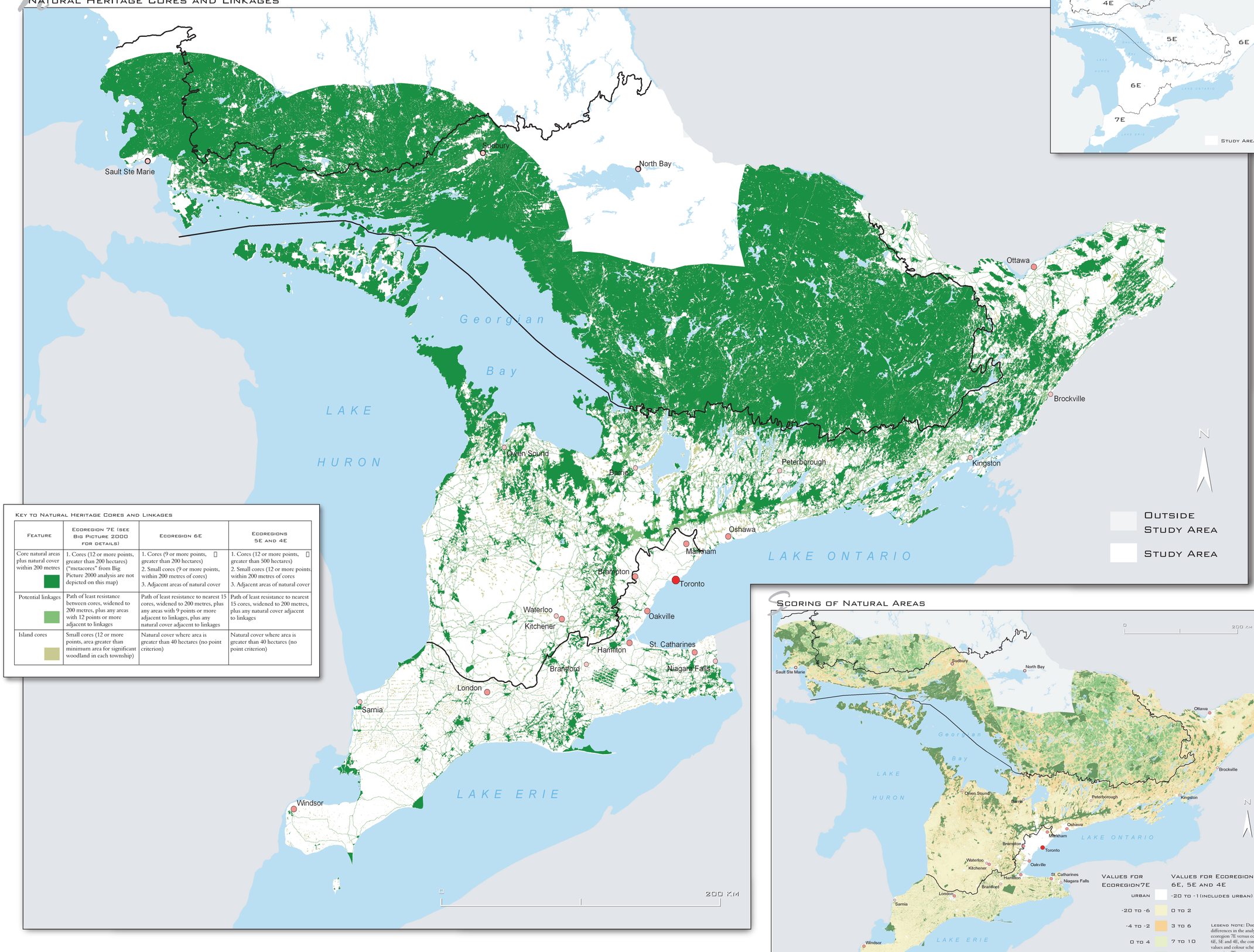
The Big Picture 2002

Identifying Key Natural Areas and Linkages in Southern Ontario

Ontario

Natural Heritage Cores and Linkages

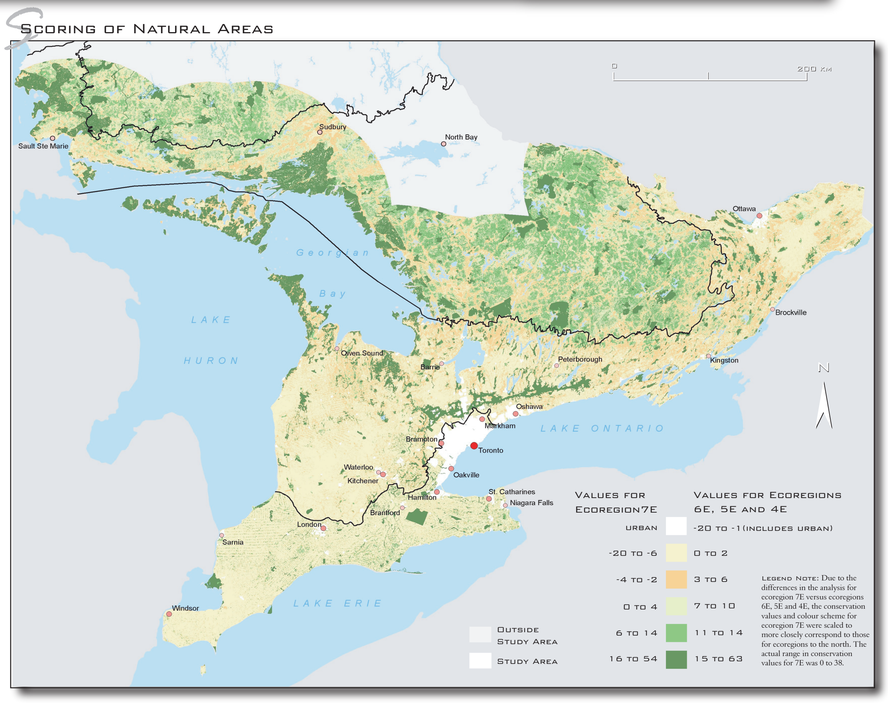


Ecoregions

Key to Natural Heritage Cores and Linkages

Feature	Ecoregion 7E (see Big Picture 2000 for details)	Ecoregion 6E	Ecoregions 5E and 4E
Core natural areas plus natural cover within 200 metres	1. Cores (12 or more points, greater than 200 hectares) ("metacores" from Big Picture 2000 analysis are not depicted on this map)	1. Cores (9 or more points, greater than 200 hectares) 2. Small cores (9 or more points, within 200 metres of cores) 3. Adjacent areas of natural cover	1. Cores (12 or more points, greater than 500 hectares) 2. Small cores (12 or more points within 200 metres of cores 3. Adjacent areas of natural cover
Potential linkages	Path of least resistance between cores, widened to 200 metres, plus any areas with 12 points or more adjacent to linkages	Path of least resistance to nearest 15 cores, widened to 200 metres, plus any areas with 9 points or more adjacent to linkages, plus any natural cover adjacent to linkages	Path of least resistance to nearest 15 cores, widened to 200 metres, plus any natural cover adjacent to linkages
Island cores	Small cores (12 or more points, area greater than minimum area for significant woodland in each township)	Natural cover where area is greater than 40 hectares (no point criterion)	Natural cover where area is greater than 40 hectares (no point criterion)

Scoring of Natural Areas



