Monitoring, Inventory and Research Needs in Parks Canada

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Abstract

This paper presents some common monitoring, inventory and research needs in Parks Canada with a focus on our evolving ecological integrity monitoring and reporting program. These needs are shared by every national park in Ontario and by the Great Lakes Bioregion as a whole. The intent of this paper is to highlight some common needs in the hope that they are shared by Ontario provincial parks, and therefore, may facilitate some joint action between Parks Canada and Ontario Parks.

What to Monitor?

At our current stage of development for Parks Canada's ecological integrity monitoring and reporting program we are still making decisions on what to monitor. The Parks Canada Agency (PCA) has received some detailed direction from our *Executive Board* for monitoring that will shape these selections (see McLennan and Zorn, this volume, for a summary of this direction). Among the most important items of this direction is that individual national parks are to monitor and report on the status and trends of ecological integrity in six to eight indicators. Indicators in this context refers to composite indices made up of several measures, similar to a ultravioloet (UV) index or Dow Jones index. Measures refer to specific variables whose data are collected during the implementation of a park's monitoring program. To facilitate decisions on what to monitor within Parks Canada's Great Lakes Bioregion we have identified some needs that we plan to pursue in the short-term (up to 2008). The needs that will be highlighted here include: conceptual ecosystem models; sensitivity analyses along stress gradients; gap analyses of currently identified ecological integrity indicators; and, shared database of monitoring protocols among agencies.

Conceptual Ecosystem Models
Parks Canada is investing in a series of park-based conceptual ecosystem models. These models, targeting a range of spatial scales (e.g., within park, whole park, greater park ecosystem), will summarize the key ecosystem structures, processes and stressors that most affect a park. "*Stock and flow*" type models will be used to summarize the linkages among model components using modeling software such as Stella™. Sensitivity analyses can also be done using these tools as a method to rank potential monitoring measures within the models. High graphic versions of these conceptual models will also be created to assist in communication with partners, stakeholders, and park visitors.

Sensitivity Analyses Along Stress Gradients
Parks Canada has already identified a candidate short list of monitoring measures for a variety of ecosystem types that occur in national parks in Ontario. These candidate measures have been identified from previous monitoring or research projects, species at risk recovery plans, existing databases that reside in and out of Parks Canada, proposed monitoring measures selected from environmental consultants under contract, and from monitoring programs conducted by partner agencies. These monitoring measures and

their associated protocols as a whole are too expensive to incorporate into an affordable, long-term monitoring program. To assist in the selection of monitoring measures and protocols from this list Parks Canada would like to invest in a series of research projects that test the sensitivity of these measures to known stress gradients that occur within national parks and surrounding greater park ecosystems. Stress gradients will be selected *a priori* from Parks Canada's national stress questionnaire and *State of the Park Reports (SoPRs)* (these stress gradients will also be consistent with Ontario Parks' stress identification initiative, see Bellhouse this volume). The focus of these research projects will be to address the questions: *"To what extent can candidate monitoring measures reliably discriminate among sites along known stress gradients?; At what point along these gradients do measures exhibit an observable signal (monitoring thresholds)?"*; and, "*How can individual measures with known sensitivities to stress gradients be aggregated to maximized the discriminatory power of sites along these stress gradients (developing multi-metric indices)?"*

Gap Analyses of Currently Identified Ecological Integrity Indicators

For reporting purposes each national park must identify six to eight indicators that it will use to report on and communicate the state of ecological integrity (see McLennan and Zorn, this volume). These six to eight indicators must be standardized across all national parks within a bioregion (in our case, the Great Lakes Bioregion). The initial set of ecological integrity indicators that the Great Lakes Bioregion has selected are: 1) human footprint; 2) habitat change; 3) pollutants; 4) stewardship; 5) biodiversity; 6) terrestrial ecosystems; 7) aquatic ecosystems; and, 8) wetland ecosystems. This is our initial list and is subject to evolve over time. Each of these indicators are in different stages of development in terms of selected measures, protocols, sampling designs, trained staff to implement, etc. The Great Lakes Bioregion has identified the largest gaps within its aquatic and wetland ecosystem indicators and has prioritized them as its short-term focus. Parks Canada will be looking to invest and develop partnerships related to these two indicators in particular.

Shared Database of Monitoring Protocols Among Agencies

As a mechanism to share information on monitoring measures and protocols in use throughout Ontario, Parks Canada would also like to invest in a shared, accessible database of monitoring protocols. A shared database between Parks Canada and Ontario Parks would be a strong first step in sharing this kind of information.

Where to Monitor?

