Central Lake Ontario Conservation

2010

Terrestrial Watershed Monitoring Report

Spotted Touch-me-not
Impatiens capensis

Marsh Marigold
Caltha palustris

Wake Robin Trillium
Trillium erectum

What we do on the land is mirrored in the water

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Report No.: 2011-02MR

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EXECUTIVE SUMMARY

In 2010 Central Lake Ontario Conservation (CLOCA) staff began a long-term terrestrial monitoring program designed to monitor the ecological integrity of the Lynde Creek Watershed. The Terrestrial Watershed Monitoring program focuses on Forests, Wetlands and Non-forested communities, including meadows and thickets. Four forest plots, two wetland plots and two non-forested plots were established within the Lynde Creek Watershed; overall the average percent of non-native species within the systems were 18%, 33% and 49% respectively. A total of 21 non native species were observed, three of which are considered highly invasive.

2010 saw the continuation of three special monitoring projects; the special monitoring projects are more refined in scope and will be implemented when the need arises. These projects provide useful information on the success of stewardship projects, trail placement and hydrological changes at wetlands. One of these projects will not be continued in 2011 as it poses a threat to an ecologically sensitive area. Two new projects have been developed and will begin in the field season of 2011.

Monitoring within the Lynde Creek Watershed will occur again in 2014.

1.0 INTRODUCTION

The Terrestrial Watershed Monitoring Program (TWMP) was developed to help determine and monitor the trends of the ecological integrity of terrestrial natural areas within the Central Lake Ontario Conservation Authority's jurisdiction. CLOCA has used the Parks Canada Agency's Panel (1998) definition of Ecological Integrity, "an ecosystem has integrity when it is deemed characteristic for its natural region, including the composition and abundance of native species and biological communities, rates of changes and supporting processes. In plain language, ecosystems have integrity when they have their native components (plants, animals and other organisms) and processes (such as growth and reproductions) intact."

CLOCA monitors specific ecological indicators within a select group of systems that cover the landscape of CLOCA's jurisdiction. The systems monitored are grouped according to corresponding Ecological Land Classification (ELC) categories, and are described in Table 1. The indicators measured in each system are represented in Table 2.

Table 1: ELC Classification with corresponding system

Ecosystem Type	ELC Community Series Included
Forested Systems	Cultural Woodlots (CUW), Cultural Plantations (CUP), Deciduous Forests (FOD), Mixed Forests (FOM), Coniferous Forests (FOC)
Non-Coastal Wetland Systems	Deciduous Swamp (SWD), Mixed Swamp (SWM), Coniferous Swamp (SWC)
Non-Forested Systems	Cultural Thicket (CUT), Cultural Meadow (CUM)

Table 2: Ecological indicators by system

Ecosystem Type	Ecological Indicator
Forested Systems	Tree Health; Regeneration; Ground Vegetation; Biodiversity
Non-Forested Systems	Ground Vegetation; Biodiversity
Non-Coastal Wetland Systems	Tree Health; Regeneration; Ground Vegetation; Biodiversity

Alongside the regular Terrestrial Watershed Monitoring Program, special projects are taken on, and are more refined in scope. 2010 saw the continuation of three special projects, monitoring of Dog-Strangling Vine at Crow's Pass Conservation Area, Tree Planting survival assessments and surficial groundwater monitoring at Heber Down Provincially Significant Wetland. The latter two projects will be continued in 2011, and two more projects will be initiated; however the monitoring of Dog-Strangling Vine at Crow's Pass CA will not be continued into 2011.

2.0 TERRESTRIAL WATERSHED MONITORING

In 2010 the Terrestrial Watershed Monitoring program was implemented within the Lynde Creek Watershed (Figure 1). This watershed covers an approximate area of 130km^2, expanding across five municipalities; in the north there is the City of Pickering, the Townships of Uxbridge and Scugog; the Town of Ajax lies to the west and the larger remaining portion of the watershed is found within the Town of Whitby. The headwaters originate in the Oak Ridges Moraine and the resulting tributaries travel south through the old glacial Lake Iroquois beach towards the Lake Iroquois Lacustrine Plain, draining into Lake Ontario through the Lynde Shores Coastal Wetland.

Approximately 29% of the Lynde Creek watershed is naturally vegetated, which equates to 38.2 km^2 of the Lynde Creek watershed landscape. Table 3 summarizes the representation of vegetation communities within the watershed. Forested systems account for 11% of the watershed's cover, while non-forested systems and non-coastal wetlands account for 8% and 6% cover respectively. The remaining 4% of the total watershed cover consists of submergent, emergent, and floating marshes, meadow marshes, cultural savannahs, bluffs (treed and open) and fens (open, treed and shrub). These are not included in this monitoring program as they cover a very small portion of CLOCA's overall landscape and many of the marshes are monitored through the Durham Region Coastal Wetland Monitoring Program (DRCWMP).

Table 3: Natural Cover by ELC Community Class

Monitoring System	ELC Classification	Cover (ha)	Cover as % of total natural area in watershed	% Cover as total land area in watershed
Forested System	FOD, FOC, FOM, CUP, CUW	1487.86	39%	11%
Non-Forested System	CUT, CUM	1051.44	28%	8%
Non-Coastal Wetlands	SWM, SWD, SWC	729.37	19%	6%
Not included in monitoring program	MAM, MAS, SAS, SAM, SAF, CUS, BBO, BBT, FEO, FET, FES, OAO	551.95	14%	4%
Total			**100%**	**29%**

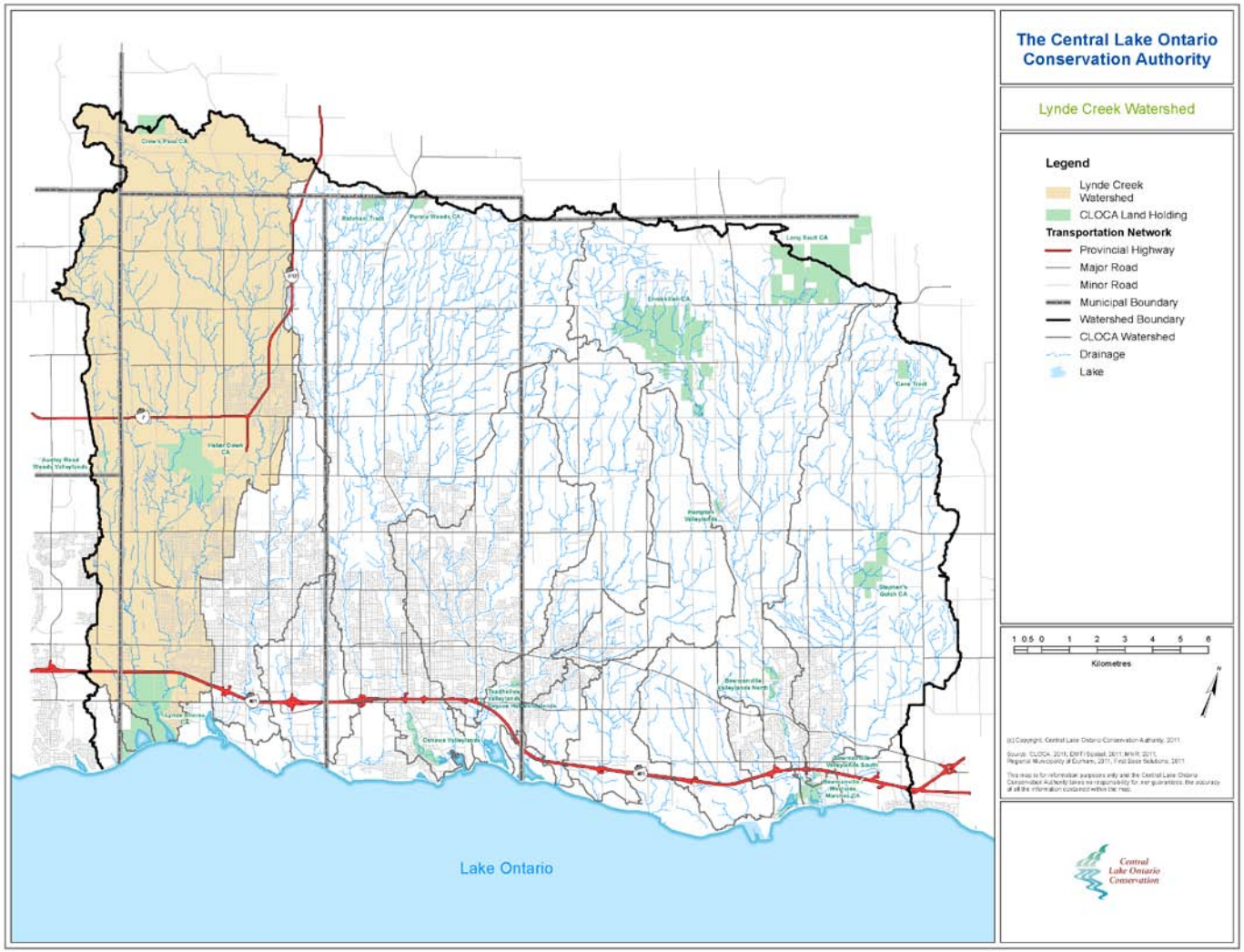

Figure 1: Lynde Creek Watershed

2.1 Forested Systems

Forests account for 39% of the natural cover within the Lynde Creek watershed, and only 11% of the entire watershed. Environment Canada (2004) recommends greater than 30% forest cover to ensure a healthy watershed. The Lynde Creek watershed's natural forest cover is evenly distributed between deciduous forests (FOD), mixed forests (FOM), cultural plantations (CUP) and woodlots (CUW) being 10%, 9%, 9%, 8% respectively, with the remaining 3% consisting of coniferous forest (FOC). Many of these areas are home to a variety of animal species, and it is vital to ensure the integrity of their habitat is maintained. For this reason, tree health, regeneration, ground vegetation and invasive species were observed.

Forest monitoring plots were established at four locations within the Lynde Creek watershed in 2010. All plots were 20mx20m plots located within CLOCA's Conservation Areas; together these plots cover a total area of 1600m^2. Forest plots were located along all three physiographic regions within CLOCA's jurisdiction. Fortunately, within the Lynde Creek watershed, CLOCA owns land within all three regions, making it feasible to accomplish this goal. As Figure 2 shows, forest plots were established, from south to north, within Lynde Shores Conservation Area, Audley Road Woods Conservation Area and Crow's Pass Conservation Area.

