PAPER 6

CHANGES IN THE LANDSCAPE OF SOUTHERN ONTARIO, CANADA SINCE 1750: IMPACTS OF EUROPEAN COLONIZATION

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ABSTRACT: As European settlement in southern Ontario began in the 18th Century, land was prepared for agriculture by draining wetlands and removing trees, leading to altered and continually stressed ecosystems. To illustrate the changing landscape, a Geographic Information System (GIS) was used to create a first approximation map of the pre-European land cover of southern Ontario. This was derived from survey notes of the original land surveys of European settlement completed from 1798-1850. When compared to a modern day map of landscape coverage, results show a decrease in forested land from more than 80 percent to less than 20 percent. The implications are decreasing forest diversity and loss of forest cores to support sensitive wildlife species resulting in significant changes in the overall forest ecology.

Keywords: landscape, Ontario, maps, forests, wetlands, history

1. Introduction

This study focuses on the natural landscape of southern Ontario prior to European settlement. Natural landscapes are defined by the American Society of Landscape Architect's committee on historic landscape preservation as "those that are relatively unchanged by human intervention." In the past, before significant European settlement, the landscape of southern Ontario has been described as "wetlands from horizon to horizon and a mass of forests" (Jameson, 1838). Subsequent human settlement, agricultural activities and urban sprawl have reduced this historic natural landscape to the point where little is left; and the woodlands are remnants completely surrounded by agricultural lands. European settlers arrived in the 18th and 19th Centuries clearing land of trees and other vegetation, as well as draining wetlands, for agricultural purposes. As an early observer stated (Jameson, 1838) "A Canadian settler hates a tree, regards it as his natural enemy, as something to be destroyed."

Prior to European settlement, the aboriginal peoples of southern Ontario had an influence on overall land cover for their own uses, but it allowed for the remainder of natural wetlands and forests to remain. The aboriginal peoples used fire as a means of clearing land for campground and portage maintenance, habitat improvement for game animals, and preparing agricultural land (Bakowsky and Riley, 1992). Also, land cover change occurred for transportation

as a network of foot trails were established crisscrossing southern Ontario, often parallel to major waterways, between waterways, and following lake shorelines (current and glacial). This damage to the natural landscape was minimal compared to that invoked by the Europeans to follow.

Surveyors

In 1783 British General Haldimand, commanding in Quebec, was considering where to place the prospective flood of United Empire Loyalist refugees - those loyal to Mother England looking to resettle after finding themselves south in the newly independent United States of America since 1776. To get the survey of potential settlement lands, the government in London, England approved a survey asking for "as accurate an Account as you can obtain of the Quantity" of land in question and of its likely produce. Later in 1791, John Graves Simcoe, the first lieutenant governor of Upper Canada (now southern Ontario) pushed for a survey of lands as he pictured himself as the "Romulus" of a new imperial province, which he would develop largely from scratch, using a corps of soldiers who would open up the country, then retire to settle on land grants very much on the Roman model (Dunbabin, 2005). The surveying helped settle the area as the human population of Upper Canada grew from under 100,000 to over 1 million from 1800 to 1871 (Figure 1). The surveys were conducted in a piecemeal

