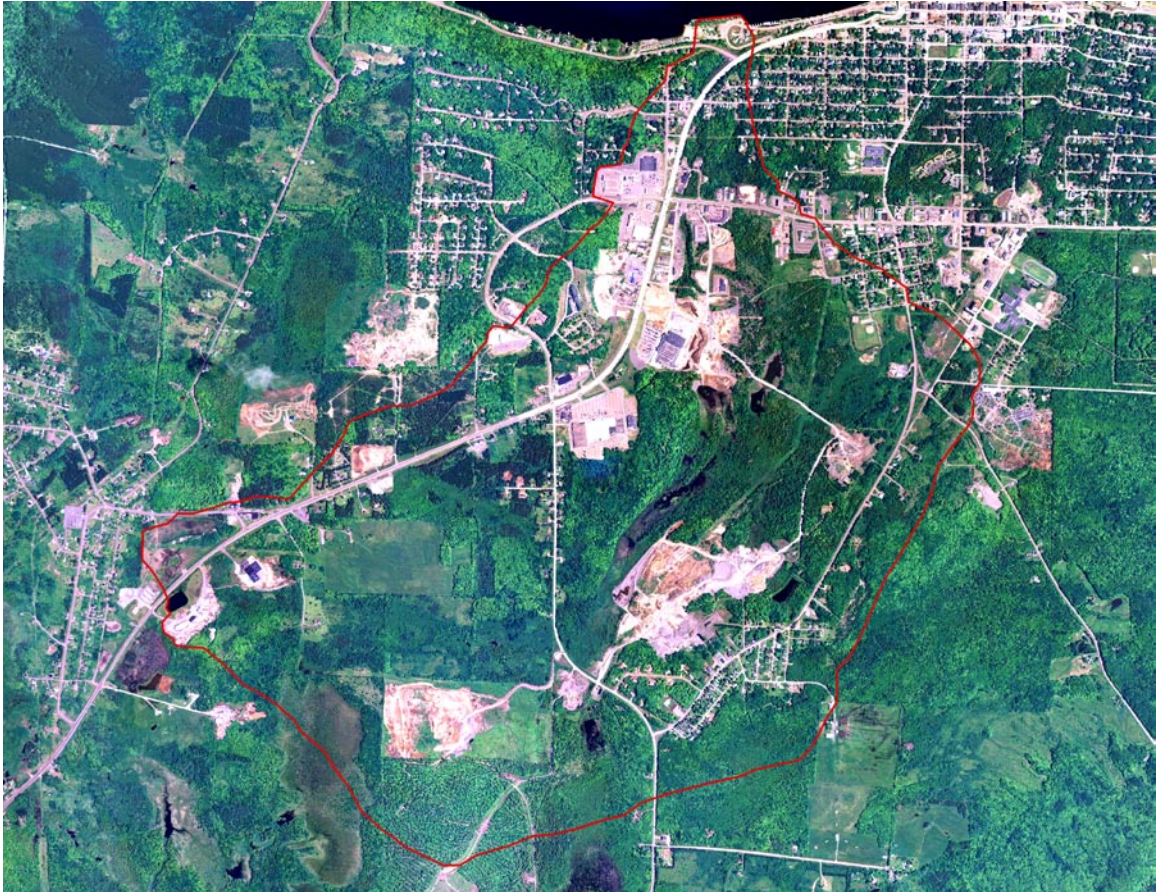


Huron Creek Watershed 2005 Land Use Map



Created By:
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Created For:
MTU Introduction to GIS Class (FW 5550)
The Huron Creek Watershed Advisory Committee

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Introduction

The Huron Creek watershed is an approximate 3.4 square mile watershed that is located in north central Houghton County, in the Upper Peninsula of Michigan. Municipalities located within this watershed include the City of Houghton, Portage Township, and the villages of Dodgeville and Hurontown. Huron Creek, the main waterway belonging to the watershed, is approximately 3.3 miles in length. The creek's source is in an area of wetlands located in the southwest corner of the watershed. The creek then flows to the east and north, and empties into the Portage Canal at the watershed's northern "tip." Huron Creek flows through areas of generally level to slightly sloping surface topography in the south and central portions of the watershed. Ground surface topography becomes sloping to steep in the north central part of the watershed near Sharon Avenue. Coincidentally, this location is also an area of concentrated urban development, where the creek is routed through multiple culverts. Downstream from this area, Huron Creek passes through a narrow wooded corridor and underneath Michigan highway M-26. Lastly, before emptying into the Portage Canal, the creek passes through a popular waterfront park and recreation area.

