activities are conducted in Provincial Parks. This section provides a list of some of the more common ecological monitoring activities and is simply an opportunity to inventory the activities occurring in each protected area.

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