# Middlesex Natural Heritage Systems Study

A study to identify Natural Heritage Systems in Middlesex County

2014

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Prepared by
**Upper Thames River Conservation Authority**
in cooperation with Middlesex County Conservation Authorities

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**Cover Photo**
North Thames River valley near Plover Mills. *Photo by Cathy Quinlan*

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**Project Study Team – Upper Thames River Conservation Authority**

| | |
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This project, like many other natural heritage projects in Middlesex County and beyond, benefitted greatly from the knowledge and guidance of Dr. Jane M. Bowles. Jane worked tirelessly on advancing natural heritage science and advocating for protection and restoration of natural heritage systems. Although she is gone, her legacy is an inspiration to all that work in the natural heritage field.

# Executive Summary

The 2014 Middlesex Natural Heritage Study (MNHSS 2014) evaluated the significant terrestrial (land) resources of the county using scientific methods and Geographic Information Systems (GIS) modeling.

Chapter 1 introduces the importance of the natural heritage systems planning, including policy rationale and a history of natural heritage planning in Middlesex County and the nearby counties of Huron and Oxford. The study scope is discussed, including the study area (geographic Middlesex), work plan and general limitations of the study.

Chapter 2 describes how the various components of the county's natural heritage system were defined and mapped. Using a variety of base mapping layers developed by the Middlesex County Conservation Authorities, the first step was to identify and delineate the smallest unit of vegetation, the *Vegetation Community*. Eighteen types of Vegetation Communities were delineated. The Vegetation Communities were then lumped into seven broader categories called *Vegetation Groups*: woodlands, thickets, meadows, water features, connected vegetation features and watercourse bluffs and depositional areas. Three Vegetation Ecosystems were defined: terrestrial, wetland and aquatic. The final step consisted of delineating Vegetation Patches, which are a mosaic of one or more abutting *Vegetation Groups*. Chapter 2 concludes with a summary of mapping results. In summary, there is 20.1% vegetation cover in the study area broken down as follows: 15.8% woodland cover, 1.0% thicket cover, 2.5% meadow cover, 0.7% water feature cover, and <0.1% connected vegetation feature cover. Wetland cover (comprised of woodland, thicket and meadow groups) is 3.5%. Environment Canada's targets for sustainability are 30% vegetation cover and 6-10% wetland cover.

Chapter 3 describes the 15 criteria used to identify significant natural heritage features and functions in the study area. Two types of criteria were developed: criteria for *Vegetation Groups* and criteria for Vegetation Patches. Three criteria are difficult to map and will have to be evaluated as part of the site specific field work needed for a Development Assessment Report (DAR). Each criterion is described, providing rationale, application/mapping rules and modeling results in terms of how many Vegetation Communities, Groups or Patches meet each criterion.

Chapter 4 summarizes the results of the criteria model. Patches meeting one or more criteria are deemed significant in this study. Maps showing the patches that meet one or more criteria for significance are provided for the study area (geographic Middlesex) as a whole and for each local municipality. Approximately 19.7% of the study area is in significant natural feature cover. This translates to 78.5% of patches (2749 of 3502) being identified as significant, representing 98.8% of the patch area. A comparison with the 2003 Middlesex Natural Heritage Study is provided.

Chapter 5 provides recommendations for the implementation of this science-based study. A number of land use planning related recommendations are provided along with additional stewardship and education recommendations.

American Beech.  Photo by Cathy Quinlan

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American Goldfinch. *Photo by Ron Ridout*

# 1.0 Background

## 1.1 Purpose of the Middlesex County Natural Heritage Systems Study

The Middlesex Natural Heritage Systems Study (MNHSS) addresses the need for information on the state of the county's natural areas and systems. The study provides a landscape level assessment of natural heritage features and functions. It builds on the 2003 Middlesex Natural Heritage Study (MNHS) (UTRCA 2003), which was a leading-edge study at the time.

The identification of significant natural features in southwestern Ontario is an important undertaking. Environment Canada (2013) identified that human activities, such as agriculture, urban development and associated infrastructure, have resulted in the loss or degradation of over 70% of the naturally vegetated areas in Southern Ontario. In some areas this reduction is greater. The remaining naturally vegetated areas tend to be in unconnected patches across the landscape. Intensive land use activities have also been found to contribute to degraded water quality conditions in many streams and lakes.

The Province of Ontario provides policy guidance to municipalities on matters of provincial interest in the Provincial Policy Statement (PPS). The PPS (2014) includes the following general directives for municipalities related to planning for natural heritage:

> ***Excerpt from the 2014 PPS (page 22)***
>
> **2.0 Wise Use and Management of Resources**
> Ontario's long-term prosperity, environmental health, and social well-being depend on conserving biodiversity, protecting the health of the Great Lakes, and protecting natural heritage, water, agricultural, mineral and cultural heritage and archaeological resources for their economic, environmental and social benefits.
> Accordingly:
> **2.1 Natural Heritage**
> 2.1.1 Natural features and areas shall be protected for the long term.
> 2.1.2 The diversity and connectivity of natural features in an area, and the long-term *ecological function* and biodiversity of *natural heritage systems*, should be maintained, restored or, where possible, improved, recognizing linkages between and among *natural heritage features and areas*, *surface water features* and *ground water features*.
> 2.1.3 *Natural heritage systems* shall be identified in Ecoregions 6E & 7E1, recognizing that *natural heritage systems* will vary in size and form in *settlement areas*, *rural areas*, and *prime agricultural areas*.

**Note:** Middlesex County is fully within the area identified as being in Ecoregions 6E and 7E in the PPS 2014.

The MNHSS (2014) is a science based study which uses high quality ortho-imagery and Geographic Information System (GIS) modeling to identify natural vegetation patches in the County that are considered to be "significant." In this context, significant is referring to the PPS (2014) definition of significant (see text box below).

***Excerpt from the 2014 PPS (pages 48, 49)***

Significant means

a) in regard to wetlands, coastal wetlands and areas of natural and scientific interest, an area identified as provincially significant by the Ontario Ministry of Natural Resources using evaluation procedures established by the Province, as amended from time to time;
b) in regard to woodlands, an area which is ecologically important in terms of features such as species composition, age of trees and stand history; functionally important due to its contribution to the broader landscape because of its location, size or due to the amount of forest cover in the planning area; or economically important due to site quality, species composition, or past management history. These are to be identified using criteria established by the Ontario Ministry of Natural Resources;
c) in regard to other features and areas in policy 2.1, ecologically important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area or natural heritage system;

Criteria for determining significance for the resources identified in sections (c)-(e) are recommended by the Province, but municipal approaches that achieve or exceed the same objective may also be used.

While some significant resources may already be identified and inventoried by official sources, the significance of others can only be determined after evaluation.

The MNHSS (2014) incorporates the most current information available from the Ministry of Natural Resources and Forestry (MNRF) to identify areas that meet components of the PPS definition of significant. The MNHSS methodology is intended to be a local approach to identifying elements of the natural heritage system as stated in second last paragraph of the definition.

The MNHSS provides mapping of the natural heritage system for the County of Middlesex and the City of London. The PPS (2014) defines the natural heritage system as follows:

> ***Excerpt from the 2014 PPS (page 45)***
>
> ***Natural heritage system:*** means a system made up of *natural heritage features and areas*, and linkages intended to provide connectivity (at the regional or site level) and support natural processes which are necessary to maintain biological and geological diversity, natural functions, viable populations of indigenous species, and ecosystems. These systems can include *natural heritage features and areas*, federal and provincial parks and conservation reserves, other natural heritage features, lands that have been restored or have the potential to be restored to a natural state, areas that support hydrologic functions, and working landscapes that enable ecological functions to continue. The Province has a recommended approach for identifying *natural heritage systems*, but municipal approaches that achieve or exceed the same objective may also be used.

Agriculture is the dominant land use in the County of Middlesex and in the area of the City of London that is located outside of the Urban Growth Boundary. The working agricultural fields can provide linkages between natural heritage features and areas and these linkages may be utilized in different ways depending on the cropping patterns or the time of year. The MNHSS does not attempt to map all of these potential system linkages but rather acknowledges that the agricultural landscape can provide linkages. Given the size of the study area, the predominantly agricultural land use and that land use change is anticipated to be limited, the MNHSS maps the natural heritage system at the county level of scale.

In cases where land use change is anticipated, the potential impact of the land use change on system linkages must be considered. For example, if agricultural land is proposed to be converted to urban development, the system linkages that would have been provided in the working agricultural landscape may be disrupted or eliminated by the post development urban landscape. In such cases it is necessary that natural heritage system linkages be studied at an appropriate level of detail and that system linkages be provided as part of the planning approval process.

For the area of London that is within the Urban Growth Boundary, the MNHSS provides a broader systems context within which existing urban development exists and new urban development may be planned.

## 1.2 The 2003 Middlesex Natural Heritage Study (MNHS)

The County of Middlesex has taken steps to identify and protect natural heritage features. The 2003 Middlesex Natural Heritage Study (MNHS) (UTRCA 2003) was led by the Conservation Authorities and completed for the County of Middlesex. Various partners participated in the project. The study has produced a solid information and policy basis to protect and rehabilitate the County's woodland and wetland features and systems. The 2003 MNHS had the following goals:

1. To increase understanding of the County's natural heritage features and systems (e.g. woodlands, wetlands, aquatic systems such as streams and rivers, threatened or endangered species, etc.).
2. To develop land use planning information and policy, at both the County and local municipal levels, in order to identify, protect and enhance the natural heritage features and systems.
3. To encourage and facilitate private stewardship and public education.
4. To strengthen links between natural areas and protect the relationships between plant and animal communities.