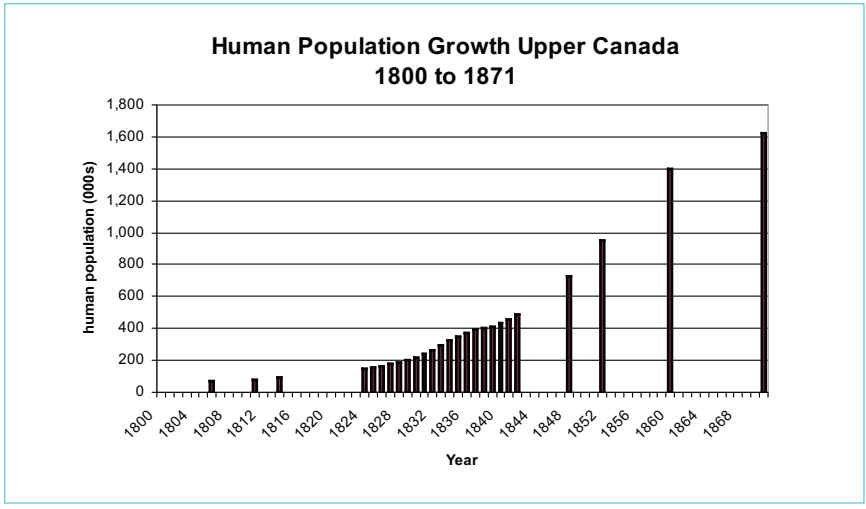

FIGURE 1

Growth of human population of Upper Canada from 1800 to 1871.
Source: Data from Statistics Canada.

fashion using different standards (much of which had to be revised, checked, and even re-done by their successors (Ladell 1993) until 1869 when the Canadian government adopted a survey system founded on the United States of America design (sections were to be 200 acres each).

Surveyors were tasked with laying out basic lines (drawing of base lines and boundaries) and doing detailed land surveys. Crown Land Surveyors underwent a 6-month license training period in surveying methods and vegetation identification to the level that it would be defendable in court should their work be contested (Ladell, 1993). Thus, the surveyors were obliged to record the type of trees available to a potential settler accurately. This information is found today in archived surveyor field notes and is the only human recorded data that was collected in a relatively methodological and uniform manner.

Surveyor methodology involved the running of concession lines that were measured using the simple tools of a compass and chains. Along the concessions, lots were marked off at 67 chains (1 chain = 66 feet = 20.12m). The surveyors initially used mounds to mark these locations and in later surveys these were replaced by wooden stakes (Ladell, 1993). As the surveyors walked along these concessions they noted the forest type or tree composition, the slope of the land, the wetlands, and any unique features of the lot. The information in these field notes is valuable to document pre-settlement land cover; and due to the methodological manner in which it was collected, is the only systematic eye-witness account indicating the type and location of forest types.

Finlay maps

The information in the surveyors' notes was used by Finlay (1978) to create land cover maps for counties in Southern Ontario. Finlay researched the Ontario and National Archives for field notes, and when field notes were not available, information was gleaned from diaries and township plans. To create polygons, the assumption was made that the vegetation would be present for half the lots on either side of the concession line. The polygons were hand drawn on Ministry of Transportation county maps with a scale of 1:64,000 (Figure 2). In addition, layers of the tall-grass prairie and oak savannah land covers were obtained from the Natural Heritage Institute of Canada (NHIC), since the NHIC found that some surveyor notes had discrepancies in describing these types of vegetation covers, NHIC has resolved these using other sources of information.

