

6.0 Community Series Analysis

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Goal number one of this Natural Areas Inventory (NAI) was to complete 'Community Series' mapping for the NAI study area. This level of Ecological Land Classification (ELC) mapping, which is the limit to what can be defined through air photo interpretation, has never been available across the entire Niagara Peninsula watershed. It was achieved by first incorporating wetland extents delineated through the Ontario Wetland Evaluation System (Southern Ontario Edition) by the Ministry of Natural Resources (MNR) and NPCA building the linework for the remaining communities through ortho-imagery analysis.

Community Series is defined under the Ecological Land Classification (ELC) as "units that are normally visible and consistently recognizable on air-photos or from a combination of maps, air-photo interpretation and other remote sensing techniques. Community Series are distinguished based on the type of vegetation cover or the plant form that characterizes the community. For the most part, Community Series are identified based on whether the community has open, shrub or treed vegetation cover, as well as whether the plant form is deciduous, coniferous or mixed. These differences in vegetation cover typically reflect differences in disturbance levels, light levels and various other environmental gradients" (Lee, et al., 1998, p. 18).

At the time of this analysis, the mapping was at varying stages of development based on the availability of finalized wetland lines and the ability to do a final quality check of the mapping fabric. Every best effort was made to use the most current information at the time of calculation; however results are subject to change as the mapping receives final quality assurance. The values presented here should be qualified as current 'estimates'. With that said, the results of this analysis provide insight into trends that the new mapping is capturing about actual phenomena on the landscape being examined for the first time (i.e. estimations of successional coverage). This analysis is presented by municipality.

Status of available mapping for Community Series Analysis:

PC (Port Colborne)- complete wetland and community series lines
WF (Wainfleet)- complete wetland and community series lines
FE (Fort Erie)- complete wetland lines, requires QAQC for CS
NF (Niagara Falls)- complete wetland lines, requires QAQC for CS
WE (Welland)- complete wetland lines, requires QAQC for CS
TH (Thorold)- very close to final wetland lines, complete CS
PL (Pelham)- very close to final wetland lines, requires QAQC for CS
WL (West Lincoln)- very close to final wetland lines, requires QAQC for CS
HAL (Haldimand)- all linework in draft
HAM (Hamilton)- existing wetland evaluations, community series interpretation to be initiated

The codes used for this analysis are from the ELC protocol of the MNR. They are part of a list of interim codes developed from the First Approximation of the ELC.

The code used for the analysis is based on the dominant percentage of cover within a given polygon. For example, if the polygon has an ELC Community Series label that reads, FOD/THD/SWX, it would be analyzed as a FOD polygon since the first code listed is the dominant cover type.

The landscape for the purpose of this discussion will be classified as Wooded, Wetland, Successional or Unique. Each will be quantified using historical percentages where available as comparison.

It should be noted that the Community Series fabric is a large scale mapping product with line generalization to support a target scale of 1:2000. As a result of smaller minimum mapping units, the community series polygons can be much finer than traditional 1:10,000 scale natural heritage inventory mapping depending on the landscape (i.e. there is no point in mapping smaller sized polygons if you have a large homogenous tract of a single community). Ultimately this leads to a more spatially accurate inventory as the mapping guidelines dictate more precision with how mapped features are represented and do not eliminate any of the smaller isolated patches that exist.

All percentages calculated and presented in this analysis are either percent of the entire Niagara Watershed study area or percent of the municipality unless otherwise indicated. Values for the City of Hamilton have been included to serve as placeholders, and are underestimates due to the fact the Community Series mapping process has not yet commenced within this municipality.

6.1 Wooded Communities

The Region Municipality of Niagara in Amendment 187 of the Official Plan defines Woodlands as “treed area that provides environmental and economic benefits to both the private landowner and the general public”. These benefits are defined as “erosion prevention, hydrologic and nutrient cycling, provision of clean air and long term storage of carbon, provision of wildlife habitat, outdoor recreational opportunities and the sustainable harvest of woodland products”. It does not however include “cultivated fruit or nut orchard or a plantation used for the purpose of producing Christmas trees”(RMN, 2008, p. 41).

