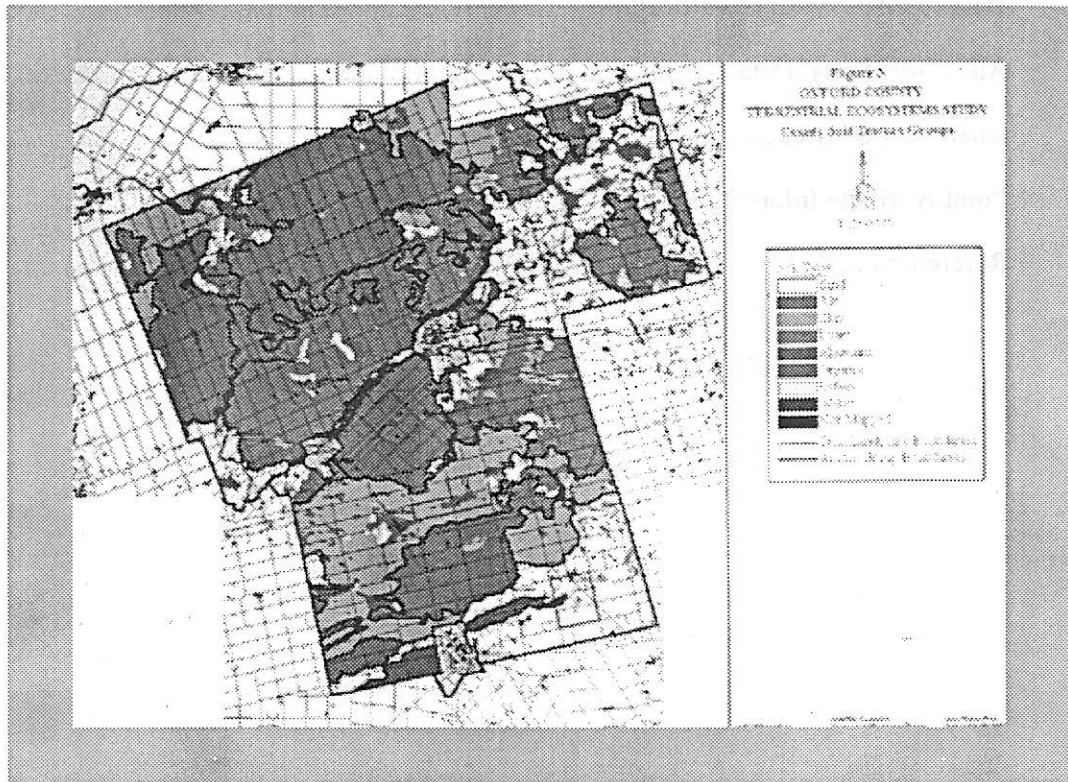# Mapping and Digital Information:

# Geographic Information Systems for the

# Oxford County Terrestrial Ecosystems Study



prepared by:

Terry Chapman

Upper Thames River Conservation Authority
January 1997

# Table of Contents

# 1.0 Introduction

Geographic Information Systems (GIS) was an invaluable tool in completing the Oxford County Terrestrial Ecosystems Study (OCTES). It allowed the synthesis of multiple layers of information across a large geographic scale which would otherwise be impossible. GIS was used to overlay data in the abiotic, biotic and cultural layers in order to establish the state of the Oxford County landscape. Eight mapping layers were created for the OCTES using GIS.

The synthesis of abiotic characteristics including soils, physiography and others was used to develop the abiotic groups from which eight trial landscapes or sample areas were chosen (see Nethercott, 1997). Field work was conducted in a total of 71 vegetation patches, as defined by GIS, in the eight trial landscapes. Historical forestry information was also assessed using GIS.

Forestry information was digitized from Conservation Reports (see Gallagher, King, 1997) and classified into simpler ecological units. GIS was also a useful tool for landowner contact within the eight trial landscapes. Forest or wetland patches were defined and categorized into size classes using GIS in order to ensure representative study within each size class (Mohring, 1997). Analytical queries were performed which further assessed biological attributes of vegetation patches using landscape parameters such as: patch size, shape, spatial distribution and total area of vegetation either by county, abiotic group or trial landscape. Landscape parameters were combined with field data results to define the state of the Oxford County landscape (see Bowles, 1997). Field data was linked to the GIS using the patch centroid.

