NATURE CHELSEA

A Conservation Planning and Outreach Project

Final Report

Rapport présenté au CLD - Fonds du Pacte Rural

August 26, 2010

CHELSEA

ACRE

1.0 PURPOSE OF THIS REPORT

The Municipality of Chelsea received funding from the centre local de développement des Collines-de-l'Outaouais (CLD), Pacte Rural program to develop an approach to biodiversity conservation at the Municipal level. Funding was also received from the ministère du Développement durable, de l'Environnement et des Parcs and from the MRC des Collines Volet II program, and In Kind donatiosn were received from numerous organizations and companies. This report documents that approach and the lessons learned, in order that it may be applied to other Municipalities in the MRC des Collines.

2.0 INTRODUCTION

2.1 What is Biodiversity?

Biodiversity is the variety of life on earth, including genes, species, ecosystems, and the ecological and evolutionary processes that sustain life. It is the foundation of the health and survival of all living things, including humans. It provides the resiliency that allows natural systems to recover from natural and human-induced stresses, and provides many other benefits to us and the other species on earth.

Biodiversity provides many ecological goods and services. For example, pollinators such as wild bees or flower flies pollinate our food crops, and wetlands filter pollutants out of water, providing clean drinking water. Trees and other natural vegetation remove carbon dioxide from the air, reducing the harmful contribution of emissions to climate change. Recent scientific studies have determined that human well-being is correlated with the protection of natural areas that provide ecological goods and services (Millenium Ecosystem Assessment 2005) and that environmental degradation is correlated with decline in human health (Bradshaw et al. 2010; Brito et al. 2010).

2.2 Benefits of Biodiversity

Biodiversity provides many benefits, identified in the Millenium Ecosystem Assessment (2005) as belonging to one of five categories :

- **Provisioning** services – such as the production of wood fibre and water;
- **Regulating** services – such as climate control;
- **Supporting** services – such as nutrient cycling and crop pollination;
- **Cultural** services – such as science, education, spiritual and recreational benefits; and
- **Preserving** services – including guarding against future scenarios (uncertainty) by maintaining diversity.

Losing these natural systems also means losing these benefits. In their place, we will be forced to replicate these services with technology, which would undoubtedly be less efficient than nature. Sustaining natural systems also means protecting the many species that depend on them for survival, and ensuring the persistence of Chelsea's ecosystems for their inherent value as well as their aesthetic and spiritual value recognized by many Chelsea residents.

2.3 Biodiversity Conservation and Municipal Governance

All levels of government have a responsibility for biodiversity conservation. At the municipal level, the key tools are zoning, conservation based by-laws and voluntary private lands stewardship. All of these approached need to be informed by a sound, scientific inventory of species, communities and ecological connections.

2.4 Chelsea's Ecological Network

Chelsea exists within the Mixedwood Plain Ecozone and the St. Lawrence lowlands Ecoregion. The abundant nature in Chelsea is attributed to the many streams, wetlands, forest stands, the Gatineau River, and its proximity to Gatineau Park. The relatively low density of roads and houses allow for rich biodiversity to thrive in the region. Chelsea exists in Québec's most temperate south, where many southern species reach the northern limit of their range. They are rare or imperilled due to the fact that they are confined to relatively small area in Canada, and are significantly affected by human activities.

The natural areas in Chelsea constitute an *ecological network.* An ecological network includes several **core areas** (large patches of forest or wetlands), connected by **movement corridors**. The core areas provide for the life history needs of its inhabitants, and movement corridors allow for the movement of species between habitat patches, across space and time. Large bodied animals could conceivably move through one of Chelsea's corridors in a period of hours; other, small bodied animal or even plant species; may take generations to move from habitat near the Gatineau River to Gatineau Park. Chelsea also provides an important habitat link between Gatineau Park and the Gatineau River. Well-functioning movement corridors in Chelsea also allow for movements of large bodied species to vast habitat beyond Gatineau Park and the Gatineau River.