A Forest under ELC refers to a treed community with “greater than 60% canopy cover”, and a Woodland within the ELC protocol means very specifically a treed community with between “35% and 60 % canopy cover” (Lee et al., 1998, p.122).

6.1.1 Wooded Community Series Codes

All of the above definitions include aspects that are difficult to interpret from aerial photography and thus, it was decided that the following ELC-Community Series codes would be considered “Wooded” for the purpose of this landscape level analysis:

FOD – Deciduous Forest
FOC - Coniferous Forest
FOM – Mixed Forest
WOD – Deciduous Woodland
WOC – Coniferous Woodland

WOM – Mixed Woodland
WOX – Unidentified Woodland Community Class
SVD – Deciduous Savanna
SVC – Coniferous Savanna
SVM – Mixed Savanna
SVX – Unidentified Savanna Community Class
SHT – Treed Shoreline
*SAG – Shrub Agriculture
*TAG – Treed Agriculture
*XAG – Unidentified Agriculture Community Class
*ELC does not break down the plantation types at the Community Series level. This conflicts with the Region of Niagara’s definition of woodland.
**HOD – Deciduous Hedgerows
**HOC – Coniferous Hedgerows
**HOM – Mixed Hedgerows
** Hedgerows were given their own code not consistent with updated ELC codes so that they could be isolated from forests for the purpose of future analysis (i.e. connectivity studies).
***SWD – Deciduous Swamp
***Deciduous Swamps are a very special case in the study area since they need to be included as not just wooded area but, also as wetlands. This of course can skew the percentages for each. Further discussion will follow.

6.1.2 Wooded Communities Analysis

For the purpose of this discussion, it was decided that these communities would be referred to as Wooded Areas rather than Woodlands, or Forest to avoid confusion. We could not conform to either of the above definitions since the percent cover is sometimes difficult to accurately define and also, there are possibly some plantations included in the cover percentages.

The ‘Wooded Area’ coverage for the watershed based on the NAI ELC Community Series fabric (no exhaustive upland community mapping in the City of Hamilton yet) is 17.79 %.

The oldest and most suitable wooded areas data available for comparison were those identified on the 1:10,000 scale Ontario Base Mapping (OBM) Series of base maps as areas of vegetation. This information became the legacy wooded area layer in the MNR’s Natural Resources Values Information System (NRVIS) dataset. According to this source, wooded area percentage for the study area was 14.24% when these maps were produced in the late ‘70’s and early ‘80’s.

In 2002, NPCA, MNR, and the Niagara Region partnered to update the 1:10,000 scale wooded area mapping based on 2000, 30 cm black and white ortho imagery analysis. Using mapping criteria based on the definition of a wooded area in the National Topographic Mapping Series of base maps, 16.63 % of the watershed was covered by ‘wooded areas’. The increase in wooded area from the OBM can likely be attributed to the temporal difference in the datasets reflecting true changes on the landscape, and to a lesser degree the slightly different definitions of what constituted a wooded area and how they came to be mapped.

The SOLRIS (Southern Ontario Land Resource Information System) project resulted in several types of wooded areas being classified such as Tallgrass Woodland, Forest, Deciduous Forest, Coniferous Forest, Mixed Forest and Swamp. These distinctions were a result of remote sensing classification techniques that were applied to a general wooded area dataset discretely captured (digitized) using ortho interpretation on 2002, 20 cm colour imagery. (MNR, 2007, p. 4-6). This SOLRIS 'Phase One' general wooded area product produced the watershed statistic of 17.65 % Wooded Area.

The analysis for the Natural Areas Inventory thus shows an increase when compared to the historic data. This change is largely based on the improvements to the accuracy and detail with which we are able to map these communities and also to the quality of the field verification.