Legend Note: Due to the differences in the analysis for ecoregion 7E versus ecoregions 6E, 5E and 4E, the conservation values and colour scheme for ecoregion 7E were scaled to more closely correspond to those for ecoregions to the north. The actual range in conservation values for 7E was 0 to 38.

The total score for conservation values varies with each 25 metre pixel (see legend above). High scores reflect sites of identified conservation value, such as parks, wetlands, and woodlands. Other values that are highlighted are concentrations of features such as rare species and habitats like prairies, alvars, and forest interiors which also make these areas of particular conservation interest.

B Building the Big Picture

Purpose

· To assemble and interpret the best available, digitally mapped data on the biological diversity of southern Ontario,

· To identify high-value core natural areas and highest-probability linkages, and adjacent areas of existing natural vegetation, and

· To generate replicable, rule-based mapping of a landscape-scale natural heritage system for southern Ontario.

Scales, and Limitations

The project restricted itself to the use of existing mapped datasets that covered the whole study area, specifically ecological regions 7E and 6E south and east of the Canadian Shield, and portions of 5E and 4E on the Shield within 100 km of 6E. The area on the Shield was included to highlight the differences as well as the connections between the natural landscapes on and off the Shield. The project title includes a date (2002) to indicate that significant data limitations still exist, and that the model is scale- and data-dependent, replicable and perfectible as new data and methods develop.