The study area did not include the City of London or the three First Nation Reserves.

The 2003 study was a pilot project for the Carolinian Canada Big Picture Project and the Ministry of Natural Resources Ecological Land Classification System. The study involved analysis of existing information along with new botanical information for private property that was collected as part of the study. This information, combined with a detailed review of the ecological literature, led to the development of a set of landscape criteria that were then modelled using Geographic Information System (GIS) technology.

To run the model, existing air photography and satellite imagery were used to create vegetation and watercourse information. The 2003 study provides a baseline for future comparison, a natural heritage systems map with a focus on woodlands, landscape criteria for considering woodland significance and a policy discussion to assist with implementation. The 2003 MNHS can be accessed at the following link: http://thamesriver.on.ca/watershed-health/natural-heritage-studies/middlesex-natural-heritage-study/.

The 2003 MNHS was accepted by Middlesex County Council. The current Middlesex County Official Plan relies on the 2003 MNHS to define significant woodlands and the Conservation Authorities have worked with the County to develop Development Assessment Report (DAR) guidelines and patch confirmation criteria to assist with implementation.

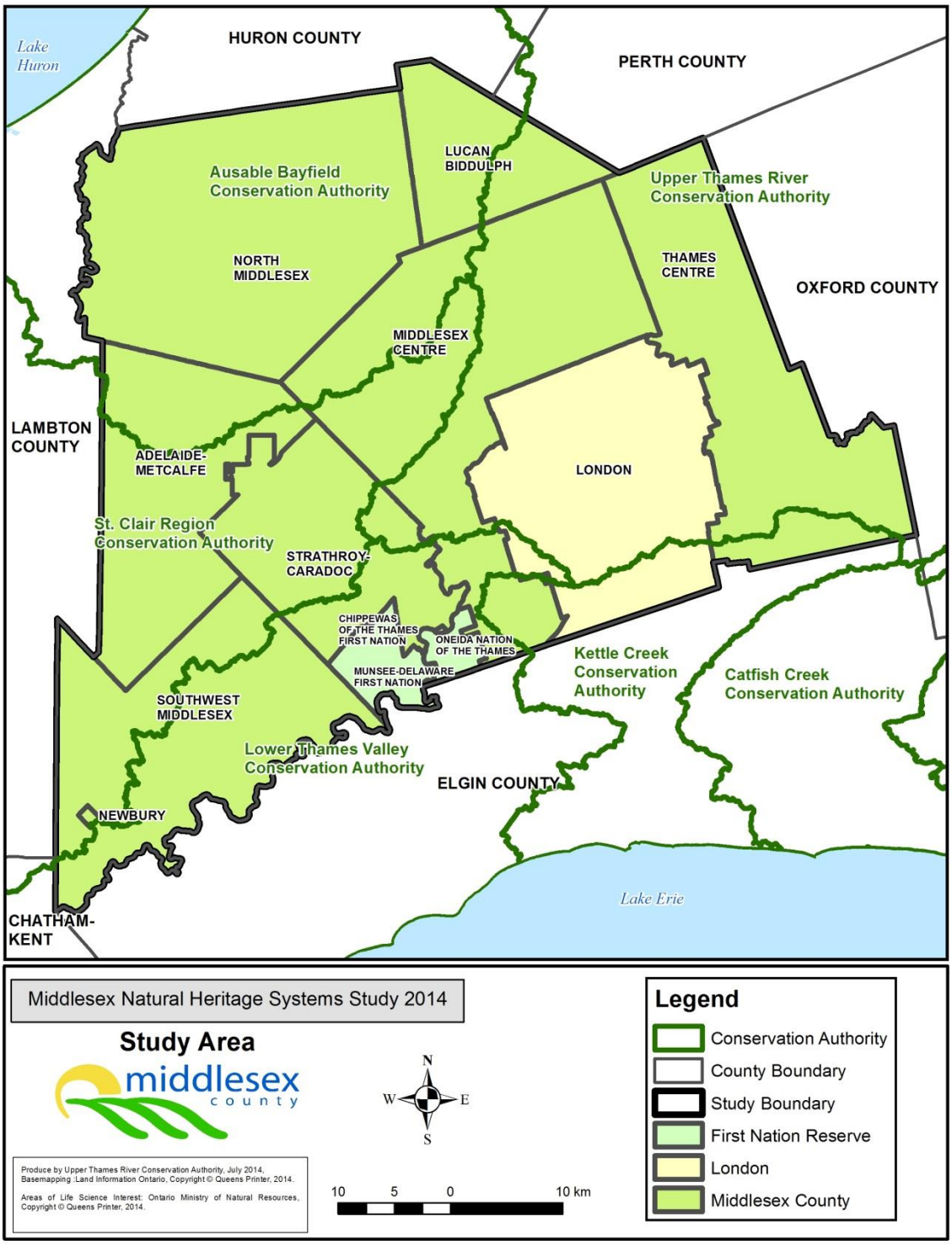
The science method developed through the MNHS has been built on over the years through other natural heritage studies. The 2006 Oxford County Natural Heritage Study (County of Oxford 2006) followed a similar landscape approach methodology. The ONHS broadens the approach beyond wooded areas to include flood plain meadows and other elements of the natural heritage system. The ONHS was received by the County of Oxford and subjected to a third party peer review. The basic approach was validated through the peer review and minor adjustments were made to some criteria. The County of Huron is nearing completion of a study that builds further on the peer reviewed ONHS. Refinements to the methodology for the Huron study have been made to incorporate the ONHS peer review results and also to refine the vegetation mapping methodology and to incorporate the Lake Huron shoreline and large river valley ecosystems.

## 1.3 Study Area

A map of the study area is shown in Figure 1. The study area includes the corporate County of Middlesex, the City of London and the three First Nation Reserves: Oneida Nation of the Thames, Chippewas of the Thames First Nation and Munsee-Delaware First Nation. This area includes part of five Conservation Authority watersheds, also shown in Figure 1. The three First Nation Reserves were included in the mapping of the Vegetation Patches and in the significance analysis as they are part of the natural heritage system of the study area. They are not included in the implementation recommendations other than that it is recommended that the County share the results of the mapping and analysis with First Nations for their consideration.

Aerial view of narrow "Back 40" woodlots in Middlesex County. *UTRCA Photo*

**Figure 1. County of Middlesex showing Member Municipalities, Conservation Authority Watersheds, City of London and First Nation Reserves.**



## 1.4 Project Governance, Committees and Peer Review

***Steering Committee***

Since this work was essentially an update to the 2003 Middlesex Natural Heritage Study, the methodology was somewhat streamlined. The project was guided by a Steering Committee with representatives from the following:

- County of Middlesex
- Local Municipalities
- The City of London
- Ausable Bayfield Conservation Authority
- Kettle Creek Conservation Authority
- Lower Thames Valley Conservation Authority
- St. Clair Region Conservation Authority
- Upper Thames River Conservation Authority
- Ministry of Natural Resources

The Steering Committee approved the final project proposal and oversaw the fulfillment of project time lines and deliverables. Any significant changes to project methodology or timing were approved by the Steering Committee. The Upper Thames River Conservation Authority (UTRCA) oversaw project coordination.

***Technical Committee***

A Technical Committee was established to assist with developing the Landscape Criteria for the updated MNHSS. The main work of the Technical Committee was completed through participation in a one day workshop in the fall of 2012.

Individuals with expertise in ecology, biology, Geographic Information Systems and planning from 19 organizations were invited to participate on the Technical Committee:

- County of Middlesex
- Municipality of Thames Centre
- Municipality of Strathroy-Caradoc
- The City of London
- Middlesex Conservation Authorities
    - Ausable Bayfield Conservation Authority
    - Kettle Creek Conservation Authority (could not attend)
    - Lower Thames Valley Conservation Authority
    - St. Clair Region Conservation Authority
    - Upper Thames River Conservation Authority
- Maitland Valley Conservation Authority
- Ministry of Natural Resources
- Carolinian Canada
- Ducks Unlimited Canada
- Nature Conservancy of Canada (could not attend)
- Western University / Thames Talbot Land Trust

- Staff from neighbouring counties
    - Oxford County
    - Lambton County
    - Perth County

At the workshop, there was a detailed review of the landscape criteria developed for the Huron Natural Heritage Study (the most current study) and, confirming or adjusting them to be applied to the updated MNHSS. The workshop was well attended and provided excellent feedback. UTRCA staff conducted further literature searches and edited the report.

***Peer Review***

The project was subjected to a technical peer review by a qualified third party expert at two stages in the process. First, the Peer Reviewer was asked to review the technical information and assumptions that were made by project technical staff to develop the draft MNHSS methodology and significance criteria. The Peer Reviewer provided detailed comments that were used to refine the study methodology and the preliminary GIS model was run to generate mapping. The Peer Reviewer was given draft outputs from the model and additional comments were provided. This second set of comments from the Peer Reviewer were reviewed and incorporated into the final project methodology.