In older datasets, there were often misclassifications and differing definitions of what constituted a wooded area. Thickets and other successional communities were often confused with and interpreted as "wooded". These communities now have been separated out. As data and mapping have been updated, the ability to more accurately discern the communities has also developed.

The Natural Areas Inventory utilized 2006, colour ortho imagery with 10 cm resolution that was digitally captured (as opposed to traditional film based photography). The added clarity in combination with the resolution at which it was captured has allowed the ability to confidently distinguish other terrestrial natural communities from wooded areas, and to readily decipher between the different early successional communities like meadows and thickets.

Another thing to consider when discussing wooded areas is the ratio of Deciduous Swamp communities. Of the total landscape, 9.14% is identified as swamp, which constitutes 51% of the overall wooded cover. Historically, swamps were considered both wooded areas and the wetlands.

Municipality	Wooded Area Percent	Swamps Percent
Fort Erie	25.12	14.86
Niagara Falls	25.07	13.40
Wainfleet	24.41	18.84
Pelham	24.24	8.06
Port Colborne	24.22	16.17
West Lincoln	20.09	13.60
Thorold	19.49	6.21
Grimsby	16.23	4.84
Lincoln	15.92	4.12
Haldimand	15.84	5.10
Welland	14.93	6.98
St. Catharines	9.54	0.00
Niagara-on-the-Lake	8.46	0.12
Hamilton*	2.99	2.91
Total NPCA	17.79	9.14

Wooded area percentages are largest in the southern municipalities of Niagara, above the escarpment where coverage ranges from one fifth to a quarter of the landscape. In most of these municipalities, save Pelham, with its well drained soils, well over half of that wooded area is comprised of swamp communities. This is not surprising considering the heavy clay soils.

6.2 Wetland Communities

Under the ELC protocol, a wetland is defined as “water table seasonally or permanently at or above the substrate surface; flooded bedrock or hydric mineral or organic (organics > 40cm) substrates; standing water, pools of water or vernal pooling > 20% of the ground cover; wetland plant species cover > 50% of total plant species cover; mean wetness of a site for native species ≤ 0 ; moisture regime ≥ 5 ” (Lee et al., 1998, p. 28).

Under the Ontario Wetland Evaluation System, wetlands are “lands that are seasonally or permanently flooded by shallow water as well as lands where the water table is close to the surface; in either case the presence of abundant water has caused the formation of hydric soils and has favoured the dominance of either hydrophytic or water tolerant plants” (MNR, 1993). The OWES of the MNR differs from the ELC protocol in that its primary purpose is not for identifying and delineating wetlands but rather evaluating them. In the absence of exhaustive and adequate wetland inventories, OWES has incorporated a wetland mapping methodology to accompany its evaluation protocol.

The Region of Niagara under their Official Plan Amendment 187 used the OWES definition of wetlands. (RMN, 2008 p. 41)

The Generic Regulations of the Niagara Peninsula Conservation Authority (NPCA) under the Conservation Authorities Act, R.S.O. 1990, c. C.27 defines a wetland as:

- is seasonally or permanently covered by shallow water or has a water table close to or at the surface;
- directly contributes to the hydrological function of a watershed through connection with a surface watercourse;
- has hydric soils, the formation of which has been caused by the presence of abundant water; and
- has vegetation dominated by hydrophytic plants and water tolerant plants, the dominance of which has been favoured by the presence of abundant water

Given that the above definitions generally align with the OWES definition, it was felt that it was most efficient to integrate the OWES wetlands into the ELC Community Series fabric and to not duplicate delineation efforts despite the subtle differences in their actual mapping approaches. This was accomplished by building the fabric initially off of the most current OWES wetland linework from the MNR as it became available.

At the start of the NAI in 2006, MNR had already begun the process of updating the evaluated wetland mapping for 20 Mile creek, Fort Erie and some other areas to coincide with the Watershed Plans of the CA.