2.1.1 Tree Health

Tree size and disturbance history can help in understanding how the forest structure is changing, and when regularly monitored, can often help identify both short-term and long-term stresses on the system. These short-term stresses may include extreme weather, insect defoliation and many other factors. While long-term stresses may be more difficult to isolate and can result from surrounding land use changes, recreational uses, climate change, and an array of other factors.

The now retired Canadian Forest Service (Sajan, 2006) states that average annual mortality rates of 1% to 3% are considered normal, but a red flag should be raised at 5% mortality rates. This threshold will be used when monitoring and analyzing data, while recommendations to management practices will be made if mortality rates exceed this rate. To utilize this threshold, a baseline must be established to measure from and be compared against. At all four sites, tree health was assessed by observing the species, dbh (diameter at breast height), tree status (alive/dead), stem defects, and crown vigor (amount of defoliation). Table 4 shows the percent mortality at each site, keeping in mind that the data represented in the table below is meant to act as baseline data and the recommended threshold will not be applied to this year's data.

While high mortality rates can raise alarm, dying, decaying and dead trees play an integral role in forest ecosystems. As mentioned below, decomposing material can provide habitat and food sources for a variety of animals, including cavity nesters, and salamanders, the latter of which are sensitive indicator species. Decomposing material is also an important component in nutrient cycling.

Table 4: Forested Plots Tree Health Summary

Site Name	Site #	Mortality of Trees (%)	Evidence of Emerald Ash Borer
Audley Rd CA	ARCAF01	7%	None
Crow's Pass CA	CRPCAF01	22%	None
Crow's Pass CA	CRPCAF02	35%	None
Lynde Shores CA	LYSCAF01	0%	None
Overall		**20%**	**None**

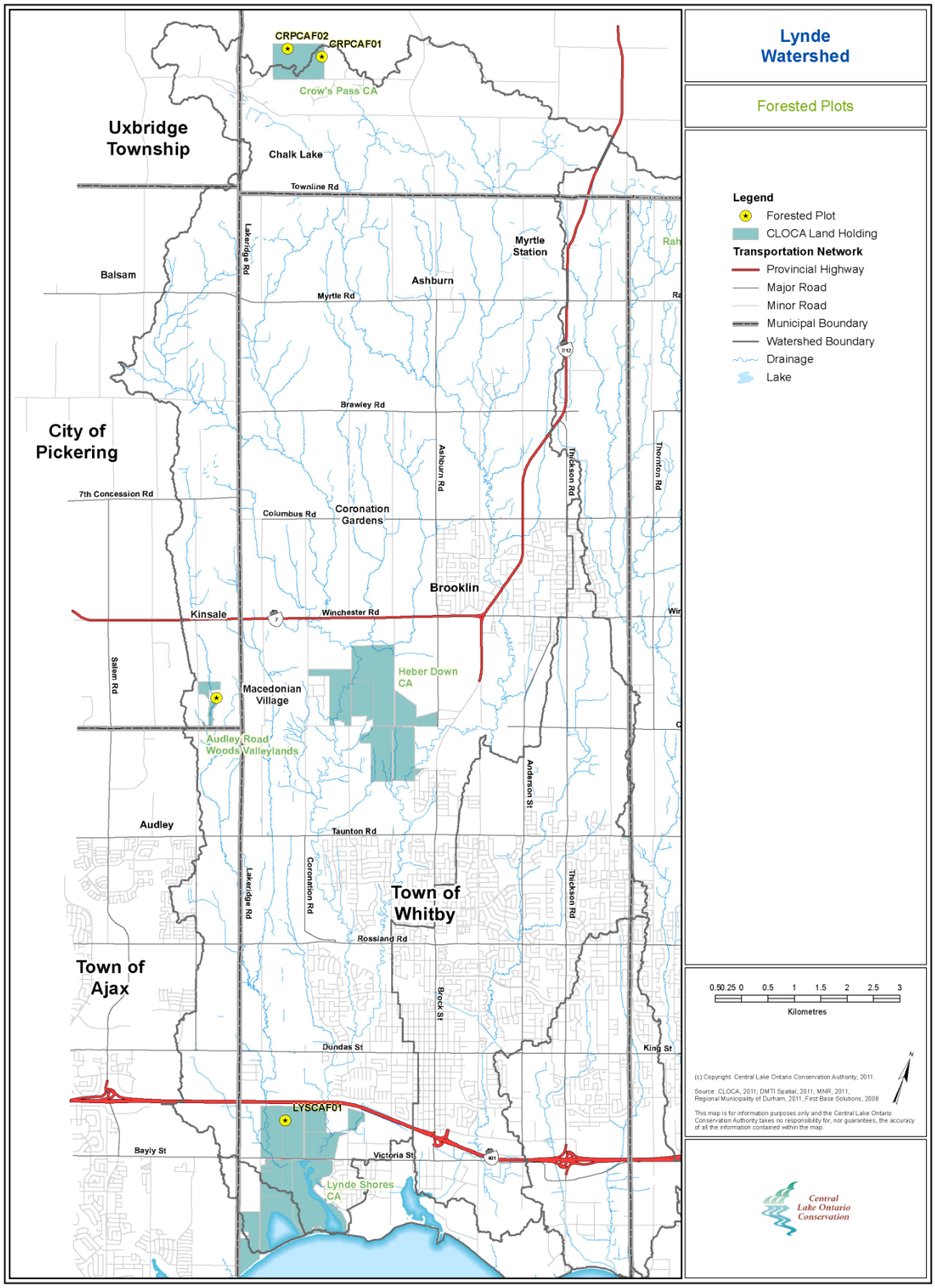

Figure 2: Lynde Creek Forested Plot Locations

Recently, Emerald Ash Borer (EAB) has been discovered within Pickering, because of this CLOCA staff inspected potential trees thoroughly. While there were no clear signs of EAB present at any of the sites, ARCAF01 had a Green Ash (*Fraxinus pennsylvanica*) that had experienced severe crown dieback greater than 50% of the branch and twigs within the crown, however upon further inspection there were no signs of EAB. Evidence of EAB, which include epicormic branching, bark deformities and discoloration or D shaped bore holes, can be difficult to detect until approximately 5 years after the initial infestation and often the trees are severely infested at this point (Lyons, *et al*., 2007).

Two other sites had trees experiencing severe dieback, CRPCAF01 and CRPCAF02. At site CRPCAF01 and CRPCAF02 the trees experiencing dieback were Scotch Pine (*Pinus sylvestris*) and Large-tooth Aspen (*Populus grandidentata*) respectively. Poplars are known as a pioneer tree and tend to be among the first to dominate a site that is regenerating; the remainder of the trees at CRPCAF02 were mostly intermediate or climax trees suggesting the site is going through natural transition. Two Scots Pine were observed at CRPCAF01 that experienced severe dieback, these trees are considered invasive and is listed in category 2 of the Central Lake Ontario Conservation Invasive Species List (CLOCA, 2010-01MP) as adapted from the Urban Forest Associates Inc. (2004) list of Invasive Exotic Species Rankings for Southern Ontario (Table 10) and are subject to many pests and diseases (Farrar, 2006). Monitoring of the Lynde Creek watershed will occur again in 2014.

Table 5: Forested Plot Tree Species Composition by Site

Site Name	Species Richness	Native	Non-Native	% Non-Native
ARCAF01	4	4	0	0%
CRPCAF01	2	1	1	50%
CRPCAF02	6	6	0	0%
LYSCAF01	2	2	0	0%

Table 6: Forested Plot Tree Species by Importance Value

Tree Species		Importance Value
Latin Name	Common Name	
Acer saccharum saccharum	Sugar Maple	110.16
Populus tremuloides	Trembling Aspen	36.20
Tsuga canadensis	Eastern Hemlock	30.14
*Pinus sylvestris**	Scotch Pine	19.90
Acer rubrum	Red Maple	17.72
Populus grandidentata	Large-Tooth Aspen	16.89
Prunus serotina	Black Cherry	16.42
Fagus grandifolia	American Beech	14.23
Fraxinus americana	White Ash	10.68
Pinus strobus	White Pine	9.99
Betula papyrifera	White Birch	8.97
Fraxinus pennsylvanica	Green Ash	8.71

Table 5 shows the species composition and the percent of non-native species by site number. Majority of the sites do not appear to have any non-native tree species, however 50% of CRPCAF01 tree species are non native; this site only had two tree species present, one of which is considered non native. Table 6 shows all the tree species found at the four forested sites according to importance value.

The only non-native species present at these sites ranks amongst the top five predominant trees in regards to importance value. Importance value is "an index made up of Relative Density, Relative Dominance and Relative Frequency that profiles the structural role of a species in a stand." (Roberts-Pinchette, *et al.*, 1999). Importance values are highly dependent on the number of individual trees observed, the higher the quantity per species, the higher the importance value. Scotch Pine (*Pinus sylvestris*), as mentioned is amongst the most abundant tree species within the forested sites. It ranks in category 2 in the CLOCA's Invasive Species List (CLOCA, 2010-01MP) (adapted from Urban Associates Inc., 2004). Plants in these categories, while highly invasive, often only dominate niche environments (CLOCA, 2010-01MP); as such, no invasive species management will occur at this time. Tree health will be monitored again in 2014.

During the summer field visits, impromptu salamander surveys were conducted at CRPCAF02 by turning over decomposing material. CRPCAF02 is a suitable location for mole salamander species (Ambystomatidae), due to the large vernal pond just north of the plot and the moist deciduous woodland habitat. Eight salamanders were spotted during a period of two visits, the first in the end of April and the second visit in mid May. The species observed were 1 blue spotted, 2 red-backed salamanders, 2 yellow spotted salamanders and 3 juvenile eastern newts. None of these salamanders are considered at risk, however they are useful indicator species of forest health because of their sensitivity to a range of ecological stressors, especially those that affect micro-climates, air and water quality (Zorn, *et al.,* 2004). The 2010 Wildlife Monitoring Report will have more information on salamander monitoring conducted by CLOCA.

2.1.2 Regeneration

Monitoring the regeneration of saplings is another important feature used to understand the structure and observe the succession of the forest. All tree species and heights are recorded for saplings within 16cm to 200cm in height that lie within the subplot boundaries. Specimens less than 16cm are not recorded as the success rate is too unpredictable and may not survive the growing season. Figure 3 shows the overall species observed at each site within the regenerating layer of the Forested monitoring plots within the Lynde Creek Watershed.