Generally speaking, the sampling designs of Parks Canada's current monitoring activities in Ontario are weak. In particular, we suffer from: too few replicates in both space and time; data points that are autocorrelated; data points that don't represent the full ecological and stress gradients we care about for park management; scale mismatches between the coverage of current monitoring stations and the ecological processes we want to assess; and, monitoring stations that are biased due to accessibility, remoteness, incomplete inventories; etc. The greatest determining factor in the weakness of Parks Canada's existing sampling designs is capacity. We simply can't afford to resample a large number of monitoring locations at a range of spatial scales with a sufficient sampling frequency.

To the extent possible, the Great Lakes Bioregion tries to mitigate our sampling design problems with the use of power analyses as a tool to make decisions on how to deploy our limited monitoring capacity. Using existing baseline data and power analysis software (e.g., PASS 2005™) we assess potential sampling frames associated with monitoring measures and determine the relationships between effect size (or minimal detectable change), variation, Type I and Type II error rates, and sample size. From here we are able to build sampling scenarios that address the questions: *"What magnitude of change can I reliably detect with the sample sizes we can afford?"*; and, *"What level of risk (Type I and Type II errors measured separately) is associated with our sample sizes and is this level of risk acceptable?"* Using power analysis to build sampling scenarios at least let's us optimize the use of our limited capacity and provides us with a means to make decisions on how to

strategically allocate resources to achieve certain sampling frame targets and allows us to understand how sampling frames should differ among measures within our monitoring programs.

While power analysis has become a predominant tool for us to make decisions on sampling designs, our sampling designs still remain too weak to address all the monitoring questions (at their range of scales) identified in national park management plans. Since many national and provincial parks in Ontario share similar management concerns we hope that there is an opportunity to develop joint sampling designs that are shared by a number of parks in a region [as well as other protected area types like conservation authorities, Areas of Natural and Scientific Interest (ANSIs), etc.]. Within a *"protected area cluster"*, Parks Canada, Ontario Parks, and other agencies can jointly develop shared sampling designs for a range of indicators that address each agencies' management needs. Individual monitoring budgets can be supplemented such that each agency takes part in resampling their portion of the cluster. Collectively the resultant data can be used to assess ecological status and trends at a range of scales, both within and beyond park boundaries, at a higher sample power that otherwise is unachievable by each agency on their own. This level of coordination would mean that Ontario Parks and Parks Canada would have to monitor standardized measures with standardized protocols and training. This level of standardization would further improve cost-efficiencies as each agency could share costs on protocol development, training courses, database development, analytical tools, field equipment, and possibly even on shared field staff.

How to Monitor?

Sometimes monitoring protocols exist, are field tested (usually through a short-term graduate thesis) and scientifically reviewed, and are still not appropriate for use by Parks Canada. To make protocols useful for Parks Canada's long-term monitoring program they need to be easily repeatable with different observers (given high levels of staff turnover), quick and easy (to minimize costs), implemented with low measurement error with the expertise of our staff (for quality control), and be precise *"enough"* to inform management decisions (precise *"enough"* for park managers is usually coarser than what's academically published). These coarser requirements make our monitoring programs more affordable and more accurate while still providing sufficiently robust information (*"Coarse"* in this context refers to larger, but still acceptable, effect sizes, Type I and Type II error rates.) For many measures within our ecological integrity monitoring and reporting program we are still looking to develop/adopt/adapt protocols. The lack of comprehensive, repeatable, and useful protocols is a significant constraint to Parks Canada's monitoring program moving forward.

An area of substantial potential partnership between Parks Canada and Ontario Parks is in the co-investment in developing, testing, and implementing useful monitoring protocols for a variety of abiotic, biotic and cultural elements of park ecosystems. These protocols need to be mindful of park capacity, expertise, staff turnover, and ease of replicibility. In addition to field methods these protocols should outline training, quality control/quality assurance, data management, and data analysis requirements.

Conclusion

This brief paper is meant to highlight some common Parks Canada monitoring needs that are shared by all national parks in Ontario. Action on these issues can occur at a park scale, a regional scale, or a provincial scale as opportunities arise. Parks Canada is especially willing to invest in these areas leading up to 2008 (our end point for the current round of Parks Canada ecological integrity funding). For more information or to discuss moving forward with joint projects please contact the lead author.

References

Parks Canada Agency. in prep. *Getting to 2008: Parks Canada Agency's Ecological Integrity Monitoring Program. Park Program Performance Targets and Four Year Action Plan.* Ecological Integriy Branch: Gatineau, Quebec.

Parks Canada Agency. in prep. *Monitoring and Reporting Ecological Integrity in Canada's National Parks. Volume 1: Background and Approach.* Ecological Integrity Branch: Gatineau, Quebec.