The CA and MNR partnered to accelerate the process of the OWES updates and to complete the draft linework for the NAI study area ahead of the field work.

The MNR protocol for evaluating wetlands includes a desktop exercise of interpreting air photos followed by field work, much like the Community Series mapping process. The MNR through the partnership with the CA under the NAI was able to capitalize on the data gathered in the field for the purpose of their evaluation. The CA in turn built the upland Community Series fabric off of the MNR wetland lines to help target field efforts and speed up the gathering of data.

Overall, the partnership ensured consistency in the core identification of wetlands on the landscape. There will be future site specific variation particularly where fieldwork was not completed.

In addition, the OWES minimum mapping unit criteria and the ELC “complexing” rules lead to some unevaluated wetlands throughout the study area that have been identified through the Community Series interpretation of the NAI.

6.2.1 Wetland Community Series Codes

The following ELC-Community Series codes were considered “Wetlands” for the purpose of this landscape level analysis:

MAM – Meadow Marsh
MAS – Shallow Marsh
MAX – Unidentified Marsh Community Class
*SWD – Deciduous Swamp
SWT – Thicket Swamp
SWX – Unidentified Swamp Community Class
SAS – Submerged Shallow Aquatic
SAF – Floating-leaved Shallow Aquatic
OAO – Open Aquatic
OAW – Open Water
**WET – wetland placeholder

*Deciduous Swamps are a very special case in the study area since they need to be included as not just wooded areas, but also as wetlands. This of course can skew the percentages for each. Further discussion will follow.

**WET – is a placeholder for a wetland that is awaiting final wetland evaluation linework that has not yet been classified by community type.

6.2.2 Wetland Communities Analysis

The ‘Wetland’ coverage for the watershed based on the NAI ELC Community Series fabric is 12.15 %.

Most would not realize that until now, wetlands in Niagara have never been thoroughly inventoried. This is likely in part due to their complicated ecological definition which is not the basis for the mapping criteria in traditional base mapping products. These particular datasets tend to discern wetlands in a general land cover context and therefore identify only the obvious wetlands on the landscape like the large marshes at the mouths of significant watercourses, or massive features like the Wainfleet Bog. Another contributing factor would be that despite there being a persistent need for complete wetland mapping for resource inventory purposes, the priority has only relatively recently escalated with the use for regulatory purposes.

The Ontario Base Mapping (OBM) Series identified 0.1 % of the Niagara watershed as wetland. A later product, the 1990 Ontario Land Cover suggested wetland coverage of 1%. The best wetland mapping available prior to the MNR's most recent mapping efforts has been the legacy OWES wetland extents from the province's NRVIS system. This data was openly never a complete inventory effort and tallied wetlands at 3.73% of the watershed.

Recently MNR's SOLRIS product, incorporated these legacy OWES wetlands along with unevaluated features identified through remote sensing techniques, and estimated wetland coverage at 9.79%. Although better, SOLRIS still is a wetland 'indicator' product at best, as the extents for new unevaluated wetland identified through the automated remote sensing process could not be relied upon as appropriate boundaries for most wetland mapping uses.

Based on the MNR's current OWES remapping efforts (with the Lake Ontario Niagara municipalities, and parts of Hamilton yet to be completed), the percentage of evaluated wetland across the Niagara watershed has risen to 10.30%, already surpassing the SOLRIS estimates. When you add the unevaluated dominant wetland communities identified through the Community Series interpretation, wetland coverage in Niagara stands at 12.15%.

It should be noted that there is approximately 2.85% of the remaining landscape that is consider dominant wooded or successional areas in this analysis that are complexed with wetland communities functioning in sub-dominate roles. Combine this with what has yet to be added by finishing the MNR OWES remapping efforts in the remaining municipalities, and Niagara could be approaching a landscape with close to 15% of natural area coverage containing some degree of wetland function.