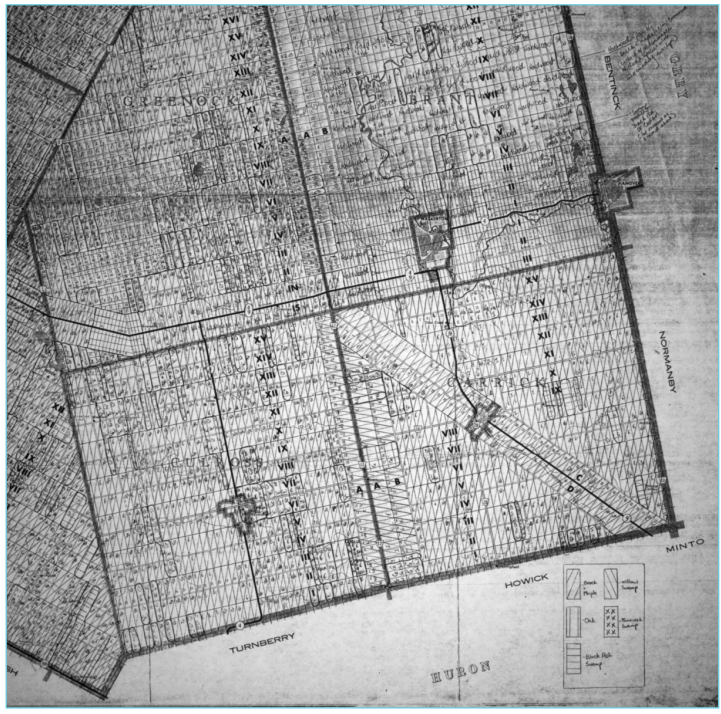

FIGURE 2
Hand drawn polygons by Finlay (1978) on Ministry of Transportation county maps with a scale of 1:64,000.

2. Methods

Digitized county base maps were obtained from the Ministry of Transportation to provide the outline of each township in southern Ontario. Finlay maps were geo-referenced accordingly, and then each of the polygons created by Finlay depicting land cover was digitized. After polygons were digitized in a township they were individually classified using Finlay's legend for both tree species and groups of trees. Where possible (due to time and clarity of information), the groupings were made according to the Ecological Land Classification (ELC) System. At the same time, the accuracy of the digitization was checked and any required amendments completed. The database was created using the geographic information software ESRI Arcview 3.2 in the Universe Mercator

Projection with UTM co-ordinates nad83 and zone 17. To determine area calculations, the final map was projected into an Albers Equal Area Conical Projection. To determine the present day forest cover, land cover maps created by Natural Heritage Institute of Canada based on satellite images were obtained. These allowed for comparisons of both forest and wetland cover change from pre-European settlement to the present. The database contains polygon information with regard to polygon area, perimeter, T-code (refers to tree groupings or Ecological Land Classification vegetation type), Ecological Land Classification series code and Ecological Land Classification class code. In addition, a field was created for notes that indicate the common name for dominant and accessory tree species.

3. Results

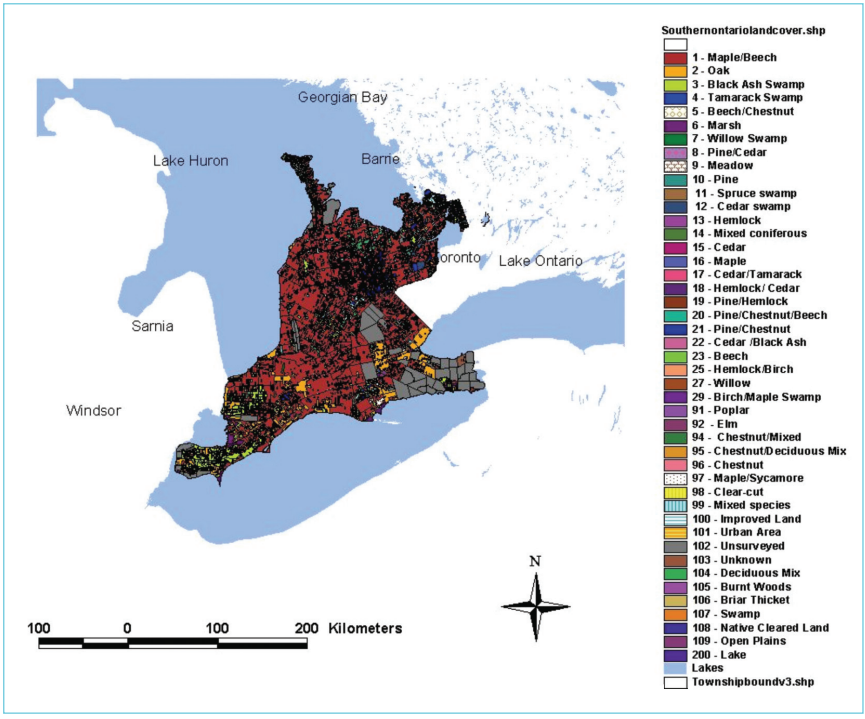

FIGURE 3
Pre-European settlement land cover in southern Ontario classified by tree groups. Note the grey areas are regions for which data has been lost or missing in the archives.