There are several existing environmental conditions in the watershed that have raised concern for the water quality of Huron Creek, as well as the watershed as a whole. These conditions are considered to have high potential for negative environmental impact. They include:

- Past mining activities
- Leachate from unlined/uncapped landfills
- Aging or inappropriately designed septic systems
- Concentrated urban development (storm water quality/quantity concerns)

As a result of the recognition of these conditions, a watershed advisory committee (Huron Creek Watershed Advisory Committee – HCWAC) has been formed and is comprised of members who are considered to be "stakeholders" in the environmental quality of the watershed. These members include business owners, various government representatives and leaders of local environmental and land conservancy organizations. The main objectives of the HCWAC are:

- To monitor water quality and to identify critical areas and pollutants
- To improve overall water quality within the watershed
- To educate local citizens and landowners about water quality issues in the watershed

These goals will be achieved using various investigation and assessment tools such as water quality sampling and analysis, collection of hydrologic, soils and land use data and through the creation of a watershed management plan.

The review of land use data is important when assessing the overall "state" of a watershed. Evaluating multiple years' land use maps can provide the following information both spatially and temporally:

- Trends in urban development (amounts of impervious ground surface)
- Creation/destruction of water resources such as lakes, ponds and wetlands
- Utilization of forest lands, agricultural lands and rangelands

Identifying these types of land use trends can provide a foundation for a holistic approach towards land and water resource management.

Problem Statement

The primary goal of this project was to create the most up-to-date land use map of the Huron Creek Watershed as possible, given various resource and time constraints (for example, wetland identification was completed using available data sets and aerial photo interpretation, not through physical on-site wetland delineations).

The secondary goal of this project was to draw conclusions on land use trends in the watershed by comparing this project's results with data from previous years.

Data (Thematic Layers Used)

This section describes source data sets and/or layers utilized in the production of this map. They are as follows:

- State of Michigan Center for Geographic Information Website (<http://www.michigan.gov/cgi>)
 - Houghton County Framework (roads layer)
 - DLG Hydrography (lakes and stream layer)
 - Land Cover/Use MIRIS 1978 (1978 land use data layer)
- GIS Data Depot/GeoCommunity (<http://data.geocomm.com/>)
 - 2005 NAIP 1-meter Digital Orthophoto (background photo)
- Data Provided by Hans Bruning
 - Land Use Map based on 1998 Digital Orthophoto
 - Huron Creek Watershed Boundary