There is obviously a huge increase in the wetland percentage across the study area. This is a function of an inventory being near completed for the first time consistently across the watershed, but also partly due to the significant changes in how Deciduous Swamps and their associated sloughs in particular are mapped through the Ontario Wetland Evaluation System. This is important as swamps account for 75% of the wetlands currently identified.

In the older OWES data, sloughs were mapped individually within a larger wooded area and only the sloughs were counted as wetlands. Under the new approach to identification of wetlands under the OWES, where soils and species composition supports a wetland designation, an area much larger than the slough is now identified as wetland. These transitional wetland areas between individual sloughs within slough forest woodlands are now contributing to the final wetland delineation, which is very similar to the ELC Community Series mapping approach of complexing highly variable natural areas which are too difficult to map as a single community (ie. SWD / FOD / MAS).

Municipality	Wetlands Percent	Swamps Percent	OWES Percent
Wainfleet	21.54	18.84	20.14
Port Colborne	19.10	16.17	17.07
Fort Erie	17.43	14.86	13.14
Niagara Falls	17.29	13.40	14.51
West Lincoln	15.95	13.60	14.09
Thorold	13.60	6.21	7.60
Haldimand	12.51	5.10	10.72
Pelham	9.91	8.06	8.79
Welland	8.52	6.98	7.28
Grimsby	7.59	4.84	5.44
Lincoln	5.08	4.12	4.24
Hamilton*	3.41	2.91	3.41
Niagara-on-the-Lake	2.17	0.12	0.37
St. Catharines	1.33	0.00	0.60
Total NPCA	12.15	9.14	10.30

Wetland communities are concentrated in the southern portion of Niagara above the escarpment with the highest percentages occurring within the three Lake Erie municipalities. Niagara Falls, south of the Welland River, and West Lincoln on the clay plain also have significant wetland totals.

Three quarter of all wetlands are swamp communities, indicating that a considerable portion of Niagara's natural areas contain both wetland and wooded area habitat functions. This also suggests that other wetland community types like marshes constitute just 25% of the total wetlands and therefore may be under represented on the landscape.

6.3 Successional Communities

Historically, successional communities were not explicitly defined. Thickets for example were lumped in with wooded areas based on perceived heights of vegetation. This of course was very difficult to decipher in old aerial photos. Meadows were generally not mapped unless then were wet and then happened to be included with an evaluated wetland.

6.3.1 Successional Community Series Codes

*MEM – Mixed Meadow

MEX – Unidentified Meadow Community Class

THD – Deciduous Thicket

THC – Coniferous Thicket

THM – Mixed Thicket

THX – Unidentified Thicket Community Class

*MEM – Under ELC Meadows are split into Forb or Graminoid dominated communities.

At the Community Series level, it is very difficult to discern which it is so they are mostly listed as Mixed Meadows.

6.3.2 Successional Communities Analysis

Due to the fact that these communities were not historically mapped in this way, no historical percentages exist.

The overall percentage of successional communities for the watershed has been calculated as 6.73 %.

It is critically important to map these areas due to their habitat value for specialized species, and their role in supplying key ecological services associated with connectivity across the landscape.

These areas are under intense development pressure where they exist since they are often perceived as less valuable in the natural heritage sense than either wooded areas and wetlands. They are also by their very nature more easily cleared for development or agricultural uses making them vulnerable.

Municipality	Successional Percent
Welland	17.46
Niagara Falls	14.26
Grimsby	13.80
Fort Erie	12.35
Port Colborne	10.51
Thorold	9.59
Niagara-on-the-Lake	7.13
St. Catharines	5.41
Wainfleet	5.25
Pelham	5.13
Lincoln	4.66
Haldimand	4.43
West Lincoln	3.11
Hamilton*	0.02
Total NPCA	6.73

Successional areas seem to be most abundant in the south east portion of the watershed, with Welland leading the way due to spoil lands attributed with its industrial past (i.e. along canal). Niagara Falls, Fort Erie and Port Colborne also have significant tallies largely due to abandoned agricultural land. In the north, Grimsby also has a substantial tally for this community type.