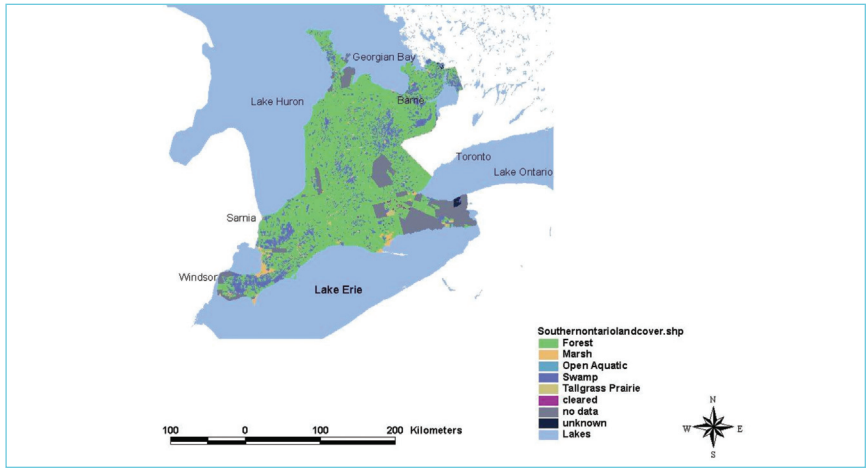

FIGURE 4
Pre-European settlement land cover in southern Ontario classified by Ecological Land Classification (ELC). Note the grey areas are regions for which data has been lost or missing in the archives.

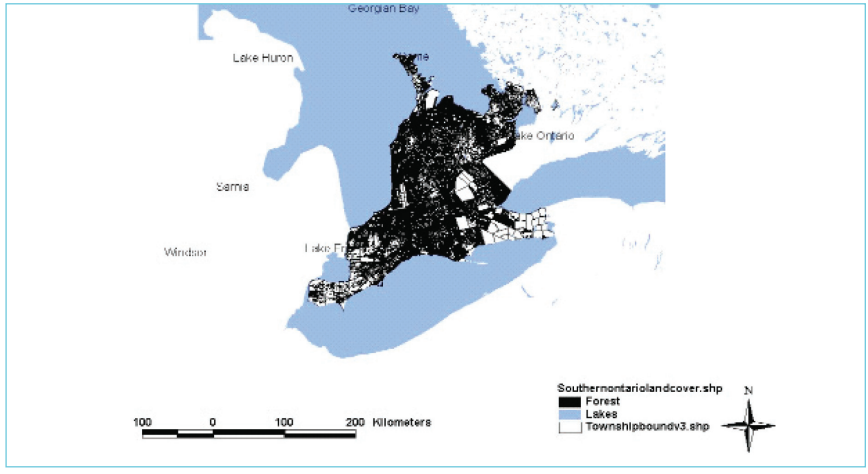

FIGURE 5
Pre-European settlement land cover in southern Ontario classified by Forest and Non-Forest areas. Note the white areas are regions for which data has been lost or missing in the archives, or is outside the study area.