Dorchester Swamp. *Photo by Cathy Quinlan*

## 1.5 Statement of Limitations (Scope)

The methodology for this study involves using the best available vegetation information from digital mapping layers and current landscape ecology literature to develop landscape criteria for significance (e.g., size, proximity). Several limitations are noted in this section.

### 1.5.1 Mapping Limitations

The base mapping layer is based on spring colour 2010 aerial photography (ortho-imagery). The 2014 MNHSS maps only the boundaries of the natural features in existence in 2010 as seen on the 2010 ortho-imagery. Base mapping layers are manually interpreted through an on-screen process. The *Vegetation Community* information is derived from the colours and patterns seen on the photography. Misinterpretation of certain features may occur. As well, the mapping layer is only accurate to the date and season when the air photo was taken.

Although the boundary of some natural heritage features will have changed from 2010 to present, it is important to use a base layer from a single point in time that is consistent across the county so that it can be used for future comparisons. The Ecological Site Assessment Process and/or associated DAR will verify any changes to the boundaries of the natural features.

Another limitation with mapping features that are developed and maintained by dynamic processes (e.g., old field succession) is that they are more likely to change over a shorter period of time than features that are more stable (e.g., mature woodlands).

For many of the ecosystem functions and derived services, it is not possible or appropriate to delineate clear spatial boundaries between natural heritage features. Often these boundaries are dynamic in both space and time, depending on seasonal patterns of rainfall and/or land use. Dynamic processes include geomorphology (e.g., bluff development), natural disturbances such as fire, wind erosion, flooding, plant succession (e.g., meadow to thicket to woodland), and anthropogenic disturbances (e.g., cattle grazing, drainage changes, deforestation, etc.).

### 1.5.2 Watercourse Layer

Due to budget constraints, the watercourse layer was not updated and, therefore, was not incorporated as a component of the natural heritage system for this study. Instead, *Vegetation Communities* adjacent to any major watercourse were identified as significant for their riparian functions. Through project development and peer review, the authors feel that the watercourse layer is an important element of the natural heritage system and encourage the County to update the layer and verify the classification of municipal drains under the Municipal Drain Classification Project (Department of Fisheries and Oceans Canada 1999), especially coldwater areas and other small watercourses. It should be noted that fish habitat is a natural heritage feature identified under Section 2.1 of the PPS, so all potential fish habitat (i.e., open watercourses) should be identified.

### 1.5.3 Connectivity and System Linkages

Ecological connectivity is a fundamental conservation biology principle that is scientifically defensible, yet difficult to identify given the dynamic nature of the landscape and the species within it (Rodewald 2003). Given the complexity of defining linkages and sustainability in an agricultural landscape, where it could be argued that the majority of farm fields are part of the system, the MNHSS does not attempt to identify current or future linkages between patches or across agricultural fields or neighbourhoods or along unvegetated stretches of watercourses as the concern over loss of connectivity is not as great as it is for urban areas.

Instead, Chapter 5 outlines recommendations for areas where there is a conversion of land use (e.g., from rural to urban) that affects the ability for species to move between natural features. The recommendations consider the site as a part of the overall system and demonstrate there is no impact on the loss of connectivity and linkages between the features defined in this study. The analysis of the loss of agricultural land to other uses must characterize and prioritize these linkages according to factors such as the presence of threatened and endangered species, proximity to other features, application of the Carolinian Canada Big Picture corridor rules, etc. As well, several significance criteria deal with proximity between Vegetation Communities and Patches.

This study evaluates what is significant, but does not attempt to analyze whether the natural heritage features are in the best location, nor does it build an ecologically sustainable ecosystem.

### 1.5.4 Features Identified through DARs

For features dependent on Development Assessment Reports (DARs) to identify them, mapping will not be comprehensive in the County Official Plan nor in the township Official Plans. Planners need to be informed that some features can only be identified through site inventory and ensure that the DAR considers all features, whether mapped or not. These features include:

- Significant Wildlife Habitat,
- Groundwater Dependent Ecosystems and
- Watercourse Bluffs and Depositional Areas.

Deciduous woodland in Southwest Middlesex. *Photo by Cathy Quinlan*

# 2.0 Mapping Guidelines

## 2.1 Assemble Digital Vegetation Layers (Base Mapping Layers)

Before evaluation criteria for significance can be applied to the natural heritage features of the County, it is necessary to develop a method to define and delineate these natural heritage features and systems. This is an important step as the delineation of natural heritage features will affect the application of some criteria (e.g., size and nearest neighbor calculations).

Photo interpretation techniques using 2010 South Western Ontario Ortho Photography (SWOOP) as a backdrop were used to prepare a detailed and comprehensive mapping product of the natural heritage features in Middlesex County.

The natural heritage features were defined using a minimum scale of 1:2,000. The work was prepared in partnership by various conservation authorities, building on earlier work prepared for the 2003 MNHS as outlined in Table 1.

**Table 1. Digital mapping layer development by CAs for the 2003 MNHS and 2014 MNHSS**

| | **2003 MNHS** | **2014 MNHSS** |
|---|---|---|
| **Product →** | Digital layer of Woodlands and Wooded Wetlands | Mapping update to include digital layers of Woodlands, Wetlands, Watercourses, Water Bodies, Thickets and Meadows |
| **Upper Thames River** | **UTRCA** developed the layer using a patchwork of 2000 black and white ortho-imagery combined with older paper mapping and some satellite imagery for areas not covered by the 2000 air photos | **UTRCA** updated the layer using 2010 colour imagery |
| **Lower Thames Valley** | Data acquired digital layer from OMNR and verified using colour Infared imagery and contact prints | **UTRCA** updated the layer using 2010 colour imagery |
| **Ausable Bayfield** | **ABCA** developed the layer using a patchwork of 1999 black and white ortho-imagery combined with older paper mapping and some satellite imagery for areas not covered by the 1999 air photos. | **ABCA** updated the layer using 2010 colour imagery |
| **Sydenham** | Data acquired digital layer from OMNR and verified using colour Infared imagery and contact prints | **SCRCA** updated the layer using 2010 colour imagery |
| **Kettle Creek** | Data acquired digital layer from OMNR and verified using colour Infared imagery and contact prints | **UTRCA** updated the layer using 2010 colour imagery |

## 2.2 Delineation of Digital Vegetation Layers

Air photo interpretation enables coarse level identification of *Vegetation Communities* without a site visit. All digital vegetation layers (a compilation of Conservation Authority and MNR data as described in Section 2.1) were corrected to reflect the 2010 colour ortho-imagery. For the UTRCA and ABCA watersheds, the vegetation had been corrected to the 2006 photography prior to this study for other purposes. In these areas, a comparison between 2006 and 2010 could provide additional information about the changes that occurred in natural heritage over that time. In the LTVCA, SCRCA and KCCA watersheds, only the woodlands and wooded wetland areas were previously updated to 2006 imagery. All other *Vegetation Communities* were interpreted and created from 2010 imagery.

Natural heritage in Middlesex County is comprised of a hierarchy of four vegetation layers or components described in detail in this chapter and shown in the schematic below. The smallest unit of delineation is the *Vegetation Community*. *Vegetation Communities* are lumped by type into *Vegetation Groups* and contiguous *Vegetation Groups* are then lumped into *Vegetation Patches* (see Table 2). *Vegetation Communities* are also lumped by type into *Vegetation Ecosystems*. The graphic below illustrates how the layers are put together.

Land ownership boundaries do not impact the creation of *Vegetation Communities*, *Groups*, *Ecosystems* and *Patches*. For example, any given *Vegetation Patch* could be under the jurisdiction of many landowners.

The metadata for *Vegetation Patch* and *Group* is included in Appendix F. The metadata for *Vegetation Community* is included in Appendix G.

**Vegetation Layers in the MNHSS**

**Vegetation Community**
smallest unit
18 types
↓
**Vegetation Group**
grouping of Vegetation Communities
7 types
↓
**Vegetation Patch**
grouping of contiguous Vegetation Groups

**Vegetation Communities and Ecosystems**

**Vegetation Community**
18 types
↓
**Vegetation Ecosystem**
grouping of Vegetation Communities
3 types

**Table 2. Relationship between *Vegetation Communities, Groups* and *Ecosystems***

| ***Vegetation Community*** **(18 types)** | ***Vegetation Group*** **(7 types)** | *Vegetation Ecosystem* **(3 types)** |
|---|---|---|
| Deciduous Woodland | Woodland | Terrestrial |
| Mixed Woodland | Woodland | Terrestrial |
| Coniferous Woodland | Woodland | Terrestrial |
| Mature Plantation | Woodland | Terrestrial |
| Deciduous Swamp | Woodland, Wetland | Wetland |
| Mixed Swamp | Woodland, Wetland | Wetland |
| Coniferous Swamp | Woodland, Wetland | Wetland |
| Plantation Swamp | Woodland, Wetland | Wetland |
| Upland Thicket | Thicket | Terrestrial |
| Young Plantation | Thicket | Terrestrial |
| Young Plantation Swamp | Thicket, Wetland | Wetland |
| Wetland Thicket | Thicket, Wetland | Wetland |
| Meadow Marsh | Meadow, Wetland | Wetland |
| Upland Meadow | Meadow | Terrestrial |
| Connected Vegetation Feature | Connected Vegetation Feature | Terrestrial |
| Watercourse Bluff and Depositional Areas | Watercourse Bluff, Bar or Beach | Terrestrial |
| Water bodies | Water Feature | Aquatic |
| Major Watercourses | Water Feature | Aquatic |

## 2.3 *Vegetation Communities*

The smallest unit mapped in Middlesex County, the *Vegetation Community*, is a unit of vegetation normally visible and consistently interpreted on remotely sensed images. *Vegetation Communities* are internally homogenous and distinguishable at a 1:2,000 scale by the dominant types of plant forms that characterize the *Vegetation Community*.