Project Procedural Outline and Information

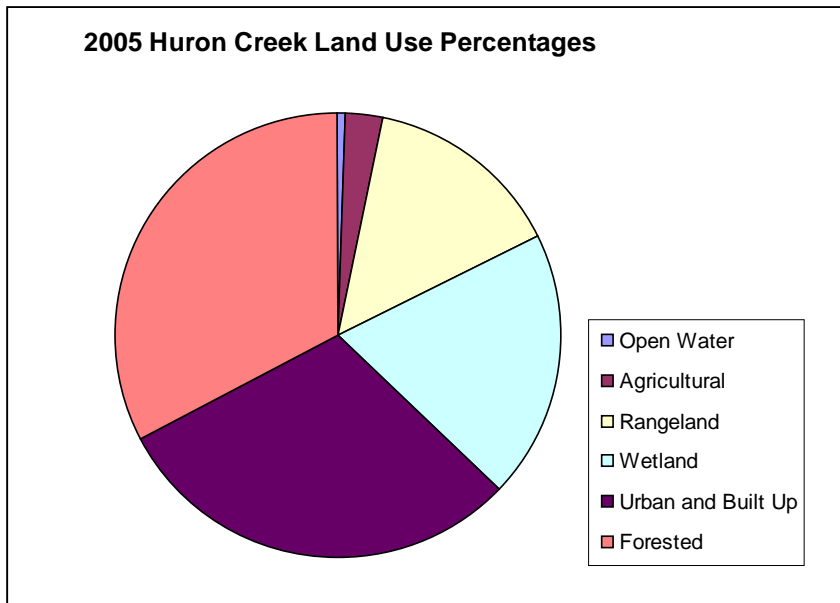
1. Software used for map creation and data analysis:
 - a. ArcMap 9.1 and ArcCatalog 9.1
2. Added thematic layers listed in above section to ArcMap document.
3. 2005 NAIP photo was clipped by others to improve the manageability of the file.
4. All layers, if not already projected to NAD 1927 UTM Zone 16N coordinate system were reprojected.
5. Created a geodatabase (GDB) and exported the above listed layers to the GDB, thereby maintaining area and/or length values for all data.
6. Edited existing layers where needed using the Edit tool.
 - a. Watershed boundary obtained from Hans Bruning - Adjustments were made based on visual comparison with 2005 orthophoto, only where required change was obvious (i.e. the watershed boundary passed through Shopko).
 - b. Stream layer (Huron Creek) - Changes were made where the creek was re-routed for the recent Wal-Mart expansion.
 - c. Former Huron Lake (small lake near Wal-Mart) - This lake was drained after removal of a dam. Portions of the area still have open water, while the rest is now wetland.

7. Created a new feature class within the GDB that would be the polygon layer for the newly created (2005) land use map. This feature class was assigned the same projection/coordinate system as the rest of features in the GDB.
8. Land use naming system:
 - a. Decided to use the same naming system as the 1998 land use map to facilitate comparisons. This naming system is a collapsed version of the Michigan Resource Information System (MIRIS) land cover labels.
9. Determination of what portions of the photo belonged to what land use category:
 - a. Forested – Obvious areas of tree cover (>25%)
 - b. Urban and Built Up – Areas of commercial or industrial use. This included active quarrying operations. Also included were areas of dense housing (homes not separated by a significant amount of forest or rangeland - significant being that it could be easily digitized around).
 - c. Agricultural – Areas where existing agricultural activity could be distinguished.
 - d. Open Water – Areas included in the polygon portion of the hydrography layer added to the GDB. These areas were verified against the aerial photo for existence and general shape.
 - e. Rangeland – Areas that had less than 25% tree cover, but were not agricultural, urban, open water or identified as wetland. (Upland meadow, shrub areas or sparse forest.)
 - f. Wetland – Wetland areas were identified using the existing 1998 and 1978 land use data. These layers were then compared to the National Wetland Inventory (NWI) data set for verification. The general rules employed were:
 - i. All NWI wetlands were labeled wetlands
 - ii. Areas of land use map wetlands that did not overlay NWI wetlands were examined accuracy against the aerial photo and labeled based on photo interpretation by the author.
 - iii. The only “new” wetlands digitized were those that were previously part of Huron Lake, now drained.
10. Digitized 2005 land use data using the Edit and Sketch tools, and the rules listed in # 9.
 - a. A number was assigned to each land use type (1-6) and entered into the attribute table after creation of each polygon.
 - b. Snap tools were used to snap digitized polygon vertices to adjacent polygon vertices and the watershed boundary.
 - c. The Eliminate tool was used to eliminate “sliver polygons” that were produced as a result of hand digitization.
 - d. The Union tool was used to join the 2005 and 1978 data sets with the hydrography (lake) data. The 1998 data was already joined with it.
 - e. The Dissolve tool was used to create multipart polygons of each land use type, thereby simplifying the attribute table into six rows.
 - f. Corresponding names, acreages and % of overall land use were calculated and added to the 2005 layer’s attribute table.
 - g. Various edits were made to the 1978 and 1998 land use attribute tables so that the data could be easily compared to 2005’s data (assigned them the same numbering system as the 2005 data). This included completing several “calculate” functions and dissolving the 1978 data.
11. Three layouts were created (8.5”x11”, portrait 11”x17”, landscape 11”x17”) of the finished 2005 land use map. This required use of the layout setting in ArcMap. Each map was made cartographically correct including a neatline, scale, north arrow, legend and reference information.

