
Designing an Initial GIS Analysis for The Land Between

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Abstract

An earlier paper suggested that “The Land Between” is a 240 km long mosaic ecotone, unique in Ontario. It is ecologically valuable and threatened. The research challenge is to support these hypotheses by matching existing GIS data with key values of biodiversity, vulnerability, and threats. This paper describes an analysis contemplated to find valid reliable descriptors, gaps in conservation, and gaps in information.

Keywords: *The Land Between, Ontario, mosaic ecotone, GIS, design*

The Problem

A presentation at the PRFO 2003 (Alley, 2003) suggested that “The Land Between” is relatively rich in biodiversity and is a vulnerable and threatened landscape. It runs 240 km from the SE corner of Georgian Bay to the middle of Frontenac County, along the southern edge of the Canadian Shield. That previous presentation argued that the landscape is a mosaic ecotone in Ontario that has escaped recognition as an environmental entity. How can we assess, at low cost, whether existing data support this hypothesis and help locate and build landscape value for this entity: The Land Between?

The problem has practical importance. Ten Ontario Land Trusts share The Land Between in part of their operating areas. It runs through part of each. All would like to understand more about The Land Between, in order to refine their priorities for where to focus their resources. Two of them, The Couchiching Conservancy and Kawartha Heritage Conservancy, under the leadership of Ron Reid and Ian Attridge, respectively, have started Phase 1 of a research project to address how the landscape fits their priorities. This paper extends our search for questions and analytical help. We welcome ideas and insights from readers.

Goals of the Phase 1 of the research project

The overall goals of Phase 1 of the research project are:

1. document and communicate natural values.;
2. build constituency of interested agencies, conservation organizations, educational institutions, municipalities, and community groups for future projects;
3. identify potential areas of special ecological significance as focal points for future research and conservation;
4. document land ownership and use patterns, and assess opportunities for securement or private stewardship activities; and,
5. develop and support land-protection projects that fit emerging priority areas.

To support these goals, it was decided to do a GIS analysis that would show the values suggested in the initial hypothesis – biodiversity, vulnerability, and threats (Alley 2003) – coloured by the above goals.

Constraints and problems

We are obliged to consider only existing data. There is no opportunity yet to collect new data.

Much data exists; however, numerous organizations have control of this potential data, so there can be no “one-stop shopping.” Concentrations of data in the Natural Heritage Information Centre (NHIC), Southern Ontario Land Information System, and the Great Lakes Conservation Blueprint may help.

Scale is a key issue. For example, the scale for which one set of data was available often did not fit the whole data area consistently, or did not fit the scale of a comparator.

Scale also matters in defining and understanding the mosaic character of The Land Between. This landscape, as a complex mozaic ecotone, is the more unusual form of ecotone in Ontario. “*As a concept, an ecotone is scale independent*” (Risser, 1995). Therefore, we may have to try different scales to find out which reveals the mosaic pattern clearly.

For analyzing diversity, the choice of diversity index makes a difference. Simpson’s index (Simpson, nd), which we have tested successfully with land cover, offers a measure of both species richness and evenness, while Wiersma and Urban’s (2005) index looks promising for suggesting boundaries based on steepness of the gradient among samples.

Research framework

The scheme of the research is to address selected values by a variety of analyses. One reason for trying to address the values early is to think ahead of time about those factors that may become persuasive in the goal of public education for conservation in The Land Between. Table 1 shows what we have identified so far, organized around selected key values. The values considered are the following:

- **Biodiversity** – This value stands on the mosaic pattern of physiography of this ecotone.
- **Vulnerability** – Imagine a fragile vase sitting on the coffee table in your living room; it will not take much to damage it irreparably.
- **Threats** – Imagine your six-year-old walks in twirling a basketball; it is a pleasant pastime, but it could easily cause irreparable damage in the circumstances.
- **Gap analysis** – What are the gaps in conservation? What do we need to know to draw stronger conclusions? These questions are the foundations for future research.
- **Opportunities for intervention** – Can the research pinpoint areas for some direct conservation activities?
- **Variables or indices** – What variables or indices of variables could shed light on a value, directly or indirectly?
- **Data** – These are particular sets of data, with GIS points, related to the variable or index.
- **Analysis** – This is a thumbnail description of how the data could be classified or manipulated to reveal something about the value. In some cases, an early step in the analysis will be to convert data to an index, such as a variance.

A few examples

Examples selected from Table 1 highlight some of the issues.

Biodiversity – mosaic character The mosaic character of physiography is the ecological base for expected biodiversity. Physiography is the foundation of the mosaic in The Land Between. For example, the number of species and their abundance occurring in a square area may offer an index of biodiversity (Simpson’s index).

An outline of surficial geology types (for example, granite barrens, limestone plains, and possibly others) may offer a proxy for where the landscape lies in GIS terms, as well as painting the mosaic pattern.

Vulnerability – wetness, soil depth Wetness, especially if combined with

fast run off, may signal source ground water problems, even if only seasonal, for both people and for natural systems.

Soil depth may also provide an index of vulnerability since deeper soils generally have greater capacity to process wastewater from development, such as septic tank effluent and storm water from roads.