The *Vegetation Communities* must be at least 0.5 ha in area and 30 m wide to be included (length is the longer direction and width is the shorter). This minimum width was chosen to ensure the protection of the roots of some of the tree species. Tree roots often extend out from the core of the tree to a distance of at least the height of the tree, and the average height of a tree in Middlesex County is 30 m. Vegetated areas 20 to 30 m wide are considered connecting features (e.g., hedgerows), not woodlands. Linear treed areas <20 m wide are considered windbreaks and are not mapped or included in this study, though it is understood that wind breaks do provide many benefits to the environment including protection from soil erosion. For consistency, the 30 m width was chosen as the minimum width for thickets and meadows as well as woodlands.

A Minimum Mapping Unit (MMU) of 0.5 ha was used as the minimum size of an isolated *Vegetation Community*. The Ecological Land Classification (ELC) (Lee et al. 1998) uses 0.5 ha since vegetation features <0.5 ha are too small to be visible on air photos or to map. Land cover classifications commonly use a MMU of 0.5 ha to 1 ha for large scale county level maps, and 10 to 100 ha for very small scale regional maps.

Exceptions to the 0.5 ha MMU rule in this study include:

i) ***Connected Vegetation Features.*** These features do not have a minimal area associated with them, but they do have to be > 20 m in length and 20 to 30 m in width.
ii) ***Provincially Significant Wetlands.*** Some evaluated wetland communities are smaller than 0.5 ha and are retained as part of the natural heritage system.
iii) ***Artifacts of Mapping***. *Vegetation Communities* smaller than 0.5 ha in size are identified if they are either: 1) surrounded by *Vegetation Communities* or 2) connect two or more *Vegetation Communities* that are greater than 0.5 ha. *Vegetation Communities* less than 0.5 ha do not, by themselves, become a *Vegetation Group*, but they are included in the *Vegetation Patch* to maintain shape and size of the *Vegetation Patch* (see Figure 3).

*Vegetation Communities* in Middlesex County were mapped and updated following the manual on-screen digitizing procedures outlined in the Southern Ontario Land Resources Information System (SOLRIS) Image Interpretation Manual (OMNR 2004), with the following three exceptions:

i) ***Human Disturbance*** − Vegetated and non-vegetated features maintained by human disturbance, such as agriculture, pasture, aggregate operations, orchards, and impervious land uses, are not identified in this study.
ii) ***Structures*** − Buildings or structures less than 20 m in width are considered part of the surrounding natural feature (i.e., there is no hole carved out of the natural feature).
iii) ***Roads*** − All municipal roads separate *Vegetation Communities* regardless of their width. However, later, when *Vegetation Communities* are put into *Vegetation Groups*, clustering rules apply (see Section 2.4).

**Note:** Features such as agricultural fields, water bodies and watercourses <20 m wide are also considered part of the surrounding natural feature (i.e., they do not cause a break in the *Vegetation Community*), as per the SOLRIS manual.

Eighteen types of *Vegetation Communities* were delineated in Middlesex County. Table 3 provides a description of each *Vegetation Community* including how they are identified and the ELC equivalent. The ELC code name descriptions are provided in Appendix A.

In the ELC, woodland and forest are different types of habitat, where woodlands have 35-60% tree cover and forests have >60% tree cover. In this study, the word woodland is used instead of forest to be consistent with the PPS.

Marsh vegetation (Joe-Pye Weed and cattails) around a pond in London. *Photo by Cathy Quinlan*

**Table 3. Definition and attributes of the 18 *Vegetation Communities***

| *Vegetation Community* | Description and Methods uses for Identification on Imagery | ELC Equivalent (Appendix A) |
|---|---|---|
| **1. Deciduous Woodland** | - Comprised of tree species that lose their leaves at the end of the growing season and are capable of reaching heights of several metres (typically 20-30 m).<br>- Individual deciduous trees have a billowy texture on air photography. If the image is taken when trees are not in leaf, individual trees have a translucent appearance such that tree trunks can be seen through the branching canopy. | FOD |
| **2. Mixed Woodland** | - Comprised of a combination of coniferous and deciduous tree species scattered throughout.<br>- Each tree type comprises >25% but <75% of the canopy. | FOM |
| **3. Coniferous Woodland** | - Comprised of > 60% coniferous (cone-bearing) tree species capable of reaching heights of several metres.<br>- Individual trees are dark in colour as most are evergreen, and have a conical shape with a pointed top. | FOC |
| **4. Mature Plantation** | - Comprised of deciduous and/or coniferous tree species.<br>- Most often started off as rows of conifers, and then the area filled in with deciduous trees.<br>- Boundary distinguishable by at least one edge with a straight line<br>- At maturity, individual trees or rows of trees are not clearly discernible at 1:2,000. | CUP |
| **5. Deciduous Swamp** | - Deciduous woodland with a more open canopy (indicating lower tree vigor) located in a wetland as identified by OMNR or CAs.<br>- Common in Middlesex.<br>- The standing water appears dark in colour. | SWD |
| **6. Mixed Swamp** | - Mixed woodland (coniferous and deciduous) with a more open canopy (indicating lower tree vigor) located in an OMNR or CA identified wetland area. | SWM |
| **7. Coniferous Swamp** | - Coniferous woodland with a more open canopy (indicating lower tree vigor) located in an OMNR or CA identified wetland area.<br>- Treed bogs, a type of coniferous wetland, are uncommon and often have a pond or low open thicket at the centre. | SWC |
| **8. Plantation Swamp** | - A mature plantation with a more open canopy (indicating lower tree vigor) located in an OMNR or CA identified wetland area.<br>- Not common in Middlesex.<br>- Trees are usually conifers. | CUP |
| **9. Upland Thicket** | - Comprised of 25 to 60% tree or shrub cover (i.e., woody plants that are not capable of reaching heights of several metres).<br>- Less than 20% standing water. | TPW, CUT, CUW |

| | | |
|---|---|---|
| **10. Wetland Thicket** | - A thicket *Vegetation Community* that is found either along a watercourse, has >20% standing water, or is located in an OMNR or CA identified wetland area.<br>- Has either 10-25% tree cover or, <10% tree cover and >25% shrub cover.<br>- Dark water tones interspersed throughout demarking standing water. | SWT, FET, FES, BOT, BOS |
| **11. Young Plantation** | - Comprised of coniferous (usually) or deciduous trees planted in rows that are discernable at 1:2,000 scale.<br>- Boundary distinguishable by at least one edge with a straight line<br>- Does NOT include Christmas tree farms, fruit orchards, or other tree cash crops. | CUT, CUW |
| **12. Young Plantation Wetland** | - A young plantation *Vegetation Community* located in an OMNR or CA identified wetland area where individual trees or rows of trees are discernible at 1:2,000. Trees are usually conifers. | CUT |
| **13. Upland Meadow** | - Comprised of grasses or forbs where less than 25% of the canopy is comprised of woody plants. Trees or shrubs often widely scattered | TPO, CUM |
| **14. Meadow Marsh** | - A meadow marsh *Vegetation Community* located in a wetland identified by the OMNR or CA, comprised of cattails, wetland grasses and other wetland forbs (non-treed).<br>- Fens and open bogs may not be distinguished in the wetland mapping layer. They are uncommon in Middlesex County. They should be distinguished when conducting DAR surveys. | FEO, BOO, MAM, MAS, SAS, SAM, SAF |
| **15. Water Bodies** | - Comprised of a body of standing water at least 20 m wide adjacent to another *Vegetation Community*. Can include a:<br>• man-made pond associated with construction or extraction (e.g., aggregate pit),<br>• reservoir created by a dam or barrier,<br>• natural pond within a wetland or a natural water feature such as a kettle lake, or<br>• sewage lagoon found in/on the outskirts of an urban area.<br>- Appears as a flat plain surface on air photos; may show patterns of wind disturbance, floating aquatic vegetation, or cloud reflections. | OAO |
| **16. Major Watercourse** | - A linear feature >1 km long and mostly >20 m wide and containing flowing water at least for part of the year.<br>- Delineated as a polygon using bank-full width as seen on aerial photography flown in the spring.<br>- See Section 2.4.5 for more details. | OAO |
| **17. Connected Vegetation Feature** | - A linear feature comprised of woody plants that connects two or more *Vegetation Communities*, often called a hedgerow.<br>- Length is >20 m and width is >20 m but <30 m. See Section 2.4.6<br>- Considered one feature as long as there are no gaps >20 m.<br>- Often located between farm fields. | -- |
| **18. Watercourse Bluff and Depositional Areas (Bars, Beaches)** | - Bluffs: Areas of mostly bare soil along the outside meander of a watercourse or on steep slopes not being actively cultivated.<br>- Bars, Beaches: Appears as a sediment/stone depositional area along inside bends of watercourses.<br>- Currently not mapped. | BBO, BBS, BBT, BLO, BLS, BLT, CLO, CLS, CLT, TAO, TAS, TAT |

## 2.4 *Vegetation Groups*

Each *Vegetation Community* is assigned to broader *Vegetation Groups*. Seven types of *Vegetation Groups* were delineated in Middlesex County:

1) Wetland (contains woodland, thicket and meadow)
2) Woodland
3) Thicket
4) Meadow
5) Water Feature
6) Connected Vegetation Feature, and
7) Watercourse Bluff and Depositional Area.