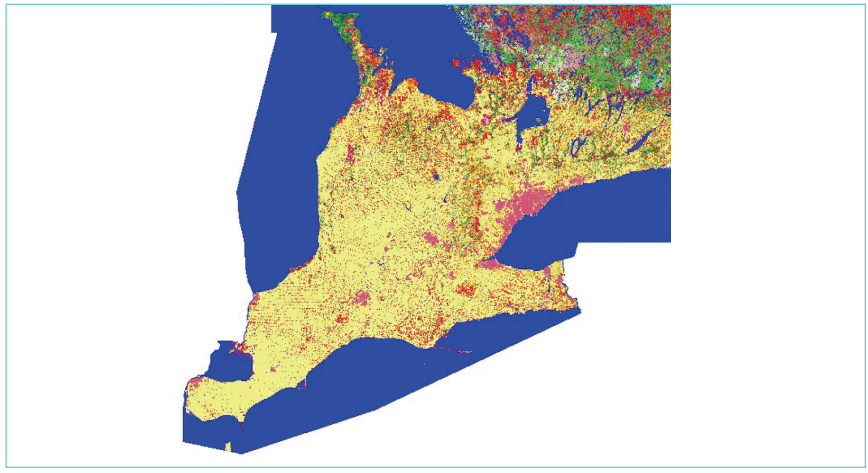

FIGURE 6
Present day forest cover adapted from Ontario Ministry of Natural Resources Provincial Landcover Map (OMNR, 2000). Note that forest cover is shown in red, non-forest in yellow, and urban areas in grey.

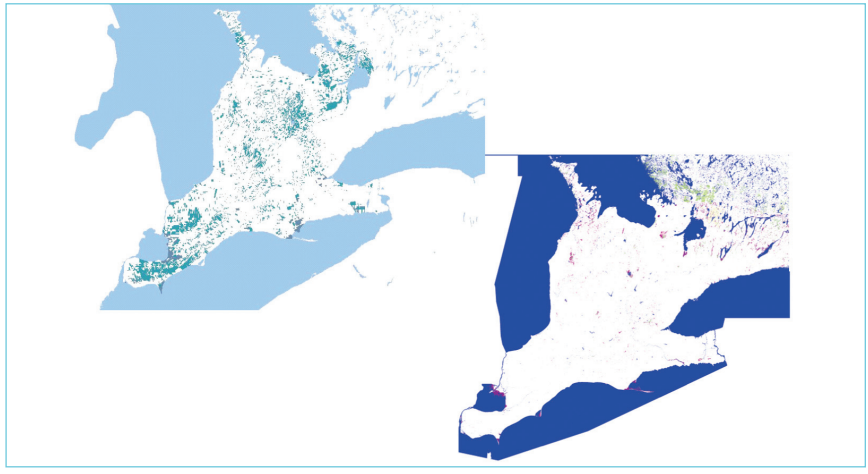

FIGURE 7
Comparison between pre-European settlement wetland cover in southern Ontario (top left) and present day wetland cover (bottom right) adapted from Ontario Ministry of Natural Resources Provincial Landcover Map (OMNR, 2000).

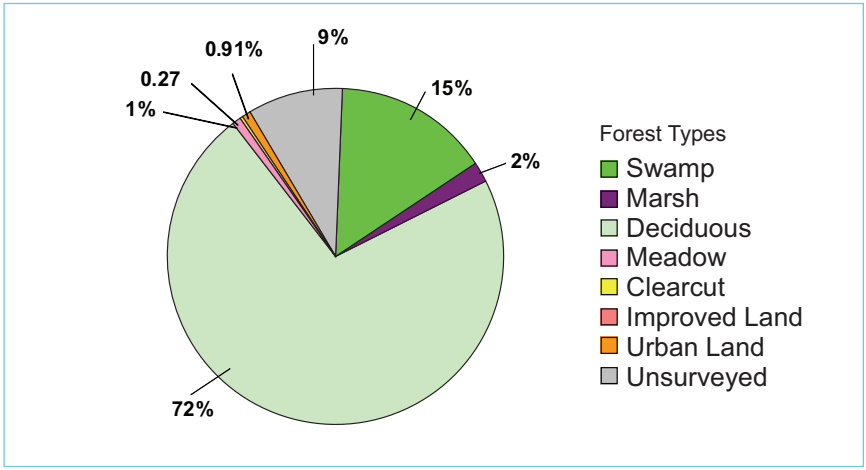

FIGURE 7
Percentage of Forest Cover Type in Southern Ontario at Pre-European Settlement.