2.5 Nature Chelsea Project

Nature Chelsea is a partnership project of the Municipality of Chelsea and Action Chelsea for the Respect of the Environment (ACRE). The Nature Chelsea approach emphasizes the maintenance of biodiversity and habitat connectivity within the Municipality of Chelsea through proactive planning. On a fine scale, Nature Chelsea aims to ensure that ecological design principles are integrated into the early stages of the design of residential subdivisions to protect biodiversity and reduce the subdivision's ecological impact. This design approach includes identifying wildlife corridors and the placement of roads and buildings for conservation and connectivity of natural features, and opportunities for the public appreciation of nature. On a broad scale, Nature Chelsea aims to identify areas with high value to biodiversity and consider how connectivity between natural areas might be incorporated early in the community development planning process.

2.5.1 Vision

Nature Chelsea envisions a system of conserved natural areas, consisting of core habitat areas (terrestrial and aquatic) and corridors that connect the Gatineau River to Gatineau Park, that together comprise an ecological network capable of providing ecological goods and services and supporting rare species, and that is supported by Chelsea residents as a valued asset.

2.5.2 Goal and Objectives

The goal of Nature Chelsea is to support the conservation of Chelsea's biodiversity and to recognize the conservation of natural areas as critical to successful sustainable development of the Municipality, through:

- Conservation Planning: Gathering scientific information to support biodiversity-friendly decision-making, and developing a biodiversity conservation plan designed to ensure effective conservation of biodiversity and natural areas of Chelsea;
- Education -- Increasing public understanding and appreciation of Chelsea's biodiversity, and;
- Stewardship -- Helping landowners to manage their properties in ways that support biodiversity.

3.0 RESULTS OF THE NATURE CHELSEA PROJECT

The results of the Nature Chelsea project are described below for each of the three main areas of focus: conservation planning, outreach, and land stewardship. An accompanying CD provides files with databases, geomatic data, and reports.

3.1 Conservation Planning

A conservation plan is a tool designed to help better conserve biodiversity and the ecological goods and services upon which we all rely. The results of the Nature Chelsea project are designed to provide support for urban planning, through the provision of tools to aid land use decision-making, including a conservation planning map, a wet areas map, and a database of species occurrence and species at risk habitat. The Conservation Plan is designed to be adaptive, with the plan being updated regularly, based on new scientific information gathered in Chelsea or available in the broader conservation biology community. The conservation plan will guide the Municipality of Chelsea in protecting its biodiversity and the ecological goods and services it provides.

Developing a conservation plan has many benefits, such as:

- Protection of biodiversity and providing a legacy for future generations;
- Improvement of water quality;
- Improving the capacity of the environment to provide the goods and services that humans depend on, such as pollination, water filtration, carbon storage, nutrient cycling, etc.

The Nature Chelsea conservation plan includes:

1. A database of species occurrence;
2. A database of species at risk habitat;
3. A conservation planning map showing areas of high biodiversity value, and;
4. A wet areas map
5. An analysis of habitat change for Blandings Turtle in Chelsea.
6. Information on the use of wildlife corridors in Chelsea by mid- to large-sized mammals

In the future, the Chelsea Conservation Plan will also include additional tools to aid specific land management decisions. For example, a biodiversity conservation plan could be developed to provide a framework for conservation practice in the Municipality. Such a plan may be embedded in a broader plan such as a Sustainable Development Plan or a Master Plan.

The specific elements of the Conservation Plan are described below. Moreover, a CD accompanies this report and includes the digital version of the elements of the Conservation Plan.

3.1.1 Database of Species Occurrence

Existing Data

Nature Chelsea received occurrence data for rare species occurring in Chelsea from the Ministère des Ressources naturelles et de la Faune, the National Capital Commission (Gatineau Park), and the Canadian Museum of Nature. A total of 1800 species occurrence records comprise a database used in the development of the Conservation Planning map. Nature Chelsea is bound to a data sharing agreement with the government agencies that provided the data and thus cannot distribute the data; however, a data sharing agreement could be requested by the MRC des Collines to each of the government agencies listed above. Appendix 1 includes contact information to request rare species occurrence data.