One highlight in traditional agricultural areas of the watershed is an apparent increase in areas adjacent to watercourses being left as buffers. Where these are not classified as wetlands, they have never before been mapped. Under the NAI, they are now identified as natural area.

6.4 Unique Communities

Similar to successional communities, unique communities such as bluffs, rock barrens and shorelines were neither wetlands nor wooded areas and thus, were not historically mapped as natural areas.

Under the NAI these infrequent but unique communities are important habitat often with a compliment of rare species. They also provide other ecological services associated with connectivity due to their position in transitional areas.

6.4.1 Unique Community Series Codes

BLS – Shrub Bluff
 BLO – Open Bluff
 RBS – Shrub Rock Barren
 RBO – Open Rock Barren
 SHS – Shrub Shoreline
 SHO – Open Shoreline

Although many of these communities are dominated by shrubs generally associated with succession, they were excluded from the successional communities analysis. We are assuming that they are climax communities in this case due to the harsh conditions of bluff, rock barren and shoreline communities.

In addition, other unique communities such as sand barrens, taluses, and cliffs are by nature difficult to interpret from ortho imagery. For this reason, they have been grouped more generally into the communities listed above.

6.4.2 Unique Communities Analysis

Due to the fact that these communities were not historically mapped in this way, no historical percentages exist.

The overall percentage of unique communities for the watershed has been calculated as 0.80 %.

Municipality	Unique Percent
Fort Erie	0.51
Port Colborne	0.38
St. Catharines	0.06
Wainfleet	0.06
Haldimand	0.05
Lincoln	0.03
Niagara Falls	0.03
Grimsby	0.02
Niagara-on-the-Lake	0.01
Hamilton*	0.00
Pelham	0.00
Thorold	0.00
Welland	0.00
West Lincoln	0.00
Total NPCA	0.08

Highest tallies for these natural areas occur within lake-front municipalities by and large due to their bluff and shore communities.