The following provides further detail on the GIS component of the OCTES. Some of the mapping layers discussed are found in the attached reports.

# 2.0 Base Digital Data

There are two primary sources for Oxford County digital data. The County of Oxford has 1:10,000 digital Ontario Base Mapping (OBM) which was used to create the new Official Plan. In 1995, the UTRCA purchased 1:50,000 National Topographic Data Base (NTDB) digital data and created a viable database for the total County. This base was used to create all of the OCTES layers and to complete the landscape level analysis.

A comparison between the 1:10,000 data to 1:50,000 data follows.

| Digital Data (information) | OBM 1:10,000 | NTDB 1:50,000 |
|---|---|---|
| Air Photography Base | 1983 | 1990 |
| North American Datum | 1927 | 1983 |
| Vegetation Criteria | Woodland boundary follows cultural features. Individual trees are not shown. | An area at least 35% covered by trees or shrubs having a minimum height of 2 metres. |
| Number of Sheets to Cover County | 130 to 140 sheets | 8 sheets in total |

# 3.0 Data Limitations and Justification

The 1:50,000 digital data was selected as the base for the OCTES for the following reasons:
- it represents the most current data available in digital format;
- vegetation shape and size reveals a high degree of correlation in comparison to aerial photography and the field data collected through the OCTES;
- time for building and cleaning digital data is not as intensive and reduces potential error because of the reduced number of digital map sheets requiring edge matching;
- data scale closely matched other digital data scales (see auxiliary data chart)

**Limitations:**
- the 1:50,000 source includes shrub and thicket vegetation communities and does not distinguish between early and late successional forest;
- vegetation is not broken by roadways, streams, and other man made features;
- 1990 data is reasonably current but not completely up to date;
- the scale allows for only general accuracy and interpretation.

# 4.0 Auxiliary Digital Data

A variety of other data was used or created for the OCTES analysis including the following:.

| Data (Scale) | Source | Year |
| --- | --- | --- |
| Soils (1:63,360) | Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) | 1958 |
| Physiography (1:63,360) | OMAFRA same as above | |
| Agricultural Land Use (1:63,360) | OMAFRA | 1983 |
| Historical Forestry Information (1:63,360) | Conservation Reports (Department of Planning and Development) and Forest Resource Inventory* (Ontario Ministry of Natural Resources) | Nith Valley 1951 Upper Thames Valley 1952 Big Creek 1953 Grand Valley 1954 Otter Creek 1957 Catfish Creek CA* |
| Forest Classification for Soil Moisture and Stage of Succession (1:63,360) | Generated from historical forestry information (above) see historical forestry information (above) | |
| Abiotic Resources Information (1:50000) | Generated using Oxford County soils and physiography mapping (OMAFRA), and ground water source areas (Ministry of the Environment and Energy) | 1958 |
| Forest Patch Size (1:50000) Classification | Generated using NTDB, Natural Resources Canada, Geomatics Canada | 1990 |
| Trial Landscapes (1:50000) | Identified through the OCTES Sampling Methods | 1996 |

### Historical Forestry Digital Information

The historical mapping is based on the woodlot information mentioned in the above table. The hard copy maps were sent to a consultant to be traced and scanned to create a digital product. The portion of the Catfish Creek watershed in Oxford County was not available through the Conservation Report; therefore, it was transferred from FRI mapping to the 1:50,000 mapping and digitized.

Only woodlots having an area of greater than one acre (0.5 hectare) were surveyed and mapped by forestry crews in the 1950s. Since the mapping was created originally from aerial photography and mapped manually, georeferencing was difficult. This made the data somewhat inaccurate to fit to the NTDB database; however the shape and general location of woodlots was consistent enough that some comparisons could be made with the 1990 NTDB vegetation layer.