BioBlitz Data

To acquire additional species occurrence data, Nature Chelsea organized a BioBlitz in collaboration with the National Capital Commission. A BioBlitz is a rapid assessment, whereby taxonomic experts record as many species as possible over a 24-hour period. On June 6-7, 2009, forty-four scientists surveyed four parcels of land in the Municipality of Chelsea, Québec (Figure 1). The weather conditions during the 2009 BioBlitz were excellent, and the final tally of species reflects these conditions. A total of 1080 records for 640 species were collected during the 24 hours of the BioBlitz, including 85 species of birds, 9 species of herptiles (reptiles and amphibians), 13 species of mammals, 198 species of insects, 79 species of lichen, and 256 species of plants (Figure 2). Five species of lichen not previously recorded in Gatineau Park were found during the BioBlitz. This represents a phenomenal amount of effort on the part of the taxonomic experts, and it illustrates the richness of biodiversity in Chelsea. The results of the BioBlitz will be used by Nature Chelsea and the Municipality of Chelsea to better understand the importance of

protecting examples of rich habitats in the Municipality of Chelsea. A summary report of the 2009 BioBlitz and a digital list of species recorded are included in the accompanying CD.

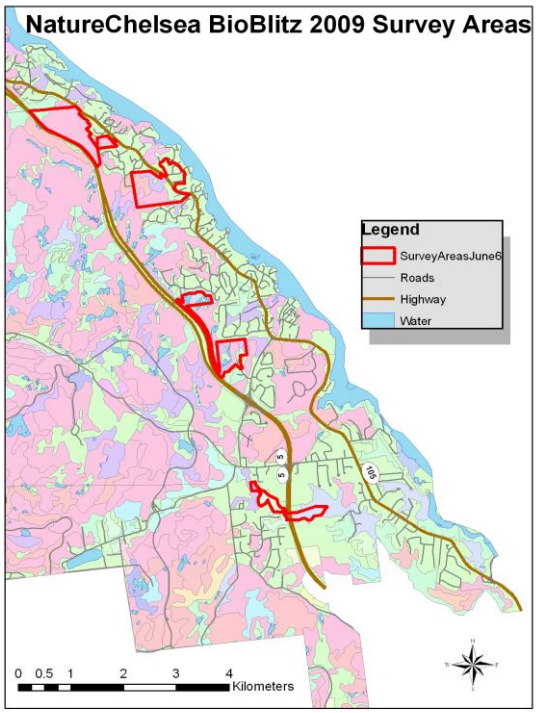

Figure 1. Areas surveyed during the 2009 BioBlitz in Chelsea, Quebec. Survey Areas are named Bocks 1 – 4, north to south.