*Vegetation Groups* are comprised of a mosaic of one or more *Vegetation Communities* within 20 m of each other (see Figures 2 and 3).

**Figure 2. Illustration of two Woodland *Vegetation Communities* (Deciduous Woodland and Deciduous Swamp) forming a *Woodland Group***

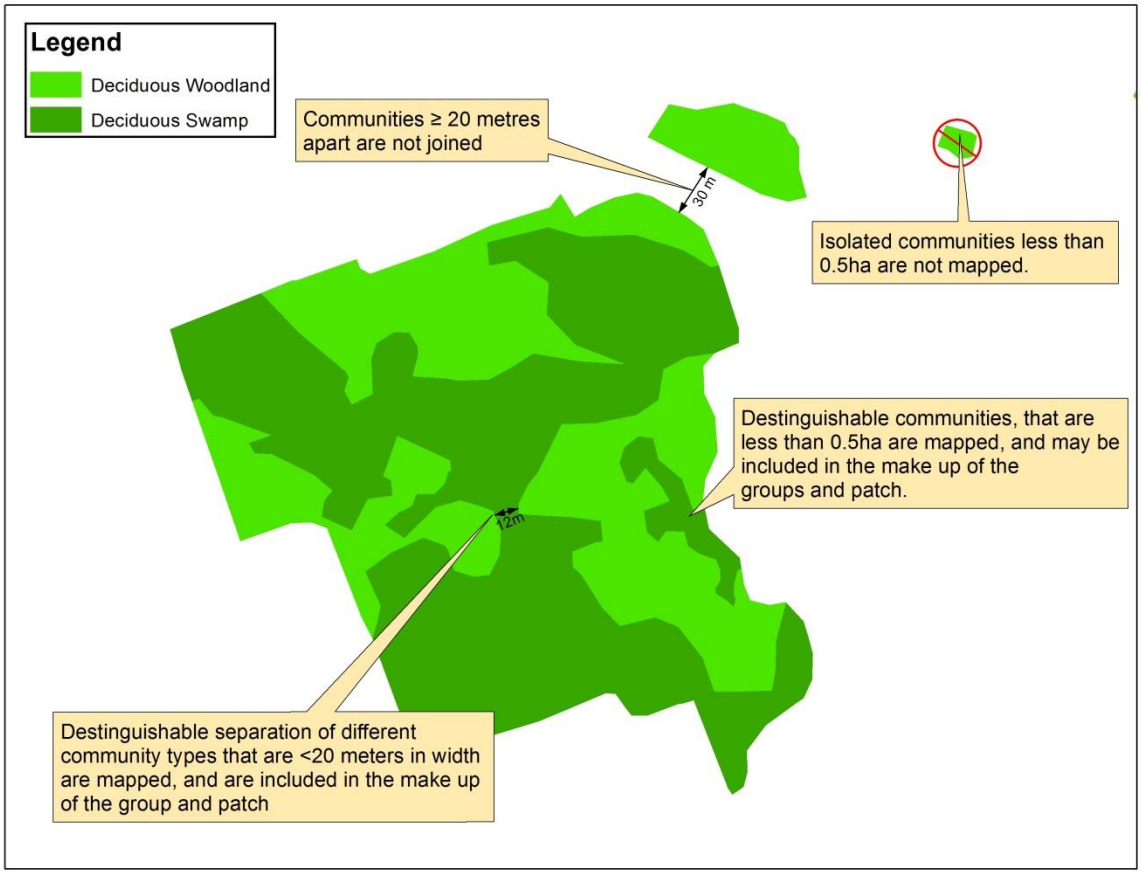


**Figure 3. Illustration of how small and large *Vegetation Communities* are combined into *Vegetation Groups* and *Patches***

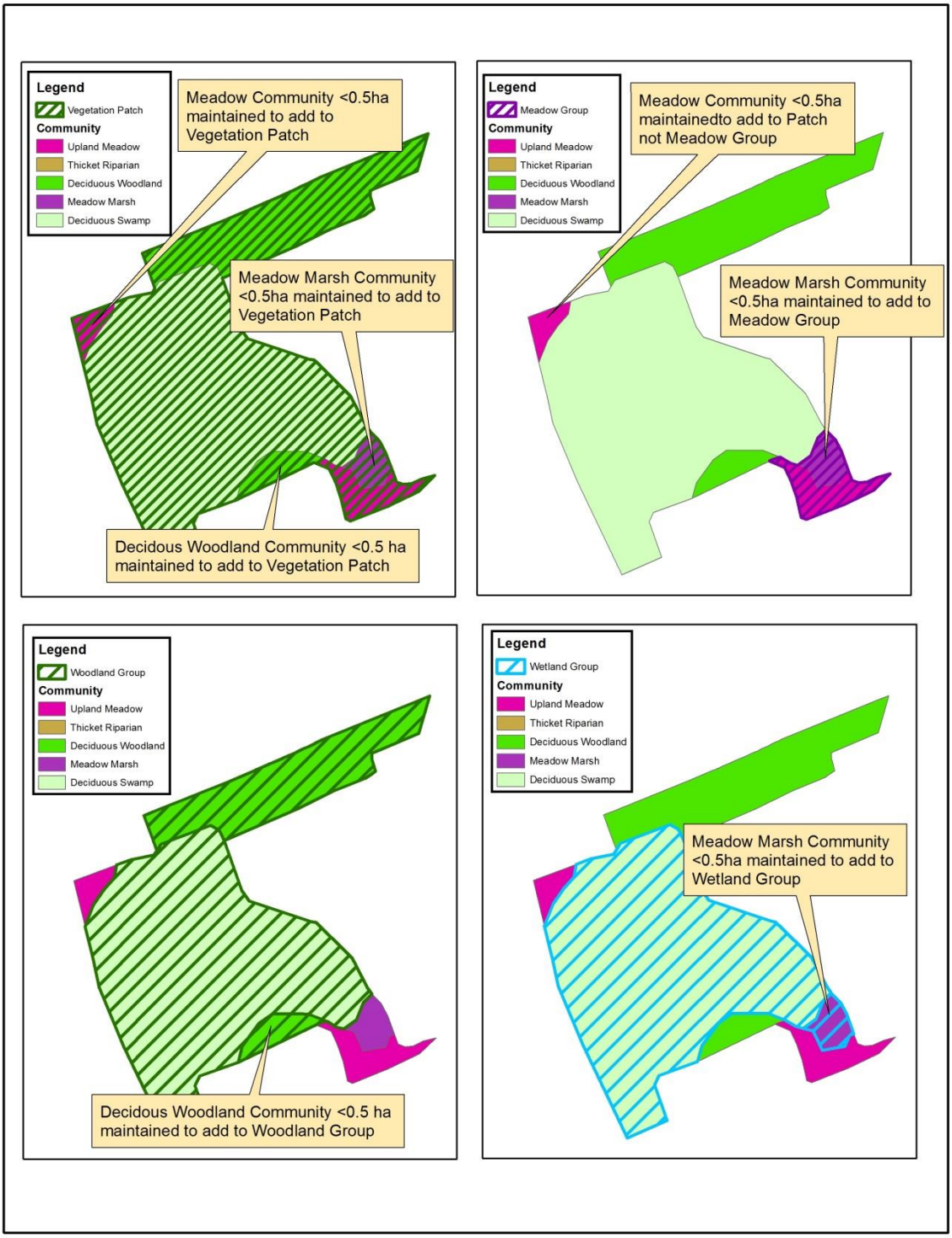


Table 3, shown earlier, presents a comparison between the *Vegetation Groups* identified in this study to the ELC *Vegetation Community* Series level (Lee et al. 1998). Appendix A contains more details. There are four main differences.

- The ELC distinguishes whether the vegetation is the result of an anthropogenic (cultural) process or a natural process. However, it should not be assumed that a cultural feature is not significant. Cultural, disturbed or successional natural features can have significant ecological functions and could be identified as Significant Wildlife Habitat (SWH). Therefore, it is important to consider any ELC communities classified as cultural for their potential to provide important ecological functions by comparing the community description with criteria in the Significant Wildlife Habitat Technical Guide. Thus, there is no distinction in the MNHSS 2014 as to whether the vegetation was influenced by natural or anthropogenic (cultural) processes.

- The ELC defines Open Water bodies as >2 m depth and Shallow Water bodies as <2 m depth. Since depth of water bodies cannot be determined from aerial photos or remotely sensed data, these two features are combined into a single open water feature.

- The key factor in distinguishing wetlands from water bodies and other aquatic components in the ELC is the presence of >25% emergent or woody vegetation cover. For this study, water bodies did not contain any water tolerant herbaceous or woody plants.