Results and Conclusions

The layouts of the completed land use map are included in the Appendix of this report. Based on this map, the following land use percentages were identified within the Huron Creek Watershed for 2005:

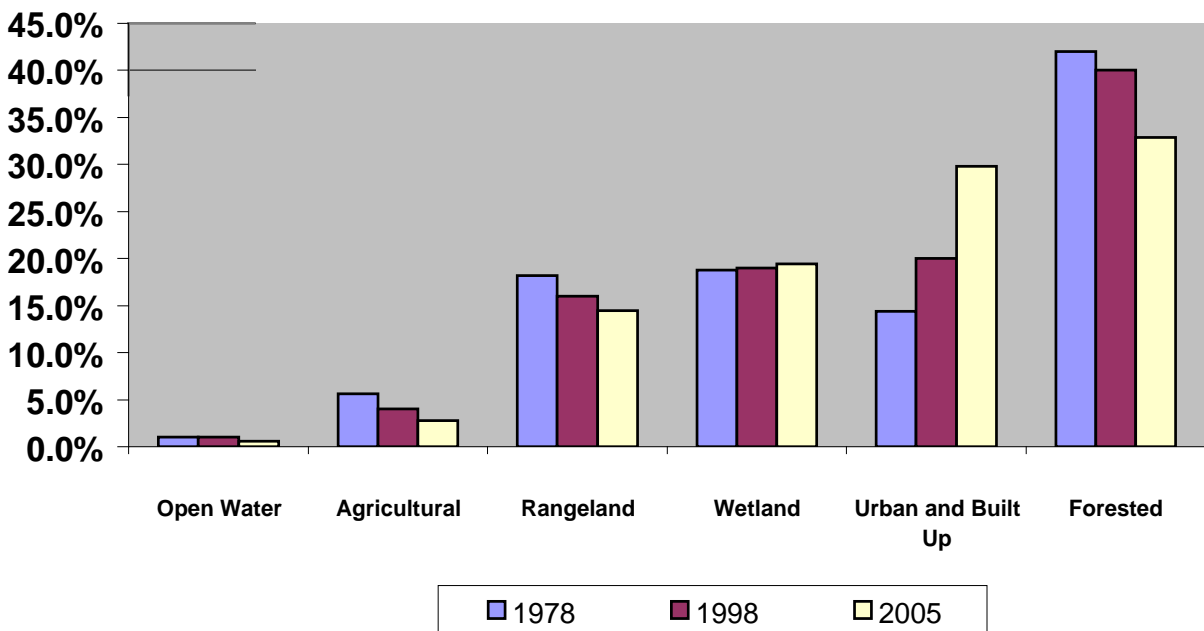
- Open Water, 0.6%
- Agricultural, 2.8%
- Rangeland, 14.5%
- Wetland, 19.4%
- Urban and Built Up, 29.8%
- Forested, 32.9%



The table and chart below compare these percentages with those derived from the land use map based on the 1998 digital orthophoto¹ and the 1978 MIRIS land use dataset.

Land Use Type	Land Use Percentage		
	1978 MIRIS Dataset	1998 Orthophoto	2005 Orthophoto
Open Water	1.00% ²	1.00%	0.60%
Agricultural	5.60%	4.00%	2.80%
Rangeland	18.20%	16.00%	14.50%
Wetland	18.80%	19.00%	19.40%
Urban and Built Up	14.40%	20.00%	29.80%
Forested	42.00%	40.00%	32.90%