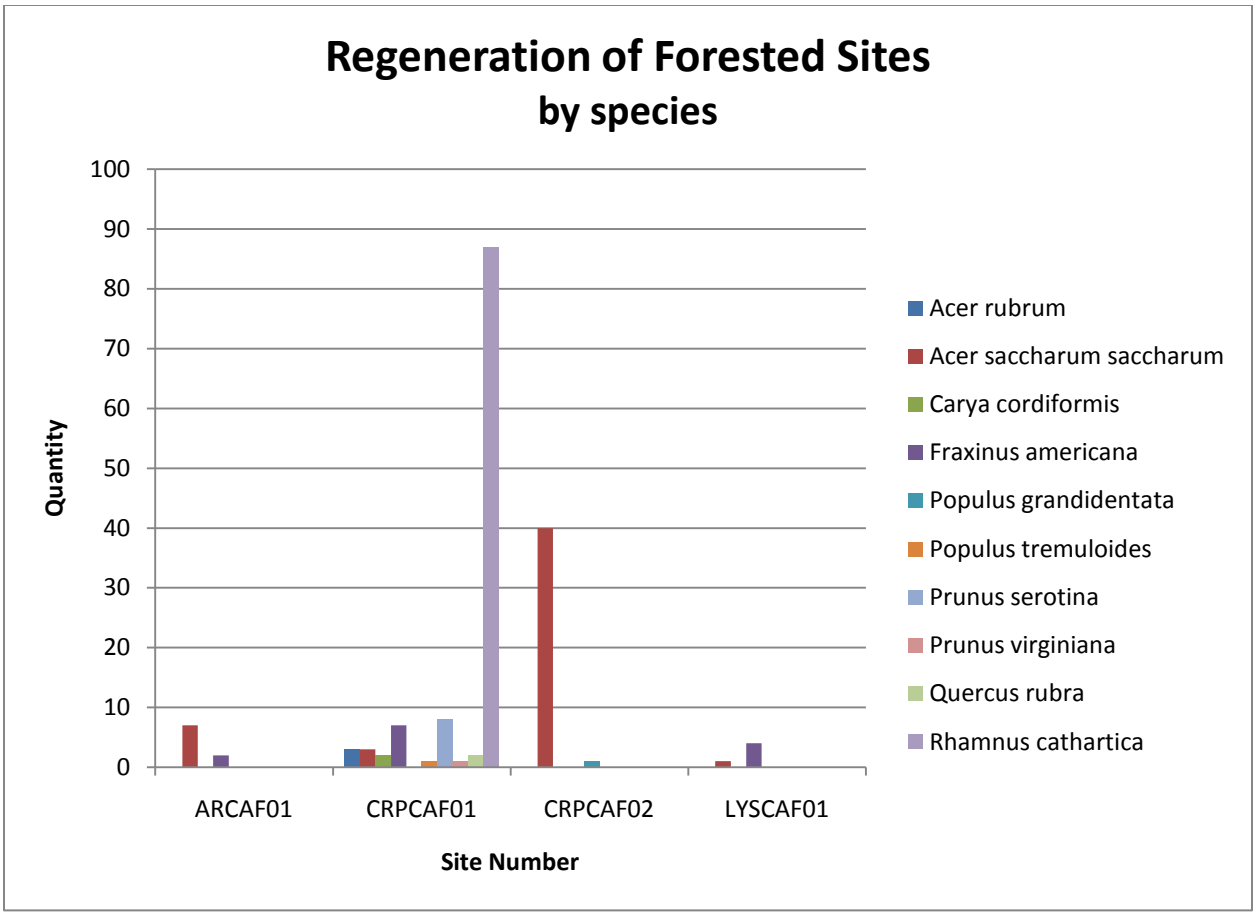

Figure 3: Regeneration of Forested Sites by Species

All four sites had regenerating seedlings large enough to be included in the survey. Sugar Maple (*Acer saccharum saccharum*) was present at all four sites, and was the most frequently reoccurring native sapling. The highly invasive Common Buckthorn (*Rhamnus cathartica*) was among the most abundant regenerating sapling, however it was only present at one site, CRPCAF01. Interestingly enough, this site had the highest diversity of regenerating species, containing 9 of the 10 tree saplings found at all four sites, yet it had the lowest species richness for trees greater than 10cm dbh. CRPCAF01 is located directly adjacent to a golf course and has a diverse history, once being owned by the Easter Seals children camp, and was once the grounds for a hunting club. Due to its location and limited visitation from the public, it is not likely to be a priority management site for invasive species management. However monitoring will continue on a five year cycle, and if large fruit bearing trees are present and abundant, pulling is a recommended technique to prevent the further establishment of Common Buckthorn.

Table 7: Regeneration by height classification for Forested Plots

Tree Species		Seedling Height Classes (cm)						Total by Species
Latin Name	Common Name	16-35	36-55	56-75	76-95	96-200	>200cm	
Acer rubrum	Red Maple		1			1	1	3
Acer saccharum saccharum	Sugar Maple	31	8	2	6		4	51
Carya cordiformis	Bitternut Hickory	2						2
Fraxinus americana	White Ash	4	2	1		2	4	13
Populus grandidentata	Large-toothed		1					1
Populus tremuloides	Trembling Aspen			1				1
Prunus serotina	Black Cherry			1	5	1		7
Prunus virginiana	Choke Cherry					1		1
Quercus rubra	Red Oak		1	1				2
*Rhamnus cathartica**	Common Buckthorn	17	21	17	8	20	4	87
Total by height class		**54**	**34**	**23**	**19**	**25**	**13**	**168**

*non-native species

Table 7 shows the height category by species, the majority of regenerating species fall within the 16-35cm category. Species within the first category are still quite vulnerable and are the most frequently observed, but overall the trees are fairly evenly distributed through the rest of the classes. Sugar Maple and White Ash were the only trees found within the southern plots, ARF01 and LYSF01, the majority of which were in the first height class, making them vulnerable to environmental factors. While all the sites are relatively isolated in nature, ARF01 experiences unauthorized ATV usage that CLOCA is trying to deter, and LYSF01 is surrounded by agricultural fields with an abundant deer population, as evidenced through the browse on native vegetation; these factors could have an effect on the amount of seedlings present. Both of these sites are also located within mature woodlots, and have little understory growth, which can be characteristic of mature forests. The remaining two sites, located on the Oak Ridges Moraine had a much greater variety of species in varying height classes; both CRPCAF01 & CRPCAF02 forest communities are mid-age, containing examples of both early successional and late successional species (Lee, *et al.*, 1998).

Next to Common Buckthorn, Sugar Maple is the next highest regenerating sapling followed by White Ash, while the latter species are some of the most common within CLOCA's jurisdiction, they could potentially face threats in the near future from Asian Long-Horned Beetle (ALHB) (presently found in the City of Vaughan and the City of Toronto) and Emerald Ash Borer (EAB), which has been discovered in the City of Pickering. ALHB can attack a number of broadleaf trees, including all species of maple, while EAB predominantly attacks ash.

2.1.3 Ground Vegetation

Monitoring ground vegetation within a forested system can provide information regarding the phenology (the timing of biological events, such as flowering, in relation to changes in season and climate) of the plant, the change in composition and species vulnerability to disturbed landscapes as well as provide information on the quality of habitat. Ground vegetation is defined as all herbaceous material and ground layer vegetation, including lichens, mosses, fungi and small trailing and rosette plants. It also encompasses woody stemmed material that is less than 1m in height. Ground vegetation can vary

depending on many factors, including forest canopy cover, soil substrate, moisture variation and time of year.

Table 8: Ground Vegetation data for Forested Plots

Site Name	Site Number	Total Species Richness	Native Species Richness	Non-native species richness	% Non-native Species
Audley Road	ARCAF01	3	2	1	33%
Crow's Pass CA F01	CRPCAF01	19	16	4	21%
Crow's Pass CA F02	CRPCAF02	5	4	0	0%
Lynde Shores CA	LYSCAF01	12	9	3	25%
Overall		**33**	**27**	**6**	**18%**

Table 8 provides a summary of the species composition for each site, and breaks it up between native, non-native and overall species richness. Total species richness ranges from 3 to 19 species, with 18% of the overall species present being non-native. CRPCAF02 had no non-native species present. Crow's Pass CA, in which this site is located, is relatively isolated, located in the far north end of CLOCA's jurisdiction. It is dominated by Sugar Maples, Red Maples and Black Cherry, with an understory rich in trilliums, mayapples, baneberry and other woodland understory. While these species were not present within the plot itself, they were abundant in surrounding areas of the woodlot. Indian Cucumber root (*Medeola virginiana*) was also present within this plot, and is considered uncommon within the Region of Durham (OMNR, 2000). The remaining plots contained between one to four non-native species. ARCAF01 had only one non-native species present, however the species present was Dog-Strangling Vine (*Cynanchum rossicum*) and is considered highly invasive (Table 9), and while it was not abundant at this site, the presence of this plant should be monitored, as ARCAF01 has many mature Eastern Hemlock and Maples, ranging from 40 to 70cm dbh and Dog-Strangling Vine could have devastating results at this site.

Table 9: Non-Native Species list for Forested Plots

Latin Name	Common Name	Rank
Alliaria petiolata	Garlic Mustard	1
Cynanchum rossicum	Dog-Strangling Vine	1
Epipactis helleborine	Helleborine	-
Geranium robertianum	Herb Robert	-
Potentilla recta	Rough Fruited Cinquefoil	-
Taraxacum officinale	Common Dandelion	-

Table 10 shows the non-native species list and their ranking of invasiveness according to the Central Lake Ontario Conservation Invasive Species List (CLOCA, 2010-01MP) as adapted from the Urban Forest Associates Inc. (2004) list of Invasive Exotic Species Rankings for Southern Ontario. Of the six (Table 9) non-native species present two, Garlic Mustard (*Alliaria petiolata*) and Dog-Strangling Vine (*Cynanchum rossicum*) are ranked as "…aggressive invasive exotic species that can alter and dominate sites and exclude native species. These organisms are a threat to natural areas, as they disperse widely, through transport by animals and natural means (water, wind, etc.) …" (CLOCA, 2010-01MP). The remaining four species are non-native; however they do not show invasive tendencies or pose a threat to natural communities. *C. rossicum* has been found in two sites, ARCAF01 and CRPCAF01; in the former site, as mentioned there was only one stem observed, however in CRPCAF01, *C. rossicum* was dominant within all five subplots. Many areas of Crow's Pass Conservation Area is inundated with *C. rossicum* and in 2005 was the subject of a control experiment, however due to lack of continued support this project was not pursued any further. Presently research is being done on biological controls for *C. rossicum*, and may be considered an option for future management.

