The Temagami-Algonquin Wildlife Corridor

by P. A. Quinby and T. Lee

The Problem

In central Ontario as well as throughout the rest of the world, forest fragmentation, global warming, and other human activities are degrading ecosystems and causing the decline and loss of species. For example, the Ontario Ministry of Natural Resources (OMNR) has developed a new forest management guideline that,

> "actively promotes large clearcuts without setting any size limits. The guideline effectively forces logging companies to create large clearcuts on the faulty premise that they mimic natural fires. The new guideline conflicts with existing legal requirements that stipulate that clearcuts larger than 260 ha should be undertaken as an exception rather than the rule. Clearcuts in the tens of thousands of hectares are expected" (*press release September 11, 2001 from the Wildlands League, Nishnawbe Aski Nation, Earthroots, and the Federation of Ontario Naturalists*).

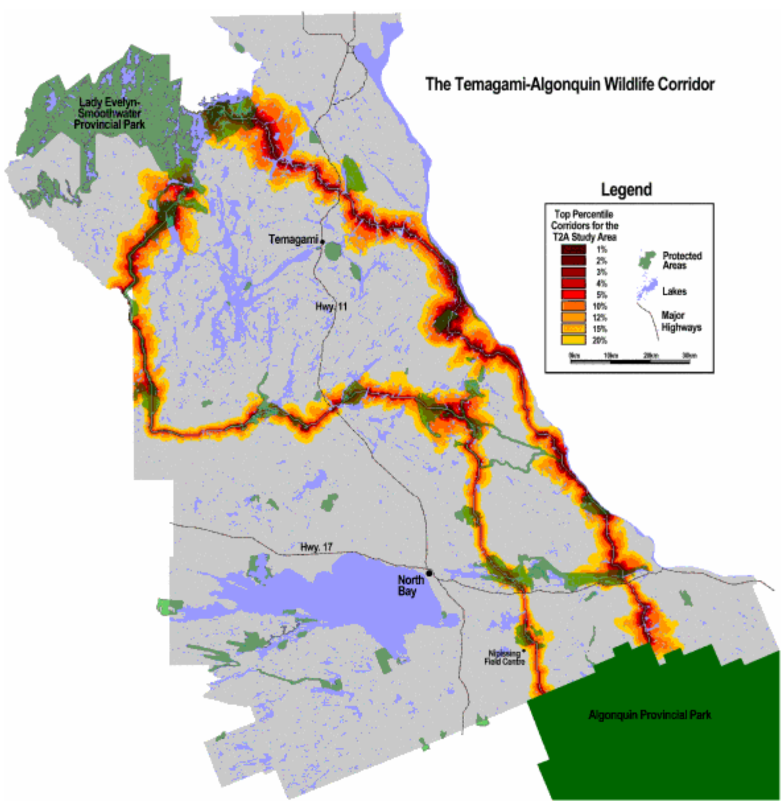
Some species may be extirpated or become extinct if they cannot migrate fast enough to keep up with changing habitat conditions. Reversing this decline in environmental quality is a challenge that we must address quickly or we will lose our opportunity to save species and restore ecosystems. Because there are no wildland parks in North America that are large enough to sustain a full range of native species and communities (Noss et al. 1997), we must protect more than isolated, large wild parks. Linking wild areas to each other by establishing functional ecological corridors will ensure a healthy, naturally functioning landscape (Soule and Terborgh 1999). Wildlife corridors were originally conceived primarily to facilitate the movement of animals with large space requirements such as large predators. For example, a pack of timber wolves uses from 250 to over 2,000 square km of land, and a black bear has a home range of about 150 square kilometers. Less obvious species such as plants, insects, and amphibians also need connectivity to be able to adapt to changing local conditions, and for genetic exchange between populations. Even relatively small inputs of genetic material into a population through connectivity can dramatically increase the persistence of a population and allow species to survive in reserves that would otherwise be too small (Forbes 1993).

Successful corridors are large enough to provide sufficient habitat for the animals that move through them, particularly if the corridors cover long distances. And since corridor boundaries are designed around key natural features and are often constrained by diverse land uses, their width is usually variable. Generally, wider corridors support a greater variety of species than narrow corridors (Forbes 1993), thus corridors should be as wide as possible. Corridors that are too narrow can sometimes be detrimental to species that use them because of high edge effect and corresponding predation (Meffe and Carroll 1997). In addition, wildlife corridors may provide unparalleled opportunities for scientific research, protect cultural heritage areas, and provide valuable recreational resources. They are often a mix of core areas, buffers, and modified management zones - the common theme is that they connect species populations and ecosystems.

Both the Temagami and the North Bay Districts of central Ontario include one large protected area - Lady Evelyn-Smoothwater Provincial Park (72,000 ha) in the Temagami District and Algonquin Provincial Park (765,000 ha) in the North Bay District (Figure 1). Currently, however, there is no established ecological linkage between these two large parks. This is of particular concern since the Temagami-Algonquin Region harbors the world's highest concentration of endangered old-growth red and white pine forest – less than 1% remains worldwide. Many interest groups and the general public have expressed their desire to protect these unique ancient ecosystems, however, the Government of Ontario continues to allow logging in 35% of Temagami's old-growth red and white pine stands. Much greater percentages of these forest types are being logged throughout the North Bay District, which still supports many unprotected pristine ancient red and white pine stands particularly along the western shore of the Ottawa River and along the northeastern boundary of Algonquin Park (Perera and Baldwin 1993). In fact, some of the highest concentrations of red and white pine forest in the world are found just outside this northern boundary of Algonquin. The objective of this study was to identify and map the highest quality wildlife habitat between Lady Evelyn-Smoothwater Provincial Park in the north and Algonquin Provincial Park in the south – we call this ecological linkage the Temagami-Algonquin Wildlife Corridor (T2A, Figure 1).