Targets and Criteria

1) Where possible, more than 30% of the non-urban area of each ecological district in the study area should be identified as part of the natural heritage system.

2) Core area selection should prefer intact natural areas with larger forest-interior habitats, natural habitats adjacent to Great Lakes coasts, and areas with high overall percentages of natural cover.

3) Core areas should include viable occurrences of globally rare species and vegetation community types, and concentrations of same.

4) Minimum core size should exceed 200 hectares south of the Shield and 500 hectares on the Shield, with smaller high-quality areas in ecoregion 7E and along the Great lakes coast.

5) Minimum corridor widths should be at least 200 metres plus any adjacent areas of natural cover. As a result, almost all of the mapped system is currently in natural cover with the exception of some portions of 200 metre-wide corridors; the latter areas may represent opportunities for future naturalisation. On the ground, it may be important for ecological reasons to establish functioning corridors more than 200 metres wide; in other situations it may not be ecologically appropriate or economically feasible.

Methods

1) All data layers selected were registered, edge matched, and converted from vector to raster (grid) coverages of 25 metre pixels. Positive conservation values (see "Scoring of Natural Areas" map panel) and negative resistance values (see "Resistance Values" map panel) were calculated for each pixel.

2) Core areas were identified as groups of pixels exceeding the sizes listed above (Targets and Criteria) as well as exceeding specified threshold cumulative values (12 points for 7E; 9 for 6E; 12 for 5E and 4E) based on accumulating assigned pixel scores for different conservation values. The values were: natural cover from LANDSAT image "Ontario Land Cover" (assigned a value of +5 points); riparian areas and 30 metre buffers (+5 points), life science Areas of Natural and Scientific Interest (ANSIs) (from +5 to +15 based on size and significance); wetlands (from +3 to +15 based on size and significance); any coastal ANSIs, provincial wetlands, or woodlands greater than 200 hectares, within 1 kilometre of coast (+15); protected areas (e.g., non-recreational provincial, protection zones in Algonquin Park, nature reserves and national parks) (+15); other Ontario Living Legacy designations (+1 to +3); "older growth woodlands" in 6E and 7E (+15); forest interiors greater than 500 hectares (+3); forest interior greater than 100 metres from woodland edge (+2); and forest-cover concentrations (0 to +4) (all three final values based on Ontario Hydro forest (south of Shield) and LANDSAT mapping (north of Sheild)); and Niagara Escarpment natural areas and Carolinian Canada sites (+15). To these were added up to +10 points on the basis of a generated surface layer of concentrations of rare species and vegetation types. Adjacent areas of natural cover, at values less than the threshold values, were added to build these initial areas into their larger contiguous "core" areas. In 7E, cores smaller than 200 hectares were included for municipalities with less than 30% forest cover (i.e. 40 hectares where cover is 15-30%, and 4 hectares where cover is less than 15%). Finally, the natural core areas on the Oak Ridges Moraine were added as cores areas because of their recent provincial designation as such.

3) Other points were then scored for each pixel in order to develop a "cost" or "resistance" surface that would influence the alignment of "least cost" linkages or corridors between core areas. These least-cost alignments follow existing areas of natural cover, especially riparian areas, preferentially because of positive values. Where no such alignments along positive values could occur, the cores were connected along the "highest value per unit length" route (i.e., in areas without natural cover), and a minimum width of 200 metres was assigned to that highest-probability alignment; these areas are the only significant part of the mapped natural heritage system not currently in natural cover. The "resistance" values were: urban areas (-10); extraction sites (-5); highways (-1 to -5, based on scale); stream or river corridors (+5); non-agricultural soils (+2); abandoned railways (+2); utility corridors (+2); agreement forests (+10); and conservation areas and recreational provincial parks (+10). The generated "corridor" fabric of pixel values was manipulated to exaggerate resistance costs by raising the cost values by a power of 5.

4) The developing product was reviewed visually to adapt the methods and to assess the final alignments of potential linkages. Variations in the methods were applied to Ecoregion 7E, 6E and the Shield, and these differences are also noted above and on the map legends. North of 7E, so many cores were generated that it was decided to coalesce them into more contiguous complexes to allow calculation of highest-probabilty linkages in a reasonable amount of processing time. This was done by buffering cores out by 1 kilometre and then buffering in again by the same amount. However, only the original cores are shown on the final map panel. In the same area, a change in methodology was also required in the linkage analysis. To discriminate among the overabundance of potential linkages, a method was developed to select only the linkages to the nearest 15 core areas. Cores and linkages developed for ecoregion 7E (Big Picture Project 2000, the precursor to this project), are shown in the top map panel without change.