Table 10: CLOCA's Invasive Species Ranking Criteria (as adapted by Urban Forest Associates, Inc., 2004)

Category Rank	Category Criteria
1	This category contains aggressive invasive exotic species that can alter or dominate sites and exclude native species. These organisms are a threat to natural areas, as they disperse widely, through transport by animals and/or natural means (water, wind, etc). These species are top priority, however control may be difficult.
2	Species that are highly invasive but tend to only dominate certain niches or do not spread rapidly from major concentrations. They spread by vegetative means or by seeds that drop close to the parent. They may persist in dense populations for long periods. Control where necessary and limit their spread to other areas.
3	Moderately invasive species, but can become locally dominant when the proper conditions exist. Control where necessary and limit their spread to other areas.
4	Species that do not pose a serious threat to natural areas unless they are competing directly with more desirable vegetation. These plants are sometimes substituted for native plants, but may not reproduce aggressively once established.
5	Some of these species have the potential to become invasive exotics in Ontario. They can reproduce aggressively on occasion but have not been shown to be a serious threat to natural areas in Ontario. Some are very similar to indigenous species and could simply have been overlooked.

Garlic Mustard (*Alliaria petiolata*) was present at LYSCAF01, and found within the southern portion of the woodlot. This site is surrounded by past agricultural fields and has been browsed heavily by deer; at least two deer were present at each site visit conducted in 2010. Deer browse was observed on Jewelweed (*Impatiens capensis*), Enchanter's Nightshade (*Circaea lutetiana*) and Jack-in-the-Pulpit (*Arisaema triphyllum*); however garlic mustard did not appear to be affected by deer herbivory. Knight *et al.* (2009) conducted a study, observing a series of plots over 9 years, and found that deer browsing reduced the number and size of flowering native species, yet they always avoided garlic mustard resulting in a bare understory and garlic mustard became the dominant species. The Invasive Species Working Group is presently developing pilot projects to control five invasive species within CLOCA lands including Black Locust, Common Buckthorn, Yellow Iris, Russian/Autumn Olive and Garlic Mustard. This location would provide a suitable site for Garlic Mustard control as the population is relatively isolated and is not a highly visited location.

2.2 Non-Forested Systems

Non-forested systems, which include cultural meadows (CUM) and cultural thickets (CUT) account for 28% of the total natural cover of the Lynde Creek watershed, or 8% of the entire watershed. Only two non-forested plots were established in 2010 throughout the Lynde Creek watershed; one was installed in Crow's Pass Conservation Area, and the other was established in Lynde Shores Conservation Area (Figure 4). Each site has six 1mx1m monitoring plots established and were observed twice during the field season, once in early June and once again in late August.

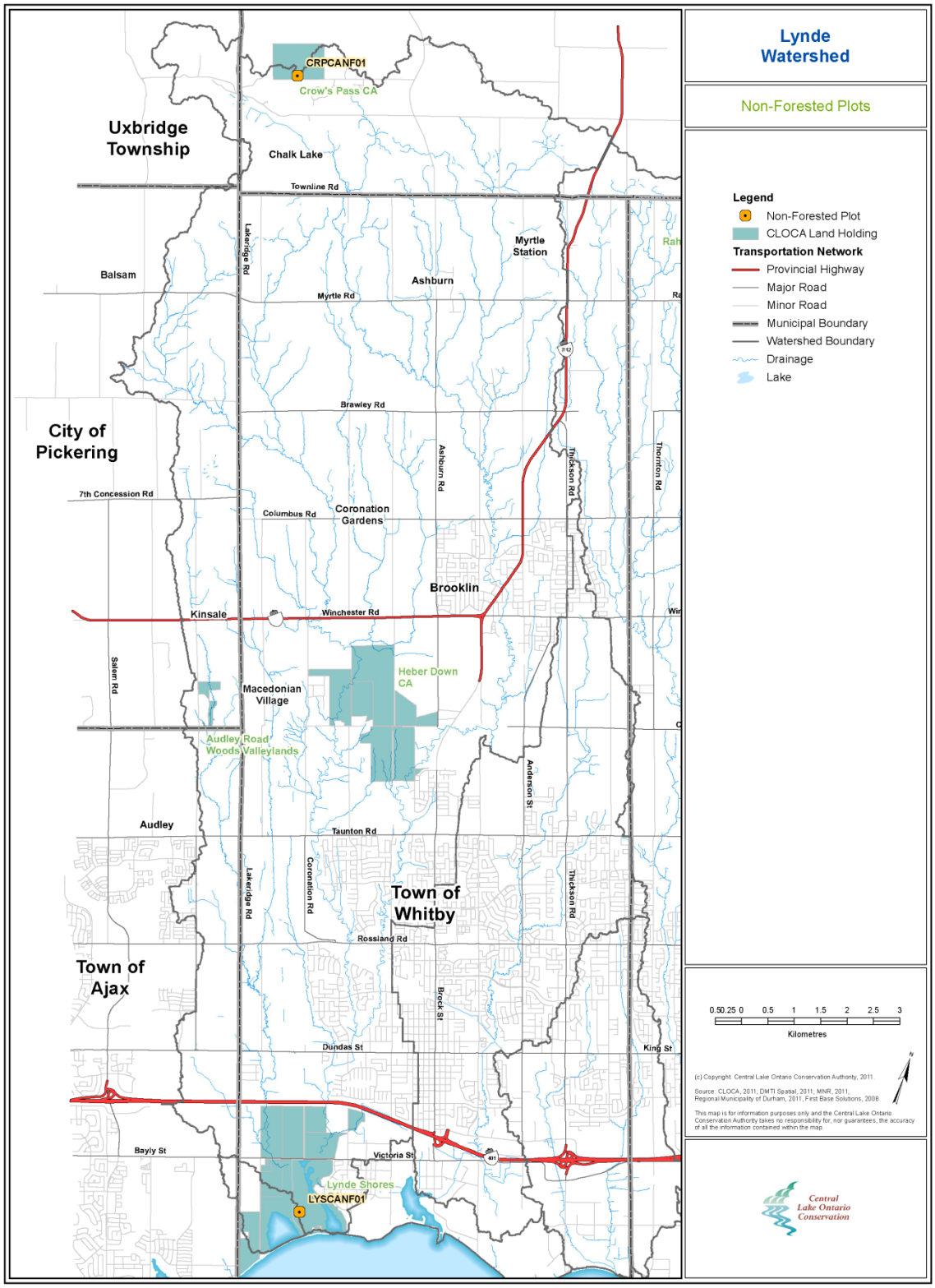

Figure 4: Lynde Creek Watershed Non-Forested Plots

Table 11: Ground Vegetation data for Non-Forested Sites

Site Name	Site Number	Total Species Richness	Native Species Richness	Non-Native Species Richness	% Non Native Species
Crow's Pass CA	CRPCANF01	20	10	10	50%
Lynde Shores CA	LYSCANF01	17	9	8	47%
Overall		**30**	**15**	**15**	**50%**

Table 11 shows the overall species composition of the two sites. A total of 30 species were observed, half of which were non-native. Even though both sites contained a high number of non-native species, not all of these species pose a threat to native diversity; many non-native species have become naturalized and live in harmony with the surrounding vegetation. Table 12 shows all the non-native species present among the five sites observed and their potential invasiveness, according to the categorized criteria.

Table 12: Non-Native Species List for Non-Forested Sites

Latin Name	Common Name	Rank	Latin Name	Common Name	Rank
Cirsium arvense	Canadian Thistle	1	*Melitotus alba*	White Sweet-Clover	2
Cynanchum rossicum	Dog-Strangling Vine	1	*Poa pratensis*	Kentucky Blue Grass	2
Daucus carota	Queen Anne's Lace	-	*Potentilla recta*	Rough-Fruited Cinquefoil	-
Hieracium aurantiacum	Hawkweed	3	*Trifolium hybridum*	Alsike Clover	-
Hypericum perforatum	St. John's Wort	4	*Trifolium repens*	White Clover	4
Linaria vulgare	Butter-and-eggs	4	*Vicia cracca*	Cow Vetch	2
Medicago lupulina	Black Medick	4			

While there is a large number of non-native species present, two of them, Canadian Thistle (*Cirsium arvense*) and Dog-Strangling Vine (*Cynanchum rossicum*) are severely invasive, ranking in the first category; however the former species dominates mostly agrilcultural fields and disturbed sites (IPANE a, 2009). The latter of the two species is on CLOCA's top terrestrial invasive species list and management strategies are currently being looked into to control and manage this species.

Species found within category two are characterized as "species that are highly invasive but tend to only dominate certain niches or do not spread rapidly from major concentrations … may persist in dense populations for long periods. Control where necessary and limit their spread to other areas." (CLOCA, 2010-01MP). Three of the species found within the non-forested plots fall in this category and have the potential to dominate a specific site and are more commonly found in cultural meadows and thickets.

The remaining species that are grouped within categories three and four are again predominantly found in Cultural Meadows (CUM); they can become locally dominant within an area without entirely transforming a site. Finding a greater number of non-native species in these sites is not a large surprise, as they are all ELC classified as Cultural meadows, which Lee, *et al.* (1998) describes as "open communities originating from, or maintained by, anthropogenic or culturally based disturbances; often having a large proportion of introduced species".

2.3 Wetland Systems

Wetlands make up 19% of the natural cover within the Lynde Creek watershed, or 6% of the entire watershed (Table 3). Wetlands play an integral part in the function and health of a watershed, as they act as natural filters, groundwater recharge sites, and provide habitat for a number of species. The wetlands being monitored as part of this program are non-coastal wetlands, as all of the coastal wetlands within the CLOCA jurisdiction are monitored through the Durham Region Coastal Wetland Monitoring Program (DRCWMP). The wetlands being monitored comprise of the ELC community class treed swamp, which includes Coniferous Swamp (SWC), Deciduous Swamp (SWD) and Mixed Swamps (SWM). Two wetland plots were installed in 2010; a third wetland plot was planned to be installed at Crow's Pass CA, however once the site was inspected the area was observed to be a mixed forest (FOM). The two sites are located at Lynde Shores CA and Heber Down CA (Figure 5).

