

# **The Land Between Waterfowl GeoDatabase Creation**

Hélène Gravel and Kimi Watanabe  
Completed in August, 2007



APST062: GIS Cooperative Project

Sir Sandford Fleming College

Supervisors and readers:

Professor Bruce Pettit  
Professor Paige Wearing

## 1. Abstract

Researchers have been trying to find the significant importance to protect the natural habitats within the Land Between (TLB) region. The TLB project consists of several researchers with multiple disciplines including geology, ecology, human geography, and history. They have been researching to understand the TLB region with the full of detail information.

The Fleming College GIS cooperative project was involved in the TLB project by assisting the biologists. Our mission was to identify the existing and potential waterfowl habitats within the TLB region and to make a connection with the waterfowl activity information to those identified waterfowl habitats and to provide a spatial database as a tool to help accomplish research.

The original datasets, both air photos and spreadsheets, were obtained from the Ducks Unlimited Canada office in Barrie. The selected study areas were Anglesea, Anson, Grimsthorpe, Havelock, Hindon, Longford, Mud Turtle Lake, Patterson, and Sherborne. Each of those names corresponds to the Beaver Pond Management program (BPM). The BPM was a program at Ducks Unlimited Canada to monitor the waterfowl activities in the central Ontario. One or more waterfowl nest box was set up in every pond across Ontario in order to protect existing the waterfowl habitats and to restore the wetland ecosystem across Ontario. The landowners and/or the volunteers at Ducks Unlimited Canada survey the nest box once or twice a year to see whether or not there was any nesting material, egg shells of waterfowl and record any findings to send to the Ducks Unlimited Canada.

Each of the air photos was georeferenced. Each of the BPM ponds was digitized from the georeferenced air photos and was assigned a BPM ID to link with the non-spatial datasets. The provided spread sheets were combined as one database. All the records were standardized and normalized to perform efficient query from the geodatabase. Some of the queries were stored for the future use to help those scientists to identify their research interests. In addition to the requirement for the GIS cooperative project, a customized tool was added to assist the query process smoothly. From the digitized BPM ponds, several statistical tests were performed to observe the trends of the BPM pond distribution in terms of the size and the shoreline length. It was found that the larger the pond size, the longer the shoreline length will be. In order to see the spatial trends in the digitized BPM ponds, the mean value of the area and the shoreline length was calculated for each image boundary. It was found that the pond size tends to be smaller when there is more Canadian Shield surface is presence. Also, the BPM pond size gradually increases from the southern area to the northern are in the study site. Lastly, a presentation poster was produced to introduce our project to public at the Open House and the presentation, to be held after the graduation.

In conclusion, all the proposed deliverables were completed. Our deliverables, especially the geodatabase, will be used for an ecological study in the TLB region. We believe that our geodatabase will assist the ecological studies and wish the best luck on their future studies.

## **Acknowledgement**

We would like to thank all the people and organization who kindly supported us through this Fleming College GIS cooperative project.

We would like to send our special thank you to Mr. James Holland at Ducks Unlimited Canada in Barrie for providing us all the datasets, all the background information of the database, and answering our questions.

We would also like to send our special thank you to Ms. Leora Berman for organizing the TLB project and conducting such fascinating studies in the TLB region.

We would like to special thank you to Mr. Ian Attridge and Ms. Carol Andrews for providing us our cooperative projects not only for us, for our classmates.

Lastly, we would like to thank all the kind support with correction and suggestions we have received from Professor Pettit and Professor Wearings through this GIS cooperative projects.

# Table of Contents

	Page
Title Page	i
1. Abstract	ii
2. Table of contents	iv
3. List of tables	vi
4. List of figures	vii
5. Introduction	1
5.1. three projects from Kawartha Heritage Conservancy, Peterborough	1
5.2. brief background information of the Land Between (TLB)	1
5.3. problematic ecological protection methodology in Ontario	5
5.4. Fleming College GIS cooperative Project and TLB	6
5.4.1. Objectives and goals	7
6. Methodology	8
6.1. brief information on our data	8
6.2. spatial data	9
6.2.1. data acquisition	9
6.2.2. flow chart	10
6.2.3. georeferencing	10
6.2.4. digitizing	11
6.3. non spatial data	13
6.3.1. data acquisition	14
6.3.2. technology analysis	23
6.3.3. database design	23
6.3.4. database pre-processing	24
6.3.5. geodatabase creation	27
6.3.6. stored queries and reports	28
6.3.7. ArcMap interface customization	28
6.4. after geodatabase creation --preprocessing for all the statistical analyses	29
7. Project Results	32
7.1. spatial data	32
7.1.1. georeferencing air photos	32
7.1.2. digitizing BPM ponds	32
7.2. non spatial data	35
7.2.1. database design	35
7.2.2. database preprocessing	36
7.2.3. stored queries and reports	45
7.2.4. ArcMap interface customization	50