Percent Land Use - Huron Creek Watershed



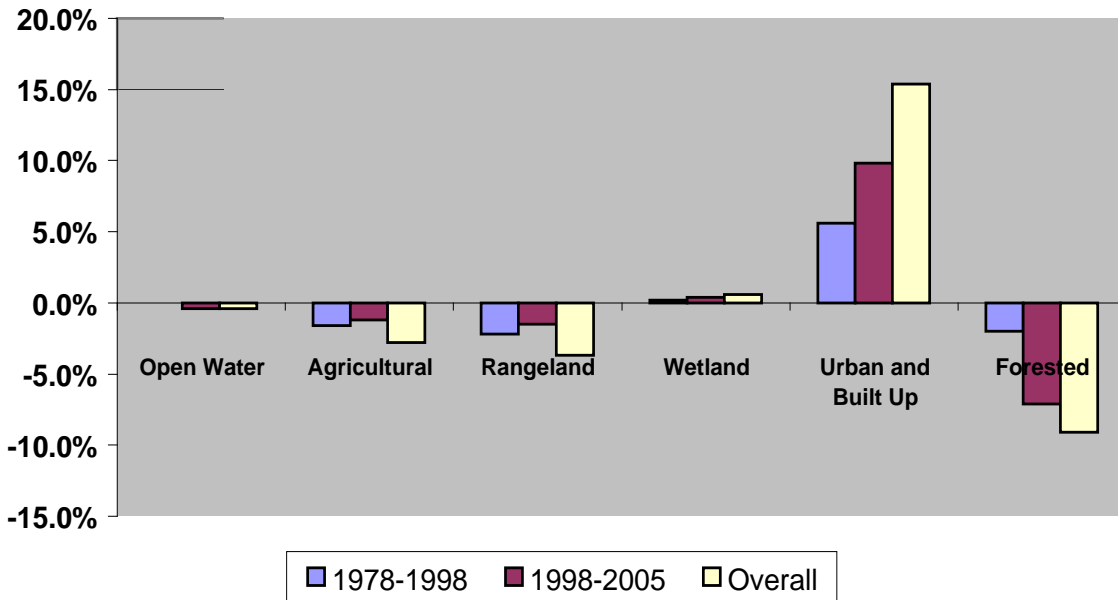
¹ Land Use Map by Hans Bruning, February 2006.

² Open water data was not available for 1978 and so it was assumed the percentage land use was the same as 1998. The one percent in the “open water” category was subtracted from the “forested” category.

The next table and chart illustrate percent change in land use between years:

	% Change in Land Use		
	1978-1998	1998-2005	Overall 1978-2005
Open Water	0.0%	-0.4%	-0.4%
Agricultural	-1.6%	-1.2%	-2.8%
Rangeland	-2.2%	-1.5%	-3.7%
Wetland	0.2%	0.4%	0.6%
Urban and Built Up	5.6%	9.8%	15.4%
Forested	-2.0%	-7.1%	-9.1%

Percent Change in Land Use - Huron Creek Watershed



The most obvious distinction that can be made from the above data is that, between 1978 and 2005, the most reduced land use is forested land (-9.1%). Less severe declines can be seen in the amount of rangeland and agricultural land (-3.7% and -2.8% respectively) during this time period. These decreases have been counteracted by the distinct rise in urban lands (+15.4%). These trends likely correlate with a steady growth in population in the Houghton area over the past 27-28 years.

In general, the open water and wetland areas of the Huron Creek watershed have stayed similar in number and size since 1978. The data shows a slight increase (+0.6%) in the amount of wetland areas between 1978 and 2005. This change is likely the result of a difference in data interpretation methods between the data sets/authors.

From review of this data and the maps provided in the Appendix, it can easily be concluded that urban areas are on the sharpest increase in the Huron Creek watershed, at the expense of forest

land and rangeland. This trend is implicative of the fact that the watershed contains the most concentrated area of commercial development in the western Upper Peninsula.

How the remaining non-developed lands fare into the future will depend on the amount of land use planning and management implemented.

Recommendations for Further Investigation

Suggestions for further analysis of the Huron Creek watershed land use data include:

- Revision the land use map by “un-collapsing” the land use naming scheme (i.e. breaking “Urban and Built Up” areas into Commercial, Residential and Industrial).
- Verification of wetland data through field confirmation/delineation and GPS surveying.
- Comparison of the land use data with environmentally impaired lands to better identify areas to be repaired or protected.
- Creation of land use maps using aerial photography from years between 1978 and 1998, and further analyzing trends in land use change over time.

APPENDIX – 2005 LAND USE MAP