2.3.1 Tree Health

Tree size and disturbance history can help in understanding how the forest structure is changing, and when regularly monitored, can often help identify both short-term and long-term stresses on the system. These short-term stresses may include extreme weather, insect defoliation and many other factors. As mentioned in the Forested Systems section, Emerald Ash Borer (EAB) has been discovered within Pickering. CLOCA staff examined potential trees at LYSCAW01, since *Fraxinus pennsylvanica* was the dominant tree species present at the site. While there was no evidence of EAB found, the presence of EAB can be difficult to detect until approximately 5 years after the initial infestation and often the trees are severely infested (Lyons, *et al*., 2007).

Table 13 shows the percent mortality at each site, keeping in mind that the data represented in the table below is meant to act as baseline data and the recommended threshold will not be applied to this year's data; refer to Section 2.1.1 for information regarding the thresholds.

Table 13: Tree Health Summary for Wetland Sites

Site Name	Site #	Mortality of Trees (%)	Evidence of Emerald Ash Borer
Heber Down CA	HDCAW01	27%	None
Lynde Shores CA	LYSCAW01	0%	None
Overall		**23%**	**None**

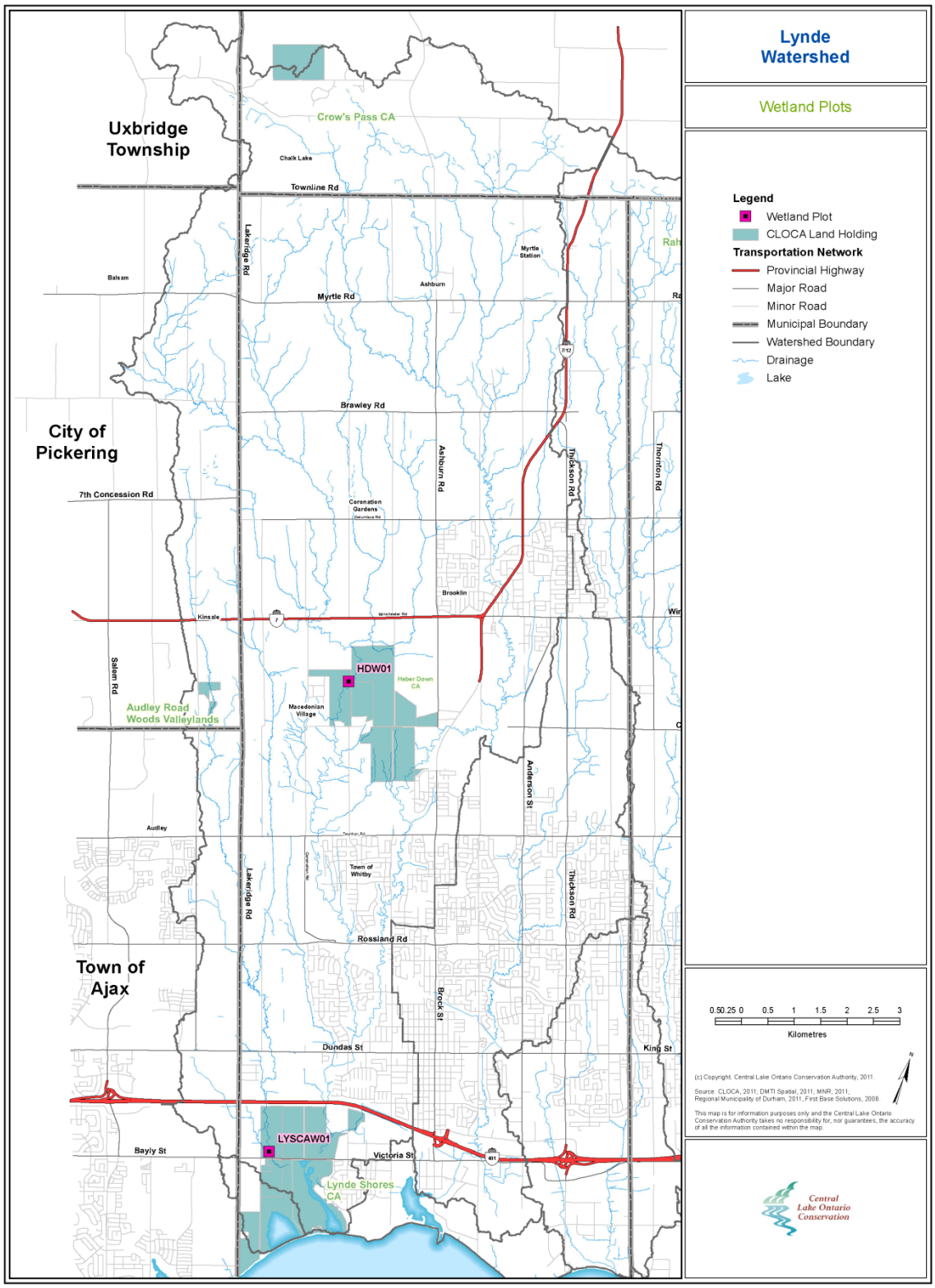

Figure 5: Lynde Creek Wetland Plot Locations

The mortality rate amongst the two wetland sites is varied, ranging from 0% to 27% mortality. Site HDCAW01 has a mortality rate of 27%, and although this is relatively high, the threshold will not be applied to this first year. The co-dominant species at the site are Eastern White Cedar (*Thuja occidentalis*), Eastern Hemlock (*Tsuga canadense*) and Black Ash (*Fraxinus nigra*). LYSCAW01 had a zero % mortality rate and is dominated by Green Ash (*Fraxinus pennsylvanica*).

Table 14: Wetland Plot Tree Species Composition

	Species Richness	Native	Non-Native	% Non-Native
HDCAW01	7	7	0	0%
LYSCAW01	3	2	1	33%

Table 15: Wetland Plot Tree Species by Importance Values

Tree Species		Importance Value
Latin Name	Common Name	
Thuja occidentalis	Eastern White Cedar	58.83
Tsuga canadensis	Easter Hemlock	55.51
Fraxinus pennsylvanica	Green Ash	53.82
Fraxinus nigra	Black Ash	43.11
Betula allegheniensis	Yellow Birch	20.16
Pinus strobus	White Pine	17.53
Acer rubrum	Red Maple	14.20
Betula papyrifera	White Birch	13.13
Acer negundo	Manitoba Maple	11.92
Ulmus americana	American Elm	11.80

Table 14 shows the species composition and the percent of non-native species by site number. HDCAW01 does not have any non-native tree species within the 400m^2 plot, while LYSCAW01 has 33% non-native tree species. Table 15 shows the tree species found in both sites according to importance value. Importance value is defined as "an index made up of Relative Density, Relative Dominance and Relative Frequency that profiles the structural role of a species in a stand." (Roberts-Pichette, *et al.*, 1999). Importance values are highly dependent on the quantity of tree species within the plots. While there appears to be an even distribution of the top four species, Manitoba Maple, an invasive tree species, ranks near the bottom of the list. Tree health will be observed every five years as the plots are monitored.

2.3.2 Regeneration

Monitoring regeneration within a wetland system can provide information regarding rate of germination, growth and development of seedlings and the quality of habitat. Monitoring plots are established in conjunction with the 20mx20m Wetland Plots, as mentioned in the regeneration section for Forested plots

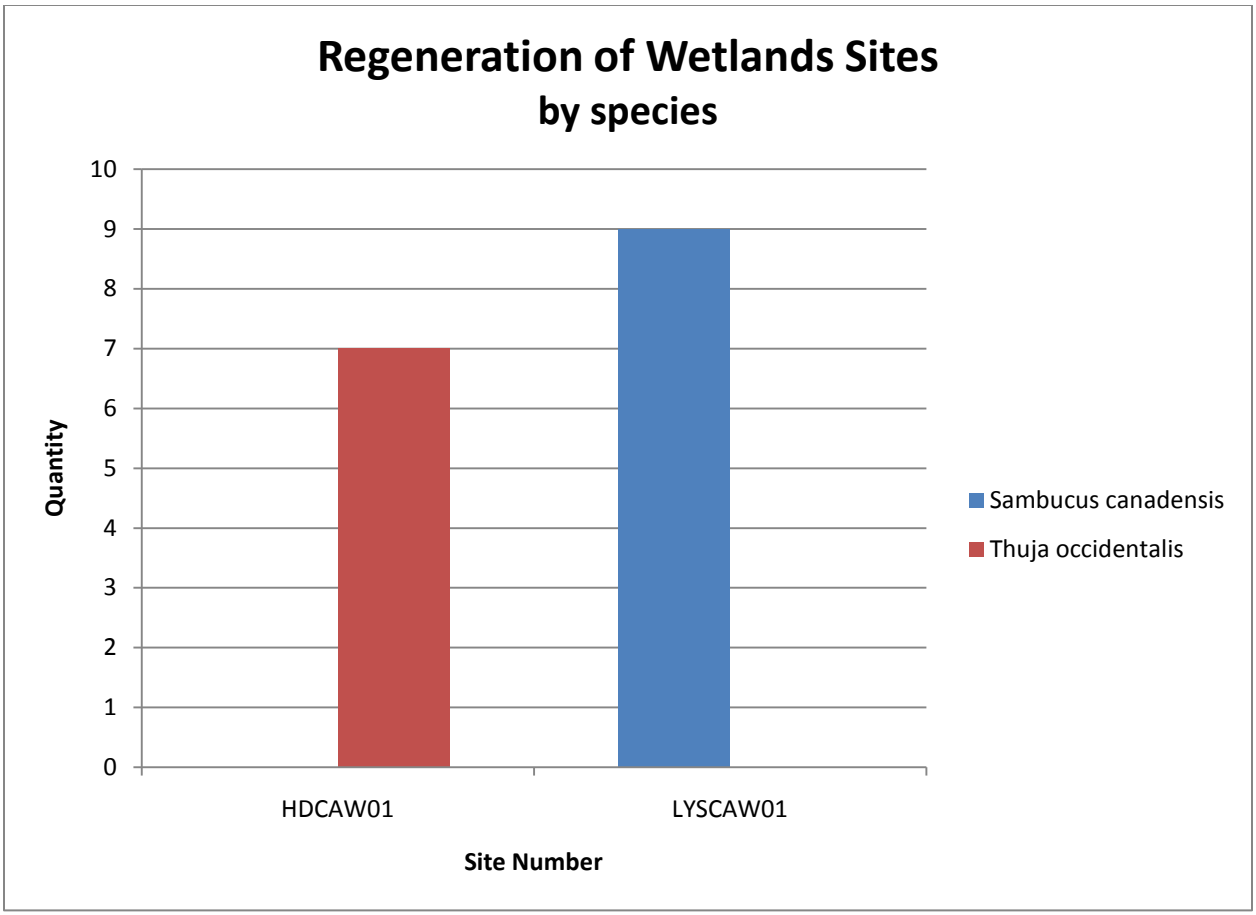

Figure 6: Regeneration of Wetland Sites by Species

Both wetland sites had regeneration occurring, however each site only had one regenerating species; both species are native to CLOCA's landscape. HDCAW01 had young Eastern White Cedar's regenerating, most of which fell within the first height class (Table 16), 16-35cm, these seedlings tend to be quite vulnerable until they reach the "free to grow" stage. Common Elderberry (*Sambucus canadensis*) was observed at LYSCAW01; and while this is a woody plant, it is often characterized as a small tree or a large shrub, often reaching a height of 10m (Farrar, 2006). This native shrub is often found in lowland areas and provides twigs and barks that are important as browse for wildlife (Farrar, 2006).