7.3. statistical analyses		52
	7.3.1. BPM statistics	52
	7.3.2. summary of descriptive statistics	55
	7.3.3. statistical analyses	58
8. Conclusion		75
9. Reference		78
Appendix		80
Appendix A	Changed deliverables from the original proposal	
Appendix B	Survey forms	
Appendix C	Detail flow chart for the spatial data	
Appendix D	Digitized BPM ponds	
Appendix E	Preprocessing flowchart for statistics	
Appendix F	Microsoft Visual Basic / ArcObjects code for the ArcMap customized tool	
Appendix G	A sample poster	
Appendix H	Resume	

---

## 2. List of Tables

Table Number	Caption	Page
Table 1	The summary of statistics of the area in m <sup>2</sup>	52
Table 2	summary of statistics for the shoreline length (metre) per each image boundary	53

### 3. List of Figures

Figure Number	Caption	Page
Figure 1	The satellite Image of the study site (TLB region) (NASA, 2006).	2
Figure 2	Bedrock information within the study site (Ministry of Northern Development and Mines, 1991).	3
Figure 3	Soil information within the study site (Department of Energy, Mines and Resources, 1975)	4
Figure 4	The example and comparison of mosaic landscape	6
Figure 5	An example of the BPM waterfowl nesting box and identification kit provided to volunteers and landowners.	8
Figure 6	The work flow with main tasks to produce a geodatabase, combining both spatial and non spatial data	9
Figure 7	An example of head-up digitizing screen	11
Figure 8	An example of the attribute table for the BPM pond digitizing	12
Figure 9	An example of one of the images showing the subdivisions of an image boundary.	12
Figure 10	Overview of the flow chart	13
Figure 11	an example of multipart polygon. A multi-part polygon shares one ID with multiple polygons	29
Figure 12	The difference between before and after the dissolve operation	30
Figure 13	The study area and the locations of 9 image boundaries	32
Figure 14	An example of the original image.	34
Figure 15	Geodatabase Schema	35
Figure 16	A screenshot of all the objects in the Geodatabase	40
Figure 17	List of stored queries	45

Figure 18	Query examples	46
Figure 19	Example of a parameter query	48
Figure 20	an example of output with a pie chart	48
Figure 21	Another query example by species outcome	49
Figure 22	a query result by species outcome	49
Figure 23	Using relational database and its issues	50
Figure 24	An example of use of our ArcMap customization tool	51
Figure 25	The distribution of the image boundaries in Ontario	55
Figure 26	The mean dissolved BPM pond size and shoreline length per image boundary	56
Figure 27	The image boundary of each project and the geological information in each image boundary.	59
Figure 28	the correlation between the area and the shoreline length among 3144 dissolved BPM ponds in 9 images.	62
Figure 29	The found significant relationship between the mean dissolved BPM pond area and the Canadian Shield ratio per image boundary.	64
Figure 30	The found significant relationship between the mean dissolved BPM pond area and the Canadian Shield ratio per image boundary.	66
Figure 31	the relationship between the Canadian Shield ratio per image and the mean dissolved Pond Length	68
Figure 32	The distribution of mean dissolved BPM pond area per image boundary	69
Figure 33	The linear relationship between the mean dissolved BPM pond area and the UTM X coordinate (above) and between the mean dissolved BPM pond area and the UTM Y coordinate (blow).	71
Figure 34	the distribution of the mean dissolve BPM pond shoreline length per image boundary within the study site	72
Figure 35	The linear relationship between the mean dissolved BPM pond shoreline length and the UTM X coordinate (above) and between the mean dissolved BPM pond area and the UTM Y coordinate (blow)	74

---