Methods

The methods applied in this study were based on the methods developed to map the Algonquin-Adirondack Wildlife Corridor (A2A) (Quinby et al. 2000, Trombulak 2001). Geographic Information System software (ArcView) was used to evaluate and integrate regional-level ecological variables, which were represented geographically in data layers, including roads (primary, secondary, tertiary, and logging roads), lakes and rivers (from 1:100,000 scale maps), mature and old-growth forests (stands over 100 yrs. old), red and white pine stands (over 50 yrs. old, minimum 10% abundance), private land (from 1:100,000 scale maps), human population density (from 1991 census data by county), and protected areas (provincial parks, conservation reserves, and enhanced management areas). Prior to running a least cost path analysis (LCPA), each data layer was converted from vector to raster form with a cell size of 100 x 100 m and cell values were rescaled to a range from 0 to 100 with the highest habitat value equivalent to 0. Thus, the cells with high habitat quality corresponded to a low "cost", and cells with low habitat quality corresponded to a high "cost". In addition, for all data layers except private land and human population, wildlife habitat quality was assumed to change with proximity to the geographic occurrence of each ecological variable. Therefore, the original data layers for roads, lakes and rivers, mature and old-growth forests, red and white pine stands, and protected areas were manipulated so that cells closer to the occurrence of an ecological variable showed more influence from the variable than cells further away.



Because the length of the path (or the number of selected cells) plays a major role in determining the cumulative cost of the path, the shortest path between the starting and ending points is often the least costly. For this study, it was critical for the LCPA to link up as many occurrences of each ecological variable as possible rather than simply choose the shortest path. To eliminate the tendency of the LCPA to minimize cost simply by choosing fewer cells, all data layers were calibrated to determine the minimum ratio of matrix value to variable value required to ensure that the path analysis recognized the highest quality cells for a particular data layer. To do this, a LCPA was performed for each data layer at successively higher matrix to variable ratios and the results were graphed. The point at which the increase in ratio no longer resulted in a significant increase in the path length was the ratio chosen for that data layer. For example, an increase in the matrix to variable ratio from 6:1 to 7:1 and above did not result in an appreciable increase the length of the least cost path for the pine forest data layer. Thus, the matrix cells were assigned values that were six times greater (or more costly) than the cells representing the pine forest occurrence. Once an appropriate matrix to variable ratio was determined and applied for each data layer, all values in the data layer were rescaled from 1 to 100 so that no single data layer would dominate during the final LCPA.

Using all of the rescaled, calibrated data layers combined, a final set of LCPAs was run to identify the best wildlife habitat linkages between Lady Evelyn-Smoothwater Park and Algonquin Park. The data layers in this study that are most highly associated with the quality of wildlife habitat include roadless areas, mature and old-growth forests, pine forests, and protected areas. Thus, a LCPA was run using these four variables equally weighted. The results, however, did not make all the intuitive linkages between existing protected areas. Therefore, two separate path analyses were performed – one using only the existing protected areas data layer and another using the roads, mature and old-growth forests, and pine forests data layers equally weighted. This resulted in two separate pathways. The final stage of this study required the addition of width to each path, which was done using a model that weighted roadless areas, mature and old-growth forests, pine forests, and protected areas at ten and all other data layers at one. Ten corridor widths were calculated as a percentage of the study area and mapped including 1-6%, 10%, 12%, 15%, and 20%.

Results and Discussion

In total, the study area is 1,830,812 ha in size (Figure 1). Together, both arms of the 20% corridor occupy 366,162 ha. This GIS analysis provides the general location of the T2A Corridor but it cannot provide the precise location of the Corridor boundaries. Nor can we assume that the general location of the Corridor as currently mapped will remain so five to ten years from now, given the multitude of factors and constraints involved in establishing wildlife corridors. The most critical constraints are the barriers to wildlife movement and occupation. For the T2A, these major barriers are Highways 17 and 11, which each Corridor arm crosses once, and the private land (Figure 1), which includes significant portions of intensively managed agriculture. Roads and their associated vehicular traffic can cause significant mortality for virtually all species of terrestrial animals and is best documented for mammals, birds, reptiles, amphibians, and insects (Trombulack and Frissell 2000). Agricultural lands do not normally support healthy populations of native fauna and may act as barriers to the movement of most terrestrial animal species due to their lack of significant amounts of natural habitat (Hudson 1991). In addition to roads and agricultural land uses, forestry practices such as clearcutting on both private and crown land may also prohibit wildlife movement and occupation. Until these major constraints to wildlife corridor establishment are successfully addressed, it is unlikely that the T2A Corridor will become a fully functional ecological linkage between Algonquin Park and Lady Evelyn-Smoothwater Park.

An additional challenge involves identifying the precise location of the Corridor boundaries. Perhaps the most logical way to obtain first iteration boundaries is to apply the concept of "ecological representation" which refers to the need to protect viable examples of all species and ecosystems in a given ecoregion. In addition, however, many additional special or unique natural features should be included within the Corridor where possible including pristine landscapes, old-growth forests, rare, threatened and endangered species, natural environmental gradients, wetlands, riparian ecosystems, and headwaters of lakes and rivers. Cultural features such as native Indian sites and trails, routes of the *coureur de bois*, *voyageurs*, surveyors, fire rangers and trappers, and old logging camps and rivers used to transport logs should also be included when possible. Recreational features such as canoe trip routes, portages, existing and potential campsites, wildlife-viewing areas, access points, hiking and backpacking areas, and areas of high ecotourism value should also be considered in the boundary determination phase. And finally, threats due to resource exploitation such as logging, mining, and hydroelectric development should be identified and assessed prior to boundary establishment. For further details on this study see Quinby et al. (in prep).

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