Threats – population growth in leisure residences Demographic changes, both in amount and rate of change, may signal an accelerating threat. It may be possible from existing data to show a relationship between changes in population age groups and the rate of development for leisure residences. If these changes turn out to be greater in some places than others, the information might be very useful for land-use planning. This variable starts exploring how natural systems and human users meet.

Gap analysis – connections At issue is not just whether The Land Between is valuable for biodiversity in itself, but also its potential for connecting to other landscapes and corridors already identified across southern Ontario. Once tentative boundaries are established for The Land Between, the space can be matched to other spaces of interest and gaps exposed as targets for acquisitions, or as being of low priority because too distant.

Conclusions

There is potential to meet the goals of Phase 1 of the research project from the analyses proposed. It is likely to produce useful information about The Land Between – useful for future research and for some modest conservation steps. It is also likely that other information will be needed: What have we missed? The results may stimulate further research by others in The Land Between. The research can be expected to produce material that helps explain its values to the public.

References

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Table 1. The Land Between Collaborative: A tentative list of variables and data for analysis.

<i>Values</i>	Variables/indices	Data Series	Analysis	Possible Source	Problems
Biodiversity					
	Mosaic character	physiography	index of types crossed within x km square or on sample lines	Ministry of Northern Development and Mines (MNDM), Great Lakes Conservation Blueprint (GLCB)	Does area of data points fit analysis?
		land cover	index of types crossed within x km radius square or on sample lines	NHIC, GLCB	Data quality
	Breeding birds	# of breeding bird species	# of species per square	Birds Studies Canada	Compatibility of scale
	Species	edge of species range	in versus out	NHIC	Incomplete data; selection?
		rare species and communities	>x% of occurrences are in TLB, which have highest # of occurrences in TLB,	NHIC	Incomplete data; selection?
	Wetness/dryness	soil depth	m. of depth - index of mean and variance, in a square or on x km of sample line	MNDM	Compatibility of scale? Availability on time?
		wetlands	% of area in squares	NHIC, GLCB	Completeness of data. More than Provincially significant ones?

continued...

Table 1, continued.

<i>Values</i>	<i>Variables/indices</i>	<i>Data Series</i>	<i>Analysis</i>	<i>Possible Source</i>	<i>Problems</i>
<i>Biodiversity, continued</i>					
		waterbodies	Number? Ratio of shore length : area?	NHIC	Computation problems?
	Other variables?				
<i>Vulnerability</i>					
	Index of vulnerability?	index created from analysis below	Nature and degree of vulnerability	created from the following	Weighting, specified or implied, relevance, auto correlation
	SARs habitat	occurrence of SARs	number of SARs per km ²	NHIC	
	Soil depth	soil depth	m. of depth - index of mean and variance, in a square or on x km on sample line	MNDM	Compatibility of scale? Availability on time?
	Low relief	elevation	slope and variance from mean	satellite data on elevation	Formula selected by trial & error; link of formula to reality
	Surface water	constructed index	# of lakes, size and ratio of shore to area	NHIC	Weighting, specified or implied
	Sensitivity to acid rain	index?	Index?	MNDM - Northern Ontario SOGETS - sensitivity/resistance to acid rain	
	Other variables?				

<i>Values</i>	<i>Variables/indices</i>	<i>Data Series</i>	<i>Analysis</i>	<i>Possible Source</i>	<i>Problems</i>
<i>Threats</i>					
	index of threats	index created from analysis below	Nature and degree of threats	created from the following	Weighting, specified or implied, relevance
	History of inroads of development	Rate of change and direction	building permits or in population by year	StatsCan or municipalities?	Cost? Compatibility of scale
	Population growth in leisure residence age group	Rate of change and location	Building permits per head of population, or per family, leisure residence ownership	StatsCan; municipalities?	Cost? Compatibility of scale
	Aggregate extraction	Pit locations, rate of extraction and land ownership	Area and location of operating pits and of land owned or controlled by aggregate companies	MNR, MNDM	Availability
	Other?				
<i>Gap analysis</i>					
	Gaps in protection	Ownership and use patterns	Provincial Parks, Conservation Reserves, Conservation Authority Parks, municipal parks & forests, Land Trusts, Managed Forest Tax Incentive Plan (MFTIP) etc. lands	Ministry of Natural Resources (MNR) Owners?	Incomplete data? Availability?

continued...

Table 1, continued.

<i>Values</i>	<i>Variables/indices</i>	<i>Data Series</i>	<i>Analysis</i>	<i>Possible Source</i>	<i>Problems</i>
<i>Gap analysis, continued</i>					
	Information gaps	where does more need to be known for new research	Review of problems encountered, review of new insights from first pass	Above analysis, tests with stakeholders (including academics and professionals)	
	Connectivity to other landscapes	location of connections	Evaluate connections - # and quality?	NHIC	
	Other variables?				
<i>Opportunities for intervention</i>					
	Intersections of conditions and interest	Review of preceding analyses + social and political context	Interplay of vulnerability, threats, gaps and external events	Above analysis, connections with other stakeholders	
	Other variables?				
<i>Other values? General problems</i>					
	Relevance, # of variables?	Relevance and reliability, compatibility of scale			Co-variance, auto-correlation, weighting