Map Panels

The selected maps, as described below, illustrate some of the limitations to, stresses on, and achievements of conservation on the landscapes of southern Ontario.

Natural Heritage Cores and Linkages:
Summarises the analysis outlined above. This natural heritage system identifies a coarse network of the most highly ranked natural areas of exceptional size on a fragmented landscape, and the most probable, minimum-width alignments that are now serving (and could increasingly serve) as natural links between core areas. Identification of natural heritage systems at finer scales, such as municipalites and watersheds, would clearly complement the identification of natural heritage systems at this broad scale.

Scoring of Natural Areas:
Summarises the pixel fabric resulting from the methods outlined above.

Parks and Protected Areas:
Illustrates the accomplishments to-date in formal, regulated conservation of lands and waters. Achievement is significant on the Crown lands of the Canadian Shield, on the Niagara Escarpment and on the Oak Ridges Moraine. Land conservation south and east of the Shield is tied closely to the stewardship efforts of private landowners and non-government organisations, and the conservation policies of municipal land-use plans.

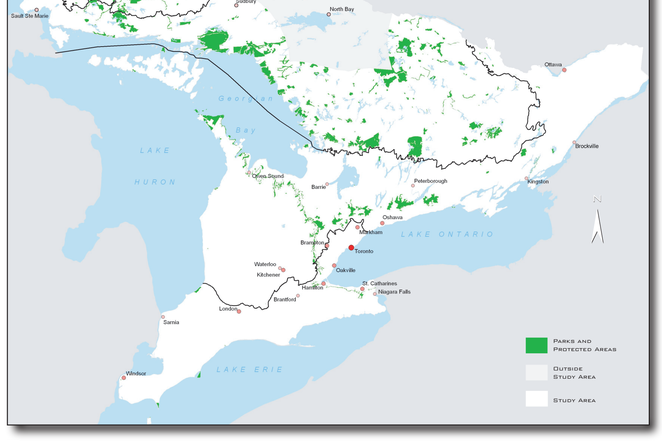
Rare Species and Habitats:
Illustrates the jurisdictional and global challenges facing particular parts of southern Ontario with regard to biodiversity conservation.

Forest Concentrations:
Mirrors the Conversion from Natural Cover map, illustrating the convergence of data sets from different sources, and providing a tool to assess the special conservation needs of forests in the natural heritage system.

Conversion from Natural Cover:
Illustrates the heavy human footprint that defines southern Ontario south and east of the Canadian Shield. This has been the fundamental motivation for conservation biologists to assign comparative values to the remaining natural heritage features of the region, and to develop innovative models to portray present and potential, conserved and restored, natural heritage systems.

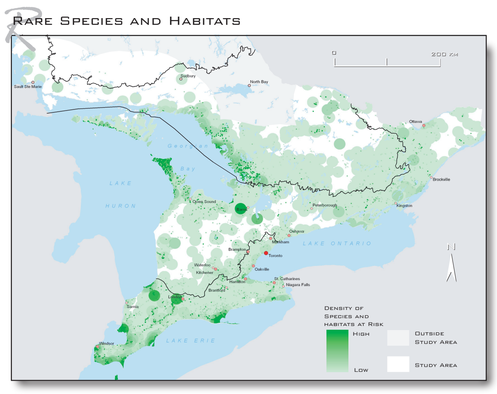
Resistance Values:
Portrays southern Ontario as a fabric of major challenges for naturally occurring species and vegetation communities to disperse, connect or even to sustain themselves adequately in the fragmented, road-covered and increasingly urban setting.

P Parks and Protected Areas



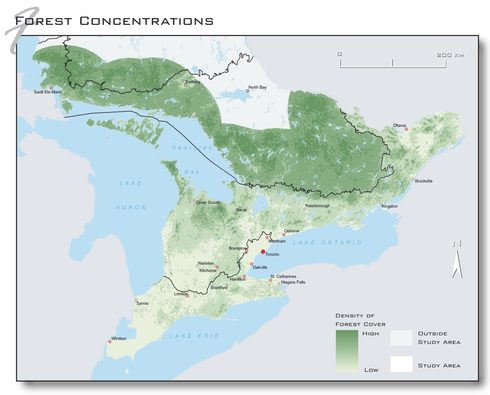
The parks and protected areas included in this analysis (year 2000): national parks, non-recreational provincial parks, protected zones of Algonquin Park, and nature reserves. Also included are areas designated as natural core areas in the Oak Ridges Moraine Conservation Plan and escarpment natural areas in the Niagara Escarpemt Plan. Other protected areas not available at the time of this analysis include some provincial parks, wildlife management areas, non-government conservation lands, and conservation authority lands.