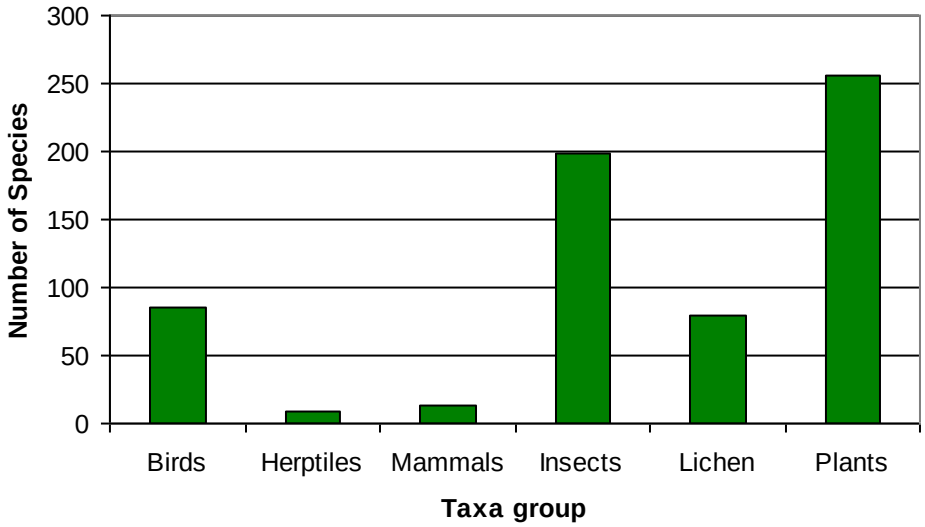

Figure 2. Number of species surveyed by taxa group in the 2009 Chelsea BioBlitz, June 6-7, 2009.

On June 5-6, 2010, a second BioBlitz was held in Chelsea, also in collaboration with the National Capital Commission. Thirty experts participated in the BioBlitz. The final tally of species has not yet been completed because some of the specimens require microscopic investigation. The weather conditions were challenging; heavy rain and cold temperatures limited the capacity of the experts to record some groups of species, such as nocturnal insects and birds. Spring was two weeks advanced from normal conditions, however, thus allowing the botanists to record some additional species from last year. Given these conditions, we expect that the final tally will be approximately 300 species.

3.1.2 Database of Species at Risk Habitat

In collaboration with the University of Ottawa, Nature Chelsea supervised a group of senior undergraduate students in the development of a database of species at risk habitat to aid in land use decision-making that is consistent with the conservation of species at risk. The objectives of the project included providing the Municipality of Chelsea with information on: (a) the habitat needs of SAR likely to occur within Chelsea and recommendations on which habitats should be of the highest conservation priority; (b) the most prevalent threats identified for the given set of SAR and how these could be mitigated through land-use planning; and (c) gaps in information for SAR and habitats within the Municipality that could inform conservation planning. The data required to fulfill these objectives were compiled into a database through the review of scientific literature and government reports. The database includes designations for each species at risk studied for National and Quebec designations, population numbers and sizes, habitat usage, threats, and potential impacts of development activities. The database includes information on 35 species that are identified as endangered, threatened or of special concern by COSEWIC or the province of Quebec, and thought to reside in the Municipality of Chelsea. The species at risk database and report are included on the accompanying CD.

3.1.3 Conservation Planning Map

We identified important areas for conservation in Chelsea by applying mapping rules to a set of geospatial data layers in ARC GIS (ESRI Inc.). The methodology for the conservation planning map was developed through an iterative process of parameter development, refinement and application. The selection of model parameters was based on potential positive and negative influences of each parameter to the biodiversity value of sites, and was constrained by available geospatial data (Table 1). In developing the model, we attempted to represent the special features that support biodiversity as well as the impacts of urbanization occurring in Chelsea. The model is designed to be iterative; it was developed in a manner to allow further refinement as new geospatial data become available or new knowledge of biological diversity and human impacts become available.

Geomatices data used to create the Conservation Planning Map originated from several sources. Table 1 in APPENDIX 1 detail the sources of the geomatices data. Nature Chelsea signed data sharing agreements with the proprieters of several data layers, including LiDAR and Element Occurrence data from the National Capital Commission (Gatineau Park), Canadian Museum of Nature, and Ministère des Resources naturelles et de la Faune (MRNF). These data sharing agreements were intended to protect proprietary information (i.e. Terra Point LiDAR data) or species at risk. It is possible for the MRC des Collines to enter data sharing agreements to obtain these data. Contact information is provided in Table 1, APPENDIX 1.