4. Discussion and Conclusions

It is clear from the digitized maps that land cover in southern Ontario has changed dramatically since the settlement of Europeans in the 18th and 19th centuries. The change in forest cover can be attributed to the changing socio-economic needs of people as they settled in the area over time (Drushka, 2003). In addition to agricultural purposes, the settler's cultural attitudes and fears of predators and enemies of the forest that could invade livestock and settler safety influenced how forests were managed around settled areas almost 200 years ago (Drushka, 2003).

From the late 18th Century, southern Ontario was logged primarily for the building of the Queen's navy ships, roads fuel wood and for settler habitats. After 1850, export logging declined and agriculture increased. Agriculture remained the dominant land use until the mid-20th Century when development began to increase with the advent of automobiles and increased human population. All these activities resulted in the decline in forest cover from over 80% in the pre-European settlement period to less than 17% presently.

The digitization of the Finlay maps allows for a first approximation of the pre-European settlement land cover. This allows for general characterizations and comparisons of forest types on a large scale at the pre-European settlement period and to document change over time. Although the dataset is not suited to pinpoint site-specific land cover type (unless located in and along a concession line) it can be used to determine both the types of forest or tree species that can be expected within an area. By using this dataset with soil and climate data, it is possible to model a more realistic distribution of forest types which will be useful for conservation and restoration programs. In addition, such a model would allow for the interpolation of forest type in areas where records from surveyor field notes have been reported as destroyed, missing or incomplete.

TABLE 1

Remaining woodlots in percent of various towns in the GTA region (CVCA, 1956).

Township	1851	1861	1891	1911	1921	1931	1941	1951	1954
Amaranth	97.2	89.6	40.4	11.6	6.6	5.4	4.9	6.4	2.6
Mono	87.9	64.8	29.4	13.1	16.2	16.1	14.6	12.3	17.6
Garafraxa East	95.0	73.2	17.9	7.0	7.4	7.5	7.7	7.0	11.6
Erin	72.6	55.1	20.1	11.8	16.5	14.8	14.6	13.5	20.8
Albion	70.4	47.8	19.7	8.1	8.9	9.1	10.0	9.1	16.6
Caledon	69.3	55.8	23.7	10.1	10.8	15.3	13.5	14.3	22.6
Chinguacousy	49.2	34.4	10.0	5.8	6.1	5.5	4.9	5.0	9.8
Esquesing	56.8	48.4	19.7	13.4	13.3	13.5	12.0	11.5	17.8
Trafalgar	41.6	30.7	16.8	5.0	6.8	8.4	5.2	5.6	4.6
Toronto	47.4	37.9	17.1	8.7	5.9	5.0	5.1	4.8	6.6
Total	**67.3**	**52.6**	**21.7**	**9.5**	**10.0**	**9.8**	**9.5**	**9.0**	**16.3**

From historical evidence (Table 1), one can see that Toronto, for example, has gone from a forest cover of 47.4% in 1851, to 6.6% over one hundred years later. Since 1954, forest cover has continued to be reduced in all areas of southern Ontario. Any increase in forest cover is due to the reversal of agricultural lands to forest (Friesen 1998) and to conservation attempts to reforest (Drushka, 2003). This study also demonstrates that there has been a significant reduction in southern Ontario wetlands since the pre-European settlement due mostly to the draining of wetlands for conversion to agricultural use.

The pre-European settlement landcover map for southern Ontario is a useful tool to document historical landcover and the changes that have occurred. The data can be used to determine historical locations of species that are now in decline such as elm (*Ulmus americana*) and chestnut (*Castanea dentata*). Also, the decline of wetland areas can be further investigated by quantifying the amounts changed and the spatial distribution of change. This information along with other databases can be used as a tool for restoration and conservation at regional and municipal levels. Future considerations are compiling this data for the entire province and nation with other groups interested in determining the pre-European settlement vegetation for large scale analysis such as carbon sequestration and forest fragmentation, and the impacts on biodiversity. Overall, this study provides maps of historical land cover for the counties of Peel, York, Etobicoke and Toronto which provide useful information for local land-use planning, policy development, resource management, environmental monitoring and environmental modeling.

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