6.5 Conclusion

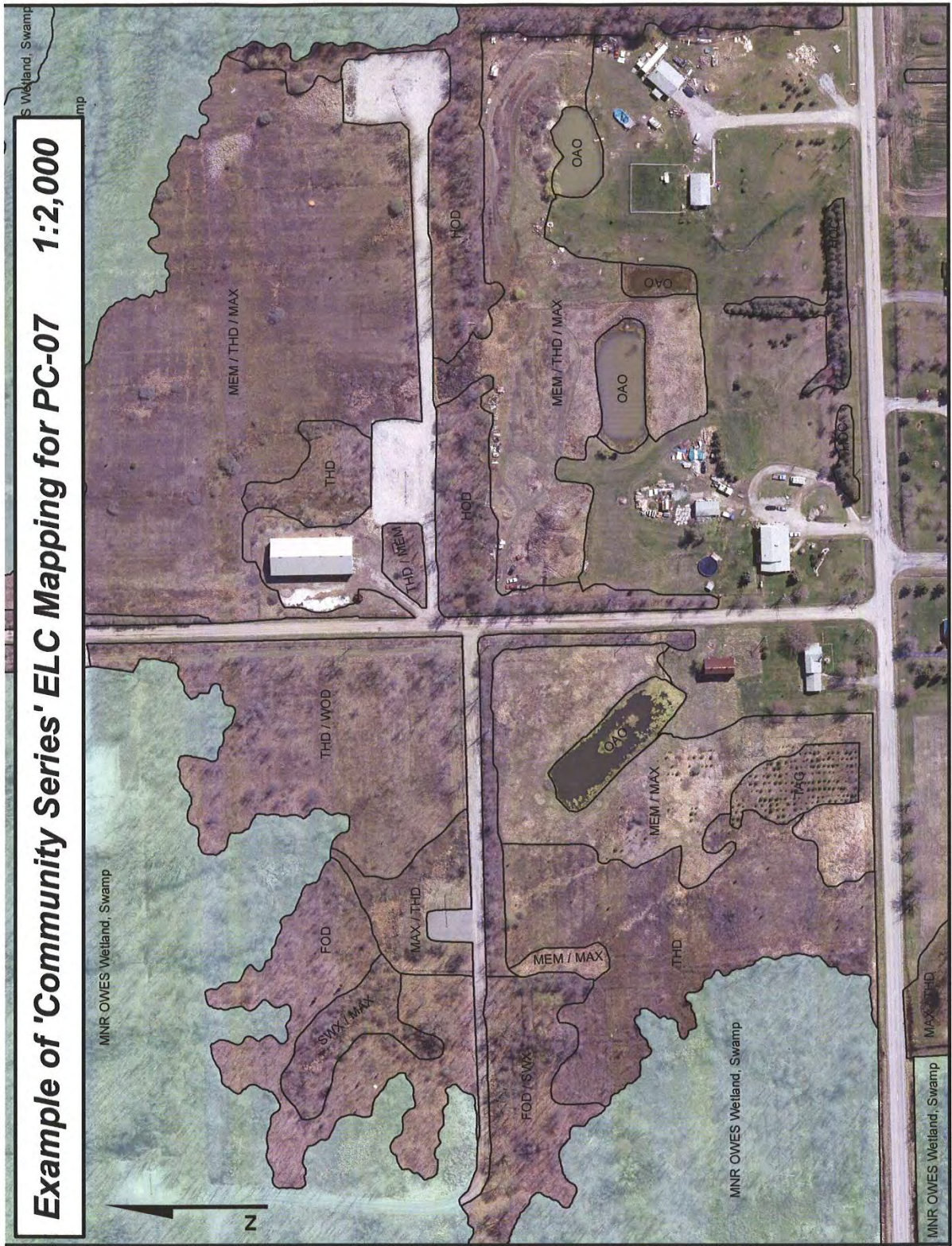
After applying the Community Series protocol at the landscape level we have developed mapping for a full compliment of natural heritage features on the landscape. They have been mapped at a 1:2000 scale allowing for site specific application of the extents. We can confidently use the mapped boundaries for a host of purposes including planning, policy development, restoration, and statistical analysis.

We have moved away from just looking at wetland and wooded communities when assessing the natural heritage of our watershed and have highlighted some of the more unique and specialized communities and in general, more accurately depicted the real world situation.

The depth of analysis and results presented here are a high level examination of what this mapping product as a complete and detailed inventory of Niagara's natural areas is capable of at the ELC class level. Once examination of the dataset is performed with account for both the dominant and subdominant communities codes for each polygon mapping unit, a more detailed landscape will emerge. Dry upland communities (FOC) will be able to be discerned from those that are mixed (FOD / SWD), climax communities (FOM) will be able to be separated from those that are more varied in maturity (WOD / THD / MEM), and insight into where true meadow communities and therefore potentially tallgrass prairie habitat exist (MEM). Once the dataset is finalized and analyzed to a higher level of scrutiny, it will be exciting to understand all that it is telling us, and its true value as an inventory will even be more apparent.

References

- Lee, H. T., W.D. Bakowski, J. Riley, J. Bowles, M. Puddister, P. Uhlig and S. McMurray. (1998). *Ecological Land Classification for Southern Ontario: First Approximation and its Application*. Ontario Ministry of Natural Resources, South Central Science Section, Science Development and Transfer Branch. SCSS Field Guide FG-02.
- Ontario Ministry of Natural Resources. (1993). Ontario Wetland Evaluation System – Southern Manual.
- Ontario Ministry of Natural Resources. (2007). Southern Ontario and Resource Information System (SOLRIS), Phase 2- Data Specifications, Version 2.
- Regional Municipality of Niagara. (2008). The Official Plan of the Region of Niagara – Amendment 187 as adopted by the Ontario Municipal Board.
Sample Mapping



(Complete Community Series Mapping on disc in back pocket)