Table 1. List of geospatial data used to develop conservation values map

Layer	**Comments**
Landsat	Classified to vegetated and non-vegetated land
Road Layer	Residential, Route 105 and Route 5, buffered to a distance beyond the road edge
Wetland Layer	Buffered to a distance beyond edge of wetland
Stream and River Layer	Buffered to a distance beyond stream or river edge
Lake and Pond Layer	Buffered to a distance beyond lake or pond edge
Railway Line	Buffered to a distance beyond railway line edge
Cadastered Layer	Parcel size reclassified
Element Occurrence of Rare species (species occurrence records)	An **Element Occurrence** (EO) is an area of land and/or water in which a species or natural community is, or was, present. An EO has practical conservation value for the Element as evidenced by potential continued (or historical) presence and/or regular recurrence at a given location. For species[1] Elements, the EO corresponds with the local population, but may be a portion of a population (*e.g.*, long distance dispersers) or a group of nearby populations (*e.g.*, metapopulation). For community Elements, the EO may represent a stand or patch of a natural community, or a cluster of stands or patches of a natural community. http://www.natureserve.org/prodServices/eodraft/2.pdf EO buffered to a distance beyond point

Model Parameters:

Model parameters were selected based on a literature review of modeling biodiversity. These parameters were chosen to reflect the conservation values and risk or threat potential for natural areas in Chelsea (Table 2). The goal of this task was to develop appropriate sets of criteria that could be used as a tool to prioritize areas for conservation, given availability of geospatial data.

The Conservation Planning Map version 1.0 included nine parameters (Table 2). The Conservation Planning Map, version 2.0 considered eight parameters (Table 2); zoning designation was eliminated from version 2.0 because of its irrelevance to conservation value. A summary of the

rationale for the inclusion of parameters in the Conservation Planning Map version 1.0 and changes made in version 2.0 follows.

1. **Distance to Roads**: Roads have well-documented negative effects on biodiversity (Fahrig and Rytwinski 2009). Impacts of roads include habitat loss, habitat fragmentation, and risk of mortality. Roads with higher traffic volume and speed have a greater impact because they are wider, thus animals must travel farther distance to cross a road and are exposed to greater risk of mortality. Individuals of many species will not cross wide roads, thus the roads function as a complete barrier to animal movement. Moreover, automobiles travelling at higher speed and at higher density impose a greater mortality risk to wildlife. Conservation Planning map version 1.0 considered all roads to have the same weighting (-1). In version 2.0, highways were assigned a greater negative value (-2) than residential roads (-1) to reflect the greater risk of highways to wildlife (Table 2).

2. **Distance to Railway Line:** The railway line in Chelsea experiences a low traffic volume of trains, is a linkage to many forest patches, and it traverses through riparian habitat. Consequently, it likely functions as a habitat linkage and a wildlife movement corridor. We selected a buffer of 50 m to represent the linkage function of the railway line in Chelsea, and assigned a weighting of 1 to reflect its positive value for biodiversity (Table 2).

3. **Distance to Stream or River:** Streams, rivers, and riparian habitat (the area adjacent to streams and rivers), support many species of aquatic and semi-aquatic plants and animals. Riparian areas are also conducive to animal movement, functioning as wildlife movement corridors. The Best Management Practices for Wildlife Corridors (Paul Beier, Dan Majka, Shawn Newell, Emily Garding, Northern Arizona University, 2008) recommends corridor widths of 200 m or greater in riparian areas. The guidebook Riparian Widths for Birds (Environmental Law Institute. 2003) reviewed 12 studies that recommended riparian buffer widths necessary to sustain bird populations. The recommended widths varied from >40m to >500m. In Conservation Thresholds for Land Use Planners (Environmental Law Institute 2003), riparian buffer widths of at least 100 m were recommended to provide water protection and wildlife protection. In version 1.0 of the Conservation Planning Map, a buffer of 100 m was assigned to riparian habitat. In Version 2.0, we selected a buffer width of 200 m to incorporate the recommendations in the literature listed above (Table 2). Although up to 500 m was recommended in one of the reference, we felt this buffer would be overly restrictive to balance the needs of Chelsea residents and biodiversity, and furthermore the preponderance of evidence indicates that a buffer of 200 m would suit the needs of most species.