Table 16: Regeneration by height classification for Wetland Plots

Tree Species		Seedling Height Classes (cm)						Total by Species
Latin Name	Common Name	16-35	36-55	56-75	76-95	96-200	>200cm	
Thuja occidentalis	Eastern White Cedar	7	-	-	-	-	-	7
Sambucus canadensis	Common Edlerberry		-	-	1	4	4	9
Total by height class		**7**	**-**	**-**	**1**	**4**	**4**	**16**

2.3.3 Ground Vegetation

Monitoring ground vegetation within a wetland system can provide information regarding the phenology (the timing of biological events, such as flowering, in relation to changes in season and climate) of the plant, the change in composition and species vulnerability to disturbed landscapes as well as provide information on the quality of habitat. Table 17 provides a summary of the species composition for each site, and breaks it up between native and non-native and overall species richness. Total species richness varies between 6 and 14 species. HDCAW01 is dominated by conifers which could explain the relatively low species richness, while LYSCAW01 is dominated by deciduous trees and has a more varied ground layer. Thirty-three percent of the species observed are considered non-native.

Table 17: Ground Vegetation data for Wetland Plots

Site Name	Site Number	Total Richness	Native Species Richness	Non-native Species Richness	% Non-native Species
Heber Down CA	HDCAW01	6	5	1	17%
Lynde Shores CA	LYSCAW01	14	9	5	36%
Overall		**20**	**14**	**6**	**30%**

Table 18: Non-Native Species List for Wetland Sites

Latin Name	Common Name	Rank
Alliaria petiolata	Garlic Mustard	1
Epipactis helleborine	Helleborine	-
Glechoma hederacea	Ground Ivy	4
Lysimachia nummularia	Money-wort	2
Nasturtium microphyllum	Small-leaved Water-cress	-
Solanum dulcamara	Bittersweet Nightshade	5

Within both sites there was a total of six non-native species, with a maximum of five non-native species found at one site. Table 18 shows the list of non-native species and their rank in CLOCA's Terrestrial Invasive Species Plant List. Two of the species, Helleborine and Smalled-leaved Water-cress, are not ranked, and thus not likely to pose a threat to the local diversity of the area; while two of the six species, Ground Ivy and Bittersweet Nightshade, rank in categories four and five respectively. These plants are common within CLOCA's jurisdiction and while their spread should be limited, they do not appear to pose a great threat to the surrounding areas. The remaining two species, Garlic Mustard and Money-wort, ranked in categories one and two respectively and are highly invasive. According to the Invasive Plant Atlas of New England (IPANE b, 2009) Money-wort dominates niche environments, and does very well in moist habitats such as wet-meadows and along the banks of streams and small water bodies. Garlic Mustard is a common, highly invasive plant within southern Ontario that "invades and dominates the understory of forested areas" (Nuzzo, 2000). These two species were found at LYSCAW01 which is located on the north side of Victoria road with limited public access. It is however, directly adjacent to a reach of the Lynde Creek which periodically floods the swamp each spring. During spring and summer visits to LYSCAW01, garbage and empty beer cans were abundant at the site, suggesting unauthorized public use. HDCAW01 is located just off a heavily used path at Heber Down Conservation Authority and only had Helleborine present as a non-native species, which does not appear to be highly invasive. Monitoring of these sites will occur again in 2014.

3.0 SPECIAL PROJECTS

3.1 Dog-Strangling Vine at Crow's Pass Conservation Area

Observation of Dog Strangling vine (DSV) (*Cynanthum rossicum*) at Crow's Pass Conservation Area was first started in 2007, then continued in 2009. The initial question asked was if the creation of new trails will facilitate the spread of DSV. In July 2007 the Oak Ridges Moraine Trail Association connected two existing trails within the Crow's Pass Conservation Area by creating a new trail in a relatively undisturbed patch of deciduous forest. There is a known population of DSV within this Conservation Area, however not within the forest patch where the new trail was created.

While the trail was visited twice in 2009 and 2010, CLOCA staff have decided to cease this monitoring program. During the 2010 field visit an individual DSV plant was found along one of the transects that had been established to monitor DSV. The occurrence of DSV along this transect most likely came about through the monitoring process as no other DSV stalks were found. The single stem was removed from the site. In 2011 this site will be visited to ensure no other DSV stalks have emerged.

The purpose of CLOCA's monitoring program was never to introduce invasive species into an ecologically sensitive area, and for this reason this special monitoring program will no longer occur. CLOCA's Invasive Species working group is developing a suite of Best Management Practices (BMP's) for field staff and summer monitoring crews to follow when conducting field work. Following best management practices will help prevent the further spread of invasive species.

3.2 Tree Planting Survival Assessments

As part of CLOCA's ongoing commitment to forest regeneration, CLOCA participates in yearly initiatives to plant trees on both CLOCA lands and privately owned lands within its jurisdiction. The tree plantings are often done with funding assistance from the Ministry of Natural Resources, Trees Ontario Foundation, Oak Ridges Moraine Foundation, CLOCA's Clean Water Land Stewardship Program along with other funding partners dependent on the project. As part of this yearly tree planting program, monitoring is conducted late in the field season to observe the survival rate of the newly planted trees.

In 2010 two sites were surveyed to assess the survival rate of the tree plantings. The sites surveyed were Sanderson Tract (Enniskillen CA) and Shisko Farm (Lynde Shores CA). According to the Trees Ontario Foundation criteria, a minimum of 2% of the planted population has to be randomly assessed for survival rates. Table 19 below shows the survival rates of the two sites surveyed in 2010.

Table 19: Tree Planting Survival Rates

Planting Site	2010
Sanderson Tract	75%
Shisko Farm	91%

At certain locations it can be difficult to guarantee that 2% of the population is surveyed, and often is the case the trees surveyed may not be representative of the entire planting, as the trees surveyed are the only existing trees found. Therefore, the table above may not be an adequate representation of the true survival rate of planted trees. CLOCA staff is currently developing a monitoring protocol to ensure that survival assessments depict an accurate portrayal of seedling survivorship.

3.2.1 Sanderson Tract

The Sanderson Tract is located north of Concession Rd 8 and west of Old Scugog Rd (Figure 7), within the Enniskillen Valley Conservation Area. This site had been managed and ploughed in the past for hay production, and is completely surrounded by a conifer woodlot. CLOCA identified this area as priority for reforestation, with the intent to restore the habitat potential of the site. It was planted in the spring of 2010 for a CLOCA Earth Day event, bringing out a number of volunteers, nature interpreters and families to assist in the planting. Approximately 2000 trees were planted, including White Pine, White Spruce, Red Oak, White Cedar and Hardwood Maples; table 20 shows the results of the survival assessment. Monitoring was conducted in the late summer of 2010, when koola markings and planted areas were still quite distinguishable. White Pine was the most abundant tree observed, and had the highest survival rate; while White Cedar had the lowest survival rate. Throughout the planted area rodent burrows were present in close proximity to the deciduous trees, and rodents were observed scurrying through the koola markings; tree collars are placed on the deciduous trees for added protection against rodents, and at most of the deciduous trees the collars were still present. To increase CLOCA's efforts and accuracy in monitoring these planting sites, trees that will be monitored on an annual basis will be tagged. This refined monitoring strategy is still in development and will be available in the fall of 2011.

Table 20: Sanderson Tract Survival Rates

Species	September 2010		
	Alive	Dead	% Survival
White Pine	68	11	86%
White Spruce	17	10	63%
Red Oak	25	10	71%
White Cedar	11	8	58%
Hardwood Maple	12	6	67%
Total	**133**	**45**	**75%**