R Rare Species and Habitats



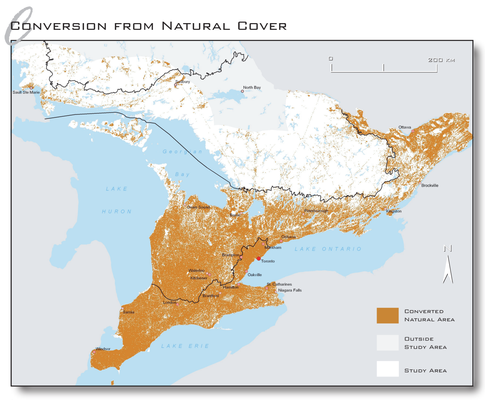
Occurrences of rare species and habitats were weighted by a combination of global rank, provincial rank and quality rank. Overlapping values were summed to result in the single layer shown here.

F Forest Concentrations



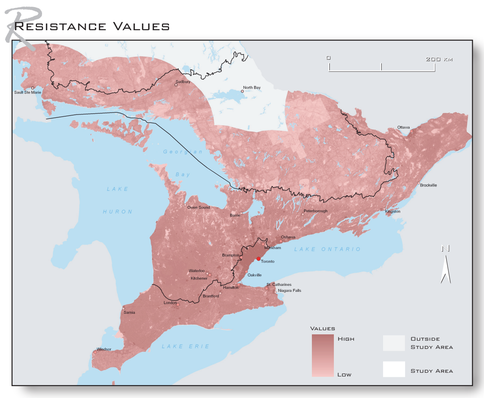
Forest cover data were obtained from LANDSAT imagery. The forest concentration within 2 km of each pixel was calculated to reflect nearby forest cover and the forest concentration within 10 km of the pixel was calculated to indicate regional forest cover. These two values were averaged to form the layer shown here.

C Conversion from Natural Cover



Natural cover within the study area was derived from LANDSAT imagery classified into 28 landcover categories. Ecoregions 7E and 6E, in the southern part of the province, have most of the province's population and therefore have experienced a greater amount of conversion and fragmentation of natural areas than ecoregions to the north.

R Resistance Values



Additional landscape features that would facilitate or constrain wildlife movement between cores were assigned positive and negative values that would modify the basic conservation values. Such features included utility corridors (positive value), highways (negative value) and urban areas (negative value). These values were added to the conservation values, inverted and increased by a power of 5 to create the coverage shown here. The layer shows the relative resistance or cost to forming connections between core natural areas.

Contributors: This project represents an evolution of the methods of the earlier Big Picture for southwestern Ontario, and a continuation of the same consensus-based core team guiding the project, involving among many members (alphabetical order): Jane Bowler, Eric Boysen, Dawn Burke, Mike Cadman, Peter Carson, Bill Crins, Mary Gartshore, Jim Faught, Don Gordon, Jason Henson, Steve Hounsell, Jarmo Jalava, Jim MacKenzie, Mike McMurtry, John Riley, Paul Smith, Peter Sorrill, Tracy Sorrill, Bill Stephenson, Sylvia Strobl, and Anthony Zammit; representing the Ontario Ministry of Natural Resources, Natural Heritage Information Centre, Nature Conservancy of Canada, Ontario Parks, Parks Canada, Canadian Wildlife Service, Federation of Ontario Naturalists, Ducks Unlimited, Carolian Canada, Ontario Hydro, and others. The *Big Picture 2002* was funded by the Nature Conservancy of Canada and the Ontario Ministry of Natural Resources.

Further information: See the Natural Heritage Information Centre website: http://www.mnr.gov.on.ca/MNR/nhic.cfm, and the Nature Conservancy of Canada website: http://www.natureconservancy.ca

Poster Credits: Text: John Riley (NCC) and Mike McMurtry (NHIC); GIS, Cartography, and Layout Design: Peter Sorrill (NHIC), Tracy Sorrill (NHIC), and Jason Henson (Provincial Geomatics Service Centre)

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