- The ELC distinguishes thickets, woodlands and forests. The ELC lists two types of woodlands, Tallgrass Woodland (TPW) and Cultural Woodland (CUW), with a tree cover of 35% to ≤60%. Both these woodland types are rare in the Middlesex area. For the MNHSS, these ELC woodlands were lumped in the thicket *Vegetation Community* because of the low tree cover. As well, the ELC defines forests as habitats with >60% tree cover. The MNHSS calls them woodlands to be consistent with the PPS wording. See Appendix A for more details.

### 2.4.1 Wetland *Vegetation Group*

The wetland *Vegetation Group* is comprised of seven wetland *Vegetation Communities* of which four are treed and three are untreed:

1) coniferous swamp (treed)
2) deciduous swamp (treed)
3) mixed swamp (treed)
4) plantation swamp (treed)
5) wetland thicket (untreed)
6) meadow marsh (untreed)
7) young plantation wetland (untreed)

The wetland information for Middlesex was derived from the OMNR Evaluated Wetlands layer and the Unevaluated Wetland layers from each conservation authority. A description of the methods used is included in Appendix B.

### 2.4.2 Woodland *Vegetation Group*

The Woodland *Vegetation Group* is comprised of eight *Vegetation Communities*, of which four are terrestrial/upland and four are wetland:

1) coniferous woodland (terrestrial/upland),
2) deciduous woodland (terrestrial/upland),
3) mixed woodland (terrestrial/upland),
4) mature plantation (terrestrial/upland),
5) coniferous swamp (wetland),
6) deciduous swamp (wetland),
7) mixed swamp (wetland) and
8) plantation swamp (wetland).

Mature plantations and plantation swamps are included as part of the woodland *Vegetation Group* as they are important components in the ecosystem. Mature plantations are old enough that the original tree rows (usually conifers) are not very visible on the ortho-imagery because a variety of other tree species (usually deciduous) have moved in. Plantation swamps are communities where trees have been planted in an area recognized as a wetland (evaluated or unevaluated) and the trees are full size or taller than shrub height.

Plantations, like natural forests and woodlands, contribute to the net removal of carbon dioxide from the atmosphere, produce oxygen, modify wind and temperature, remediate soil pollution and structure and provide wildlife habitat. Landowners often plant trees into a plantation or block planting to retire land from agriculture and begin the process of natural succession towards mature forest/woodland.

### 2.4.3 Thicket *Vegetation Group*

The Thicket *Vegetation Group* is comprised of four *Vegetation Communities*, two terrestrial/upland and two wetland:

1) upland thicket (terrestrial/upland),
2) young plantation (terrestrial/upland),
3) wetland thicket (wetland), and
4) young plantation wetland (wetland).

Thickets are usually early successional communities dominated by shrubs, young trees or stunted mature trees. Upland thickets that develop on abandoned farm fields succeed to woodland much more quickly than wetland thickets which tend to be found in areas too wet for trees. Wetland thickets may also succeed to swamp if the wetland slowly fills in. Thickets along watercourses may be maintained even longer as flooding and ice scour knock trees back. Young tree plantations are called thickets when the trees are still short (e.g., shrub height).

Table 3 provides definitions for each thicket *Vegetation Community*. To be included, thicket *Vegetation Communities* must be ≥30 m wide and ≥0.5 ha.

### 2.4.4 Meadow *Vegetation Group*

The Meadow *Vegetation Group* is comprised of two *Vegetation Communities*, one terrestrial/upland and one wetland:

1) upland meadow (terrestrial/upland), and
2) meadow marsh (wetland).

Table 3 (page 16) provides a description of the defining meadow habitat features. Meadows are short, open *Vegetation Communities* dominated by grasses and broad-leaved herbaceous plants and a scattering of shrubs and trees. Many meadows in Middlesex County are old fields of cultural origin (e.g., abandoned or retired farmland) and will, in time, succeed to thicket and then forest/woodland. However, meadows along watercourses may be more permanent habitats as the frequent flooding and ice scour keeps trees and shrubs from becoming established.

Meadows must be ≥30 m wide and ≥0.5 ha to be included. Pastures are not included in meadows as they are often heavily grazed and are part of the farm cycle.

Meadow habitat at Komoka Provincial Park. *Photo by Cathy Quinlan*

### 2.4.5 Water Feature *Vegetation Group*

The Water Feature *Vegetation Group* is comprised of two *Vegetation Communities*:

1) permanent water bodies and
2) major watercourses.

Permanent water bodies include natural and man-made ponds ≥20 m wide and ≥0.5 ha in size without any vegetation cover. Water features do not have any tree, shrub or emergent vegetation.

Major watercourses are defined as watercourses ≥20 wide and ≥1 km long. Short stretches of major watercourses that are <20 m wide are included as part of the major watercourse to maintain continuity. However, when a watercourse is <20 m wide for 1 km or longer, it no longer becomes a major watercourse and becomes part of the surrounding *Vegetation Group*.

### 2.4.6 Connected Vegetation Feature *Vegetation Group*

The Connected Vegetation Feature *Vegetation Group* is comprised only of the Connected Vegetation Features *Vegetation Community*.

Connected Vegetation Features are narrow *Vegetation Communities* consisting of trees and/or shrubs and are sometimes called hedgerows or shelterbelts. They are an important component of the natural heritage system because they provide corridors for wildlife movement as well as wildlife habitat, and may include remnants of vegetation present prior to disturbance (e.g., forest remnants). While more common in the past, many of these features have been or are being removed in the agricultural landscape to increase field size.

Section 7.3.2 of the Natural Heritage Reference Manual (NHRM) (OMNR 2010) recommends establishing a minimum width to these features to exclude relatively narrow linear treed areas (e.g., windbreaks) when delineating Woodland *Vegetation Groups*. Recognizing that breaks <20 m are too small to separate Woodland *Vegetation Groups*, the width of a connected vegetation feature was defined as being >20 m but <30 m in width.

***Note:*** The Natural Heritage Reference Manual recommends that, where the size threshold is 4 ha for woodland significance in a given planning area, a hedgerow is defined as <40 m wide. In the MNHSS, to account for both the minimum width and animal movement, connected vegetation features must connect two or more natural heritage features and be >20 m in length.

### 2.4.7 Watercourse Bluff and Depositional Area (Bar or Beach) Vegetation Group

This Watercourse Bluff and Depositional Area *Vegetation Group* is part of the terrestrial/upland *Vegetation Ecosystem* and consists of very open and generally active geomorphic sites including beach bars, cliffs and talus slopes, all of which represent unique and sometimes significant habitats for animals and plants.

Watercourse bluffs usually occur on steep slopes on an outside meander where active erosion takes place preventing the long-term establishment of vegetation. Bluffs are used by Bank Swallows and burrowing animals.

Depositional areas are often found on an inside river meander or on the downstream tip of river islands where sediment is deposited in slower moving water. Beach-like areas of sand and cobble result. They are generally open or unvegetated because of fluctuating water levels and water flow action. Their shape and even their presence changes from year to year, depending on flow conditions. Depositional Areas are used by wildlife such as snakes and turtles for basking and, in the case of Spiny Softshell turtles, for nesting.

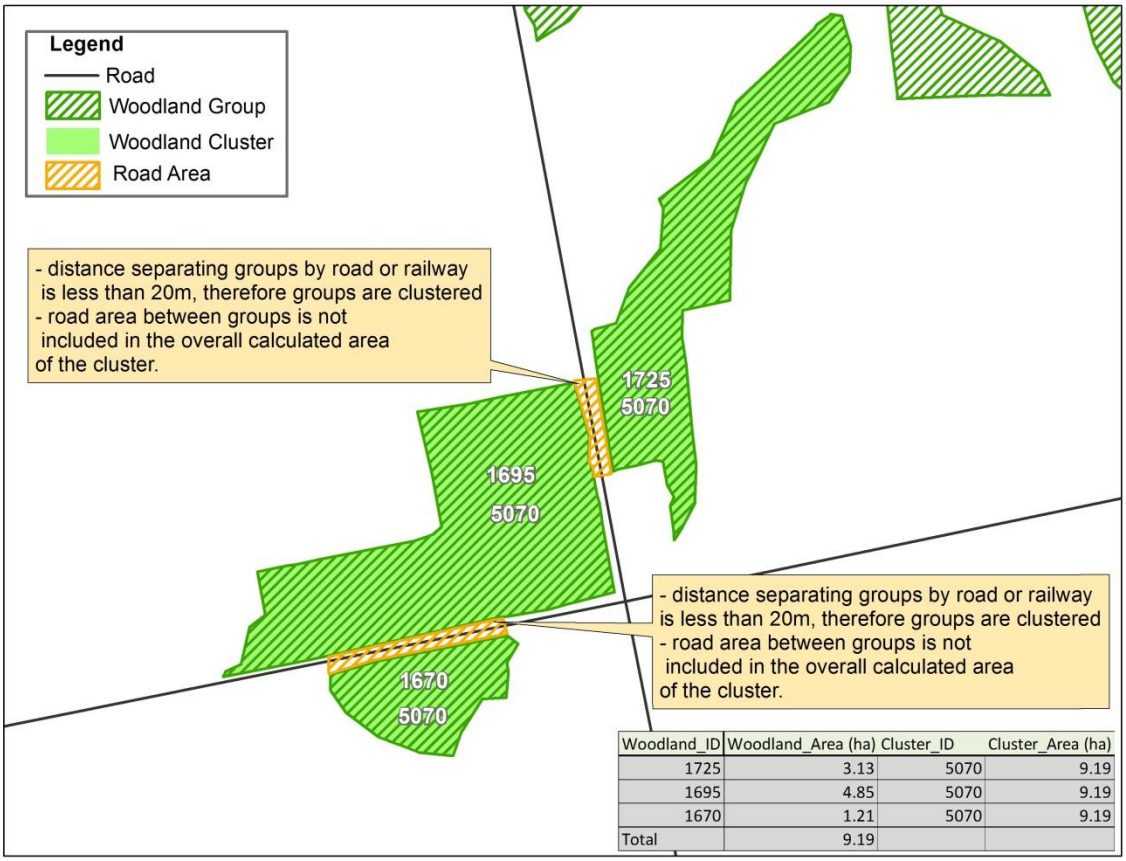
The dynamic nature of watercourses means these features are constantly being altered and recreated. These features are generally quite small and because of the vertical nature of Bluffs, they not very visible on ortho-imagery. Thus, most watercourse bluffs and depositional areas are not mapped currently and will need to be identified through field studies as part of the Ecological Site Assessment Process and recorded in the Development Assessment Report (see Chapter 5). These features do not have to meet a minimum size for mapping standards.