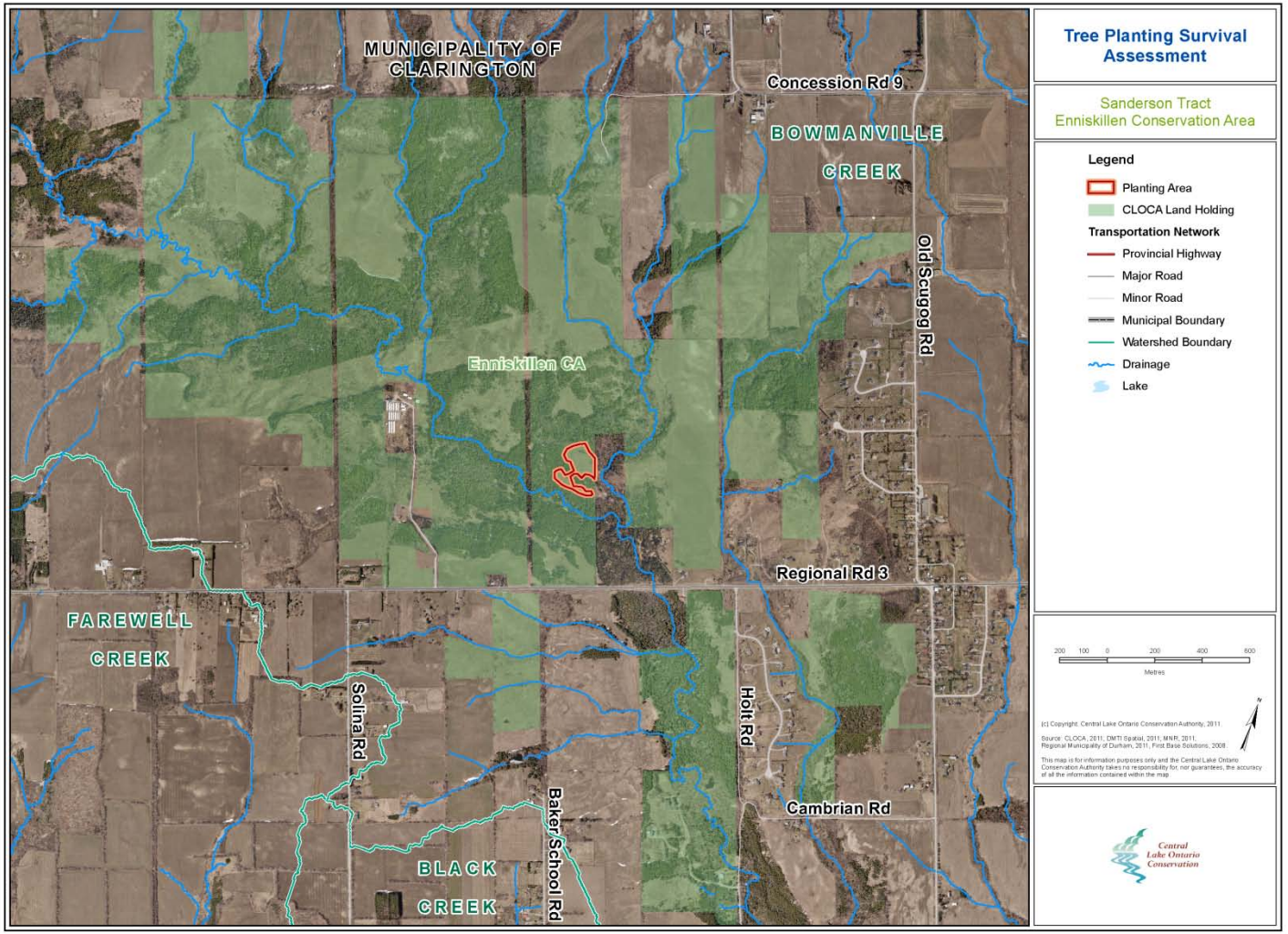

Figure 7: Map of Sanderson Tract

3.2.2 Shisko Farm

A 1.5ha compartment at Lynde Shores Conservation Area along Halls Rd. (Figure 8) was planted in April of 2009 as a volunteer Earth Day event. Approximately 1,800 trees were planted including White Pine, White Spruce, White Cedar and Hardwood Maples. A survival assessment was conducted in the fall of 2010 and yielded a very high survival rate of 91%. As mentioned above, this may not be truly representative of the site as there was evidence of deer browsing and vegetative competition. This site provided two different habitats, a lower ground which was much more moist, and was well suited for the White Cedar and Hardwood Maples; while the higher ground had sandier soils and was well suited to all species, especially the White Pine and White Spruce. On the higher ground their tended to be a higher survival rate, however assessments were not split between high and low ground, and were compiled for the entire compartment (Table 21). On the lower portion of the site it was more challenging to find trees to assess as the surrounding vegetation out grew the seedlings, some of the outcompeting vegetation included Cow Vetch, Goldenrod, Milkweed, Canada Thistle, Sensitive Fern and Canary Reed grass. Browsing was also evident at this site on many deciduous trees, resulting in foliage on only the lower portion of the saplings; deer beds were also present.

Table 21: Shisko Farm Survival Rates

Species	September 2010		
	Alive	Dead	% Survival
White Pine	26	0	100%
White Spruce	14	0	100%
White Cedar	1	0	100%
Hardwood Maple	20	12	63%
Total	**12**	**61**	**91%**

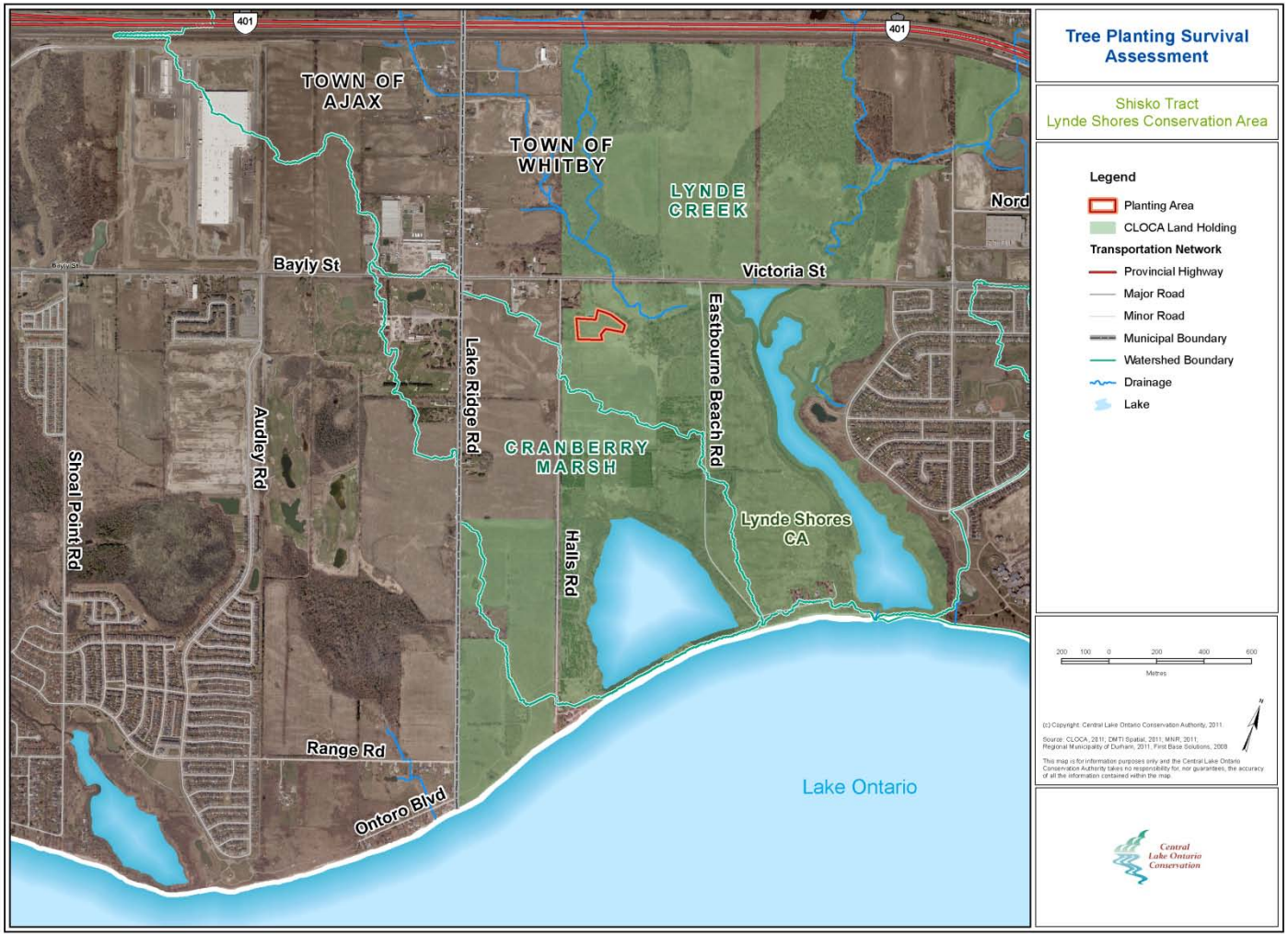

Figure 8: Map of Shisko Farm

3.2.3 Discussion

The two sites visited in 2010 were recently planted, and as a result it was still possible to achieve the sample size for each site. While competing vegetation growth was not a huge problem at the Sanderson tract, the assessment was done within the same year of planting, and results will be better seen in subsequent assessments. CLOCA staff are developing a post-planting strategy to better deal with controlling weeds, browsing and other potential factors that may affect the success of the saplings after planting. A more refined monitoring strategy is also in development.

For the two sites assessed in 2010, CLOCA staff will revisit the site in the spring of 2011 to assess the survival rates of those trees. By marking the trees and taking the GPS location staff will be able to go back and assess these same trees in following years.

A series of literature was reviewed on tree planting and post planting techniques that could potentially be adapted into CLOCA's tree planting strategy. These techniques include pit and mound planting, mimicking the natural landscape of mature forests and wetlands; prescribed burn as a pre-treatment to remove competing vegetation; increasing the size of planting stock, more specifically the root collar diameter; and ensuring an appropriate long-term weed control program. More information on these studies will be included the Tree Planting Survival monitoring protocol.

3.3 Ground Water Levels at Heber Down CA

Heber Down Conservation Area contains the largest publicly owned Provincially Significant Wetland Complex along the former Lake Iroquois Shoreline. It is approximately 85.3ha, 96% swamp and 4% marsh. All but 2ha of this wetland complex fall within the Conservation Area (Planning Director's Report to the Planning and Development Committee, 2002). Over the past few years, CLOCA staff have made informal observations of water level changes occurring in the wetlands at Heber Down Conservation Area. Due to the nature of wetlands and their dependency on annual precipitation, changes in water levels are an expected occurrence. However, due to the increased development occurring in the Brooklin area and the anticipated future development in the area, monitoring began in the field season of 2009 to observe and document these changes.

Water levels were recorded on a monthly basis at the four piezometers. In addition vegetation inventories were conducted at the 4 transects, each containing 12 1mx1m plots.

Table 22: Ground Vegetation Data by Transect

Site Number	Total Richness	Native Species Richness	Non-native Species Richness	% Non Native Species
Transect 1	24	21	3	13%
Transect 2	15	14	1	7%
Transect 3	20	18	2	10%
Transect 4	22	19	3	14%
Overall	33	29	4	12%

Table 22 shows the species composition for each transect, breaking it up by native species, non-native species and percent non-native. Overall, there were 33 different species identified which are distributed through all four monitoring points. The amount of cover at each transect may have been limited since the

transects are located in mixed conifer swamps, dominated by Eastern White Cedar (*Thuja occidenatlis*), Blue Beech (*Carpinus caroliniana*), and Black Ash (*Fraxinus nigra*).