### Identification of Abiotic Information and Trial Landscapes

Abiotic information was generated by overlaying a series of hard copy maps supplied by the County of Oxford. This procedure was done manually because not all mapping required was available in a digital format. The information generated was created at a 1:50,000 scale and then digitized for use within the GIS for analysis. Trial landscapes or sample areas were selected as 10% of each abiotic group for field level analysis. The trial landscapes were also digitized and imported into the GIS system.

### Identification of Forest Patches

Based on the 1:50,000 digital information, a map was created to identify different patch sizes. Digital vegetation data were not split by roads, watercourses, railways or pipelines, other than Highway 401 and the Thames and Grand Rivers. Consequently, the patches along river corridors, for example, were of significant size. The attribute information provided in the digital data and the calculations created through the GIS software allowed patch sizes to be categorized. Patch sizes were classified into six size categories: less than 4 ha, 4 to 10 ha, 10 to 20 ha, 20 to 30 ha, 30 to 40 ha and greater than 40 ha.

# 5.0 Analytical Queries

A variety of queries were completed to assess the state of Oxford County's forest dominated landscape. The queries were used in conjunction with the field data to formulate the results compiled by the ecologist, Dr. Jane Bowles and the OCTES Team. They include the following:

- total county-wide vegetation cover;
- the area of vegetation in each abiotic group and trial landscape using historical and present data;
- the percentage of different woodlot sizes in each abiotic group and landscape;
- the area of interior forest based on a 100 metre edge/buffer around the perimeter of each woodlot for each abiotic group and trial landscape;
- the area of vegetation within a 2 km radius of the patch centroid for visited patches within the trial landscapes, using historical and current data;
- the area of forest community types in each woodlot visited using historical data;
- the area of different agricultural land uses in each abiotic group;
- the area for forest classification for soil moisture and stage of succession to calculate dominant forest cover type for each abiotic group.

# 6.0 Point Attribute Information

Detailed flora and fauna information was collected for 71 vegetation patches in Oxford County and entered into a database/spreadsheet for analysis purpose. The database information was added to the GIS as point attribute files. The flora or fauna databases support a common field for the vegetation patch number. The centroid database supports latitude and longitude co-ordinates which are linked to the vegetation patch numbers in the flora and fauna databases. The latitude and longitude for each centroid was derived from the National Topographic Series (1:50,000) maps. This linkage permits database queries to be performed using GIS.

# Map References

Base mapping is based on information taken from the National Topographic System map sheets 40p/ 1,2,3,6,7,8,40i14,15 © 1995. Her Majesty the Queen in Right of Canada with permission of Natural Resources Canada.

Forest Classification for Soil Moisture and Stage Succession based on Conservation Reports and Ministry of Natural Resources' Forest Resource Inventories (FRI) maps. Mapping is divided by watershed and inventories were completed in years as follows: Nith Valley 1951, Upper Thames Valley 1952, Big Creek 1953, Grand Valley 1954, Otter Creek 1957, Catfish Creek (FRI) 1978.

Soils, Land Use and Physiography Digital Information Supplied by: Ontario Ministry of Agriculture, Food, and Rural Affairs, Resources and Regulation Branch, Geographical Information System Unit.

# Text References

Bowles, J. *Oxford County Terrestrial Ecosystems Study: Life Sciences Report.*

Gallagher, B., King, L. 1997. *Assessment of Biotic Resource Information: An Evaluation of Historical Biotic Resources.* UTRCA.

King, L. 1997. *Oxford County Terrestrial Ecosystems Study: A Natural Heritage Study for Oxford County.* UTRCA.

Ministry of Natural Resources Information Resources Division Provincial Mapping Office, 1994. *Digital Topographic Database Overview Version 2.*

Natural Resources Canada, Geomatics Canada, 1991, *National Topographic Data Base, Data Dictionary 1:50,000.*

Nethercott, D. 1997. *Assessment of Abiotic Resource Information: An Evaluation of Abiotic Resources for the Oxford County Terrestrial Ecosystems Study.* UTRCA.