### 2.4.8 Clustering around Narrow (<20m) Roads and Railroads

As stated in Section 2.3, roads and railroads 20 m or wider separate *Vegetation Communities* and *Vegetation Groups* (i.e., the canopy must be separated by at least 20 m). Where roads/railroads are <20 m wide, the vegetation is not broken, but an extra step in the mapping is needed so that the area of the road is not included when vegetation area measurements are calculated, as per the Natural Heritage Reference Manual (OMNR 2010). This step is called clustering and the methodology is as follows (see Figure 4 example):

- A unique identification number is assigned to each *Vegetation Group* (in Figure 4: 1725, 1695, 1670).
- A unique cluster identification number is assigned to each clustered *Vegetation Group* (5070).
- Clustering was applied to the *Vegetation Groups* before modeling the significance criteria.
- Criteria that measure area were applied to the entire clustered *Vegetation Group* (5070), and then the area of the road was subtracted.
- The remaining significance criteria were applied to the clustered *Vegetation Groups* (5070).

**Figure 4. Illustration of clustering *Vegetation Groups* (1725, 1695, 1670) around narrow roads into one Woodland Cluster (5070)**




| Woodland_ID | Woodland_Area (ha) | Cluster_ID | Cluster_Area (ha) |
|---|---|---|---|
| 1725 | 3.13 | 5070 | 9.19 |
| 1695 | 4.85 | 5070 | 9.19 |
| 1670 | 1.21 | 5070 | 9.19 |
| Total | 9.19 | | |

## 2.5 *Vegetation Patches*

A *Vegetation Patch* is a mosaic of one or many different abutting (or <20 m apart) *Vegetation Groups* (see Figure 5).

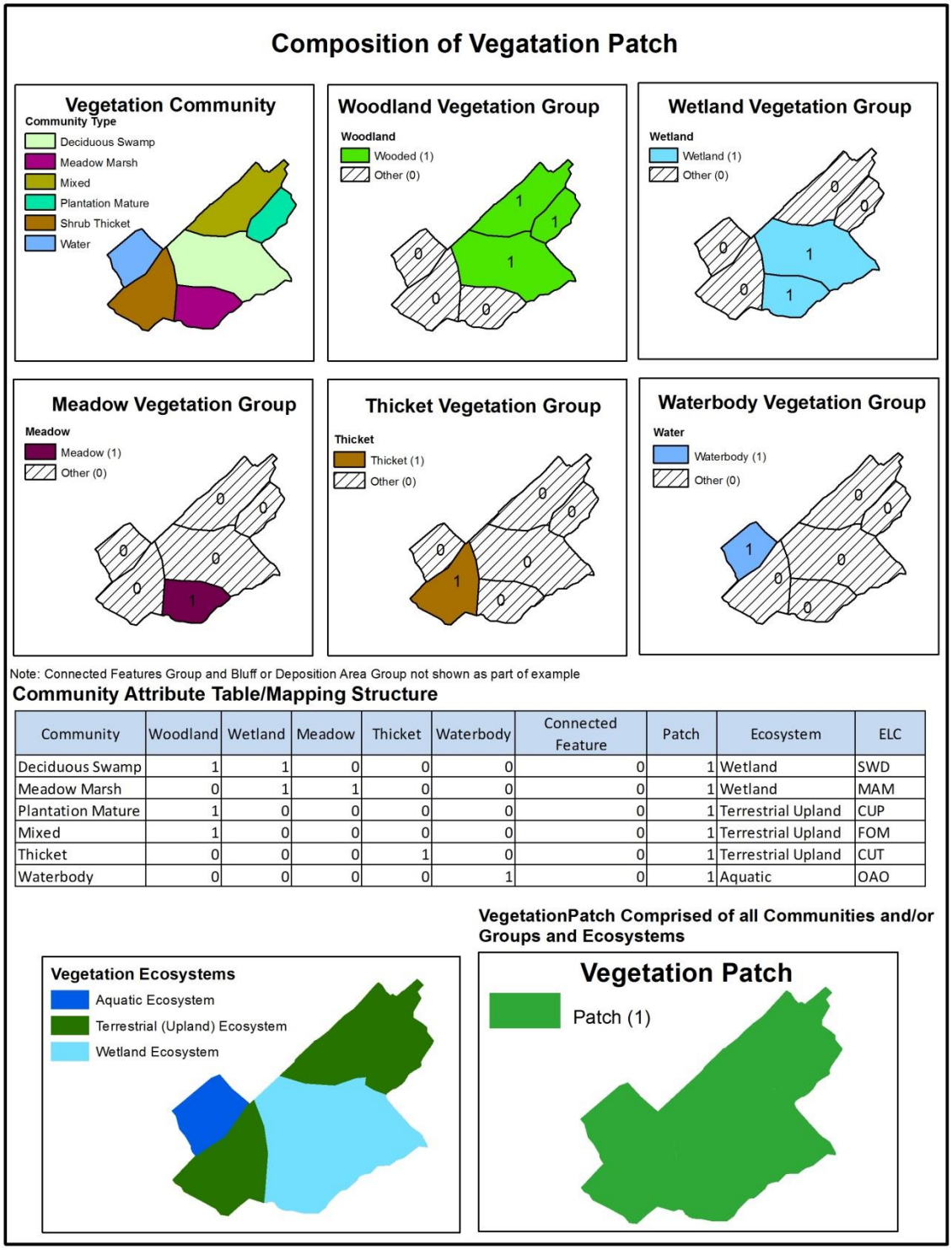
Roads >20 m wide separate *Vegetation Patches* as they do for *Vegetation Groups*. However, where smaller roads <20 m wide separate *Vegetation Patches*, the patches are rejoined as a cluster as described in Section 2.4.8. Clustering is applied to the *Vegetation Patches* before modeling the significance criteria. Since the NHRM does not calculate the area of a road when determining size and interior (OMNR 2010), area criteria will be applied to the entire clustered *Vegetation Patch* less the area of the road. The remaining significance criteria will be applied to the clustered *Vegetation Patches* and include the road and railroads as part of the *Vegetation Patch* (see Figure 4).

A *Vegetation Patch* digital layer was created with unique number attributes assigned to each *Vegetation Patch*:

- the unique identification number to each *Vegetation Patch*, and
- a unique cluster identification number for clustered *Vegetation Patch*(s).

Aerial photo of a large wetland/woodland patch near Dorchester. *Photo by UTRCA*

**Figure 5. Illustration of the composition of a *Vegetation Patch* comprised of different *Vegetation Communities*, *Groups* and *Ecosystems***




Note: Connected Features Group and Bluff or Deposition Area Group not shown as part of example

**Community Attribute Table/Mapping Structure**

| Community | Woodland | Wetland | Meadow | Thicket | Waterbody | Connected Feature | Patch | Ecosystem | ELC |
|---|---|---|---|---|---|---|---|---|---|
| Deciduous Swamp | 1 | 1 | 0 | 0 | 0 | 0 | 1 | Wetland | SWD |
| Meadow Marsh | 0 | 1 | 1 | 0 | 0 | 0 | 1 | Wetland | MAM |
| Plantation Mature | 1 | 0 | 0 | 0 | 0 | 0 | 1 | Terrestrial Upland | CUP |
| Mixed | 1 | 0 | 0 | 0 | 0 | 0 | 1 | Terrestrial Upland | FOM |
| Thicket | 0 | 0 | 0 | 1 | 0 | 0 | 1 | Terrestrial Upland | CUT |
| Waterbody | 0 | 0 | 0 | 0 | 1 | 0 | 1 | Aquatic | OAO |

## 2.6 *Vegetation Ecosystems*

The 18 *Vegetation Communities* belong to one of three *Vegetation Ecosystems*:

1) terrestrial,
2) wetland and
3) aquatic.

*Vegetation Groups* can belong to one or more *Vegetation Ecosystem* (see Table 4). For example, woodland, thicket and meadow *Vegetation Groups* include both wetland and terrestrial *Vegetation Communities*. The only time *Vegetation Ecosystems* are used is for Criterion 13 on habitat diversity.