In all of the transects combined, there was a total of 4 non-native species found, however Common Buckthorn (*Rhamnus cathartica*) is not included in the table of the collected data, as it is considered a tree and only herbaceous plants are shown here. The remaining four non-native herbaceous plants observed were Common Buttercup (*Ranunculus acris*), Bittersweet Nightshade (*Solanum dulcamara*), Dog-Strangling-Vine (*Cynanchum rossicum*) and Helleborine (*Epipactis helleborine*). While all five species are non-native, three of them are on CLOCA's Invasive Species list for Terrestrial Plants; Common Buckthorn and Dog-Strangling Vine are ranked in category 1 and listed among CLOCA's top terrestrial invaders. Category 1 "contains aggressive invasive exotic species that can alter and dominate sites and exclude native species. These organisms are a threat to natural areas, as they disperse widely, through transport by animals and natural means (water, wind, etc). These species are top priority, however control may be difficult." (CLOCA, 2010-01MP). While these non-native species were present within the quadrats, the total percent cover an individual species covered within one transect was 7%. Expectedly, there seems to be a greater presence of Common Buckthorn, and Dog-Strangling Vine near the trail edges, but has been noticed to creep into the interior of the swamp.

Table 23: Wetness index by Transect

Site Number	Mean Wetness index	Maximum Wetness Value	Minimum Wetness Value	Mode Wetness Value
Transect 1	-1.38	5	-5	-5
Transect 2	-0.8	5	-5	-3
Transect 3	-1.1	5	-5	-3
Transect 4	-0.05	5	-5	-3

The wetness index categorizes plants based on the probability for them to be found in a wetland or upland area. Table 23 shows the average wetness for each transect, the maximum wetness value, minimum wetness value and the mode. The maximum wetness value represents the most upland plant within the transect, while the minimum value represents the most wetland plant within the transect. While the wetness index may classify a plant as an obligate wetland plant or obligate upland plant, it may not always be found in those specific areas. Non-native species are perfect examples of that; Common Buckthorn, Helleborine and Dog-Strangling Vine receive a +3 (facultative upland), +5 and +5 (obligate upland) respectively, however, while they are more likely to inhabit dryer areas, due to their prolific nature to spread they are still found quite readily in wetland areas.

Table 23 shows that transect 1 has a majority of obligate wetland species present, which include Water Hemlock (*Cicuta maculata*), Marsh Bedstraw (*Galium palustre*), Fowl Manna Grass (*Glyceria striata*) and Bugleweed (*Lycopus uniflorus*). It also contains the highest average wetness value of -1.38. This was somewhat expected as Transect 1 was installed in a major discharge site, and while located in a mixed swamp, it is situated on the north side of a marsh.

The mode represents the wetness value that occurs most frequently. All the transects have average wetness indices that fall in the negative, which shows they contain a greater number of wetland plants.

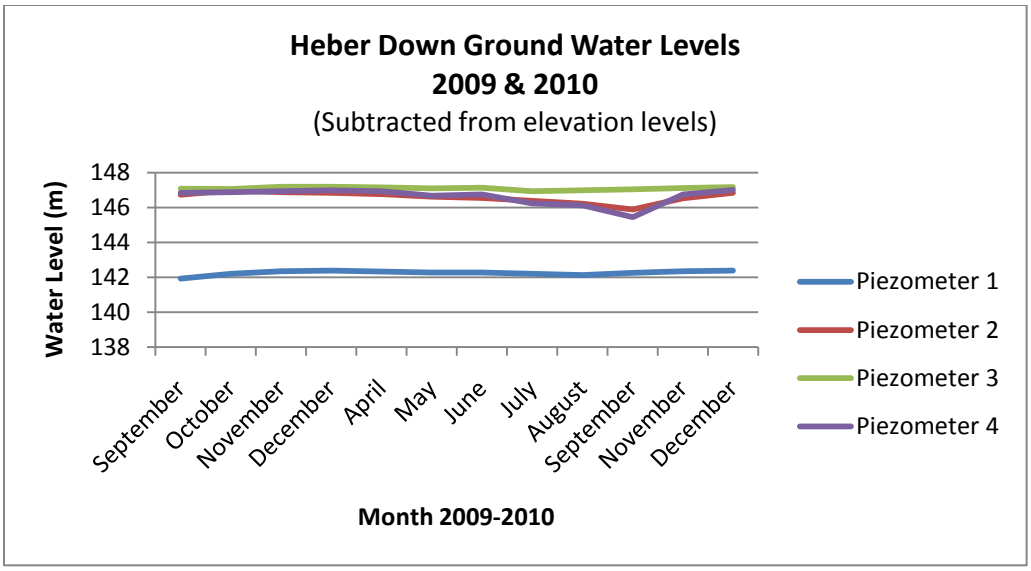

Figure 9: Piezometer groundwater levels

The pizometers measure surficial ground water and have been installed to a depth of maximum 6ft because without the use of drills and augers it was impossible to get the piezometers any deeper; and the roots of herbaceous vegetation reach a maximum depth of 2m (~6ft) (Canadell et al, 1996).

Figure 9 shows the water levels for 2009 and 2010. These monitoring sites will be observed on a yearly basis, when further data is collected the values will be compared to see if there is a change in species composition. Range gauges were introduced in the spring of 2010 to observe the varying precipitation rates over the monitoring season.

3.4 Transplant Monitoring

During the confirmation of rare species noted in the Headgate Group of Companies EIS at Courtice Road and Nash Road, a field of Fringed Gentia (*Gentianopsis crinita*), Bottle Gentia (*Gentiana andrewsii*), Large Yellow Lady's Slippers (*Cypripedium calceolus var. pubescens*), Gerardia (*Agalinis* spp) and other orchid species were observed. While none of these species are considered to be at risk according to the provincial and federal Species at Risk Act (SARA), they are considered uncommon or rare within Durham Region and CLOCA's jurisdiction. As part of CLOCA's permit conditions, over 200 of these plants were transplanted to a site at Heber Down Conservation Area having similar habitat to that in which they were originally found. CLOCA has permitted transplants of sensitive uncommon species as part of permit conditions in the past where plants could not be maintained in situ and have required the proponent to undertake monitoring to ensure a successful transplant. Typically, these transplants occur within the same geographical location, and until now, none of these transplants have been on CLOCA property. In this particular application, many of the rare species were not noted during the original EIS, a subsequent site visit prior to the transplant unveiled much higher numbers of rare specimens. As such, the pre-determined local transplant site was not large enough to support the entire population. Staff saw a unique opportunity to transplant and monitor at the Heber Down Conservation Area.

The purpose of this special project is to gauge the success of the transplant of four uncommon and rare species from a site set for development to a naturalized and protected area to better inform CLOCA Natural Heritage staff when confronted with rare or uncommon plants at development sites. The success

of the transplant will be assessed according to information collected on the abundance of the plants, vegetative condition, reproduction, spatial extent and threat of competition on the populations over time. For more information on the transplant monitoring protocol, refer to the Transplant Monitoring Methodology at Heber Down CA – DRAFT (2011-01MM).

3.5 Invasive Species Management Monitoring

The Chickadee Trail at Lynde Shores Conservation Area has been assessed as a priority for restoration due to trampling of off-trail areas and invasive species. Restoration works required include fencing to keep the public on the designated trails, removing invasive species, and planting native trees and shrubs in trampled areas.

A number of volunteer activities have taken place at Lynde Shores CA, specifically at the Chickadee Trail. Some of these volunteer partnerships include Deloitte & Touche LLP, Monsignor John Pereyma Catholic Secondary School, and a number of public volunteers participating in CLOCA's conservation work days.

These volunteer activities assisted CLOCA staff in constructing split rail fences, planting native shrubs and removing Common Buckthorn (*Rhamnus cathartica*), an invasive non-native understory shrub. These partnerships are planned to continue into the future, while not all necessarily focusing on Lynde Shores, other partnerships with a variety of organizations will allow for the continual management of *R. cathartica* along the Chickadee Trail at Lynde Shores Conservation Area.

Presently active management of *R. cathartica* on CLOCA lands has focused on girdling (severing the bark of the tree); cutting trees down; full removal of trees and root systems; and cutting trees down combined with a basal application of an herbicide called glyphosate. The Nature Conservancy, Michigan Chapter (2001) has used a propane torch to spot treat buckthorn saplings after large trees have been removed. CLOCA has not yet tried this method, but after initial management methods have been applied, this method will be used as follow-up to ensure buckthorn does not return.

Monitoring will take place at the Chickadee Trail to examine the effects of different management techniques and allow us to optimize future efforts and resources.

To observe the benefits of past restoration activities at Chickadee Trail, three 10mx10m plots will be established within the woodlot where active *R. cathartica* management is taking place. One plot will be used as a control where there is no management taking place. This site will be used to observe the vegetation composition where *R. cathartica* is the dominant plant and will be used to compare the results of the other management methods. A second plot will be established at sites where there will be predominantly pulling, and some cutting and girdling of *R. cathartica (*when access to glyphosate is available). The third plot will have similar active management methods as the previous plot, consisting of primarily pulling, with some cutting and girdling of *R. cathartica (*when access to glyphosate is available) but this area will also include replanting of native species.

In spring 2011 CLOCA staff will conduct mapping at the three plots to observe the species present. This information will be used as baseline data for the site. At each of the three plots, monitoring set-up will follow the EMAN protocol which is in line with CLOCA's Terrestrial Watershed Monitoring Program (CLOCA 2009-03MM). Each 10mx10m plot contains 5 1mx1m plots that will allow for observation of ground vegetation. By monitoring the ground vegetation within these contained plots, CLOCA staff will be able to observe if the removal of buckthorn promotes the growth of native vegetation. For more

information on the Common Buckthorn management monitoring at Chickadee Trails refer to the Common Buckthorn Management Pilot Project for Chickadee Trail Pilot Project – DRAFT (2011-01PP).

4.0 SUMMARY

2010 saw the establishment of Terrestrial Watershed Monitoring plots within the Lynde Creek watershed. The field season proved to be a productive and successful period, a total of 8 plots were installed, all on conservation area landholdings.

This data will be used in conjunction with future existing condition reports for CLOCA's watersheds, CA management plans, and Invasive Species Management planning. Monitoring will occur once every five years, similar to those established for CLOCA's other natural heritage monitoring programs.

The special projects have been evaluated individually, and while one project will not be continued in the 2011 field season, two new projects will be initiated to provide information on CLOCA's permitting conditions and to determine the success of CLOCA's recent invasive species management projects.

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