***Terrestrial Vegetation Ecosystem***

Terrestrial *Vegetation Ecosystems* occur where soil moisture is scarce for at least some point in the growing season. Terrestrial *Vegetation Ecosystems* are distinguished from wetland or aquatic Vegetation Ecosystems by:

- a lower availability of water and the consequent importance of water as a limiting factor,
- greater temperature fluctuations on both a diurnal and seasonal basis,
- greater availability of light and gases (including carbon dioxide for photosynthesis, oxygen for aerobic respiration, and nitrogen for nitrogen fixation), and
- a subterranean portion (soil) from which most water and ions are obtained, and an atmospheric portion from which gases are obtained and where the physical energy of light is transformed into the organic energy of carbon-carbon bonds through the process of photosynthesis.

***Wetland Vegetation Ecosystem***

Wetland *Vegetation Ecosystems* are considered semi aquatic and are differentiated into swamp, marsh, bog and fen by the quality, quantity and timing of water and the associated vegetation that develops as a result of the input of water. Section 2.4.1 describes how these features were identified and delineated.

***Aquatic Vegetation Ecosystem***

Freshwater aquatic *Vegetation Ecosystems* are characterized as lotic (having flowing water) or lentic (still water). Lotic water systems include streams, springs, rivulets, creeks, brooks and rivers etc., and can be narrow, shallow and relatively rapid to increasingly broad, deep and slow moving. Lotic systems can be cold or warm water and the major source of food is the organic matter brought in from the surrounding terrestrial *Vegetation Ecosystems*. Therefore, nutrient levels tend to the higher downstream because there is continual addition of nutrients. Lentic systems include pools, ponds, some swamps, bogs and lakes. They vary considerably in physical, chemical and biological characteristics. For this study, aquatic *Vegetation Ecosystems* include natural or constructed permanent water bodies or major watercourses.

**Table 4. Relationship between *Vegetation Communities, Groups* and *Ecosystems***

| | Vegetation Ecosystem | | |
|---|---|---|---|
| ***Vegetation Group*** ↓ | **Aquatic** | **Wetland** | **Terrestrial** |
| ***Vegetation Community*** | | | |
| **Deciduous Woodland** | | | Yes |
| **Coniferous Woodland** | | | Yes |
| **Mixed Woodland** | | | Yes |
| **Mature Plantation** | | | Yes |
| **Deciduous Swamp** | | Yes | |
| **Mixed Swamp** | | Yes | |
| **Coniferous Swamp** | | Yes | |
| **Plantation Swamp** | | Yes | |
| **Upland Thicket** | | | Yes |
| **Wetland Thicket** | | Yes | |
| **Young Plantation** | | | Yes |
| **Young Plantation Wetland** | | Yes | |
| **Upland Meadow** | | | Yes |
| **Meadow Marsh** | | Yes | |
| **Water Bodies** | Yes | | |
| **Major Watercourse** | Yes | | |
| **Connected Vegetation Feature** | | | Yes |
| **Watercourse Bluff + Depositional Area** | | | Yes |
| ***Vegetation Group*** | | | |
| **Woodland** | | Yes | Yes |
| **Thicket** | | Yes | Yes |
| **Meadow** | | Yes | Yes |
| **Wetland** | | Yes | |
| **Water Body Feature** | Yes | | |
| **Connected Vegetation Feature** | | | Yes |
| **Watercourse Bluff + Depositional Area** | | | Yes |

## 2.7 Results of Mapping the Vegetation Layers

Table 5 summarizes the number and area of the three vegetation layers: communities, groups and patches. The 15,045 *Vegetation Communities* are merged into over 6,813 *Vegetation Groups*, and then are compiled into 3,502 *Vegetation Patches*. The total area of natural vegetation cover is around 66,887 ha, or 20.1% of the study area (geographic Middlesex). The area of each layer varies slightly due to the way the communities are merged (see Chapter 2).

**Table 5. Number and area of vegetation layers**

| **Vegetation Layers** | **Number** | **Area** (ha) | **% Area of Geographic Middlesex** (333,330ha) |
|---|---|---|---|
| **Communities** | 15,045 | 66,955 | |
| **Groups** (including wetlands) | 8,732 | 66,574 | |
| **Patches** | 3,502 | 66,887 | 20.1% |

Table 6 shows the number and area of each *Vegetation Community* in the study area. Table 7 shows the same information, sorted from largest to smallest area. The three *Vegetation Communities* making up the largest area are: deciduous woodland, deciduous swamp and upland meadow. Deciduous woodland is the largest community by far at 38,413 ha or 57.3% of the total vegetation cover and 11.5% of the study area. In second place is deciduous swamp at 7,843 ha or 11.7% of the total vegetation cover and 2.4% of the study area. A close third, upland meadow, covers 7,727 ha or 11.5% of the vegetation cover and 2.3% of the study area.

Table 8 summarizes the information by *Vegetation Group*. Overall, woodland covers 15.8% of geographic Middlesex, thicket covers 1.0%, meadow 2.5% and water features 0.7%. Connected vegetation features cover less than 0.1% and watercourse bluff and depositional area are not yet mapped but also will be very small.

There is 3.5% wetland cover in the county, comprised of swamps, wetland thickets and meadow marshes. The 3.5% wetland cover is part of the 20.1% vegetation cover.

**Table 6. Number and area of the 18 *Vegetation Community* types in the study area (geographic Middlesex)**

| *Vegetation Community* | Number of *Vegetation Communities* | Area of *Vegetation Communities* (ha) | % Area of all *Vegetation Communities* (66,955 ha) | % Area of Middlesex Land Base (333,330 ha) |
|---|---|---|---|---|
| **Deciduous Woodland** | 4928 | 38413 | 57.3 | 11.5 |
| **Mixed Woodland** | 622 | 3252 | 4.9 | 1.0 |
| **Coniferous Woodland** | 364 | 632 | 0.9 | 0.2 |
| **Mature Plantation** | 492 | 1326 | 2.0 | 0.4 |
| **Deciduous Swamp** | 1961 | 7843 | 11.7 | 2.4 |
| **Mixed Swamp** | 189 | 1299 | 1.9 | 0.4 |
| **Coniferous Swamp** | 17 | 47 | 0.1 | 0.0 |
| **Plantation Swamp** | 17 | 6 | 0.0 | 0.0 |
| **Upland Thicket** | 1182 | 2369 | 3.5 | 0.7 |
| **Wetland Thicket** | 175 | 333 | 0.5 | 0.1 |
| **Young Plantation** | 299 | 532 | 0.8 | 0.2 |
| **Young Plantation Swamp** | 3 | 1 | 0.0 | 0.0 |
| **Upland Meadow** | 3507 | 7727 | 11.5 | 2.3 |
| **Marsh Meadow (Meadow Marsh)** | 510 | 759 | 1.1 | 0.2 |
| **Water Body** | 535 | 1169 | 1.8 | 0.4 |
| **Major Watercourse** | 119 | 1150 | 1.8 | 0.3 |
| **Connected Vegetation Feature** | 125 | 97 | 0.1 | 0.0 |
| **Watercourse Bluff and Depositional Areas *** | Not mapped | -- | -- | -- |
| **TOTAL** | **15,045** | **66,955** | **100.0** | **20.1** |

*Not yet mapped as these features are usually too small to detect on air photos.

**Table 7. *Vegetation Community* types sorted by area**

| Order Number | *Vegetation Community* | Area (ha) |
|---|---|---|
| **1** | **Deciduous Woodland** | 38,413 |
| **2** | **Deciduous Swamp** | 7,843 |
| **3** | **Upland Meadow** | 7,727 |
| **4** | **Mixed Woodland** | 3,252 |
| **5** | **Upland Thicket** | 2,369 |
| **6** | **Mature Plantation** | 1,326 |
| **7** | **Mixed Swamp** | 1,299 |
| **8** | **Water Body** | 1,169 |
| **9** | **Major Watercourse** | 1,150 |
| **10** | **Marsh Meadow** | 759 |
| **11** | **Coniferous Woodland** | 632 |
| **12** | **Young Plantation** | 532 |
| **13** | **Wetland Thicket** | 333 |
| **14** | **Connected Vegetation Feature** | 97 |
| **15** | **Coniferous Swamp** | 47 |
| **16** | **Plantation Swamp** | 6 |
| **17** | **Young Plantation Swamp** | 1 |
| **18** | **Watercourse Bluff + Depositional Areas (Bars/Beaches)** | Not mapped |
| | **TOTAL** | **66,955** |

**Table 8. Number and area of *Vegetation Groups* as a percentage of the study area**

| **Vegetation Group** | **# of Groups** | **Area (ha)** | **% Area of Middlesex Land Base** (333,330 ha) |
|---|---|---|---|
| **Woodland** | 4,123 | 52,748 | 15.8% |
| **Thicket** | 1,365 | 3,205 | 1.0% |
| **Meadow** | 3,040 | 8,319 | 2.5% |
| **Water Feature** | 284 | 2,205 | 0.7% |
| **Connected Veg. Feature** | 124 | 97 | <0.1% |
| **Watercourse Bluff + Depositional Area** | 0 | 0 | Not mapped |
| **Total** | **8,936** | **66,574** | **20.1%** |
| **Wetland Group** (part of the total above) | 1,916 | 11,729 | 3.5% |

North Thames River valley in Thames Centre. *Photo by Cathy Quinlan*