4. **Distance to Lake or Pond:** Lakes and ponds are important habitat for many aquatic and semi-aquatic species, and vegetated riparian areas adjacent to ponds and lakes function to filter run-off and stabilize shoreline, thus improve water quality. Shoreline vegetation is also important breeding habitat for many species. Maintaining a buffer surrounding ponds and lakes effectively protects important habitat and allows animals to migrate between ponds and lakes more effectively. Harper et al. (2008) recommended a buffer zone of greater than 100 – 165 m to maintain populations of spotted salamanders and an additional buffer zone to ensure the quality of core-habitat. Version 1.0 of the Conservation Planning Map buffered shorelines by 100 m and assigned a weighing of 1 to the buffer. Version 2.0 selected a buffer of 200 m to represent the importance of habitat surrounding ponds and

lakes and retained the same weighting of 1 (Table 2).

5. **Element Occurrence of Rare Species:** An Element Occurrence (EO) is a term used by NatureServe (www.natureserve.) to describe … " an area of land and/or water in which a species or natural community is, or was, present. An EO has practical conservation value for the Element as evidenced by potential continued (or historical) presence and/or regular recurrence at a given location. For species Elements, the EO corresponds with the local population, but may be a portion of a population (*e.g.*, long distance dispersers) or a group of nearby populations (*e.g.*, metapopulation). For community Elements, the EO may represent a stand or patch of a natural community, or a cluster of stands or patches of a natural community." Version 1.0 and 2.0 of the Conservation Planning Map used a buffer of 100 m surrounding element occurrences and a value of 2 to reflect the high quality habitat for rare species (Table 2).

6. **Distance to Wetland**: Wetlands are one of the richest habitats for biodiversity in Chelsea, supporting aquatic and semi-aquatic species of plants and animals, including several species at risk. The landscape surrounding wetlands serve many functions, including breeding, dispersal, foraging, and overwintering habitat, and uplands adjacent to wetlands provide habitat for the terrestrial life stages for species such as frogs that breed in wetlands and overwinter in nearby uplands. Semlisch and Bodie (2003) reviewed the literature for effective buffer size surrounding wetlands and found that buffers of up to 290 m from wetlands protected the habitat needs of most amphibian and reptile species. Version 1.0 of the Conservation Planning Map used a buffer of 100 m and assigned a weighting of 1. Version 2.0 used a buffer of 300 m to reflect the recommendations in the literature, and assigned a weighting of 2 to reflect the high value of wetlands to biodiversity (Table 2).

7. **Parcel Size:** Small forests support small numbers of wildlife. Some species are "area-sensitive" and do not inhabit small woodlands, regardless of the condition of the forest. Bird species that breed only in large forest patches and far from edges are known as forest interior species. Small patches of forest distributed throughout a landscape isolates populations of small mammals, amphibians and reptiles with limited mobility, thus reducing population survival over the long term. For species with greater mobility, populations are typically healthier where forest fragments are distributed closely together or connected by movement corridors. The publication Conservation Thresholds for Landscape Planners (Environmental Law Institute 2003) recommends maintaining some forest patches greater than 55 ha (136 acres). A review of patch size requirements by a variety of species indicate that patch size greater than 1 ha (2.5 acres) is recommended for maintaining invertebrates such as butterflies, and patches greater than 10 ha (25 acres) are recommended to maintain higher bird and rodent diversity (Environmental Law Insitute 2003). Version 1.0 of the Conservation Planning Map assigned a weighting of 1 for parcels under 2 acres, 2 for parcels between 2 and 5 acres in size, and 3 for parcels greater than 5 acres. Version 2.0 incorporated the recommendations from the literature and assigned weightings to parcel sizes 2.5, 25, and 136 acres (Table 2).

8. **Vegetated Zone:** Using Landsate imagery, we classified the landcover into vegetated and non-vegetated lands, to partition human infrastructure (e.g. buildings) from

natural areas. Versions 1.0 and 2.0 of the Conservation Planning Map assigned a weighting of 1 to vegetated areas. (Table 2)

9. **Parcels with Zone PAE:** Version 1.0 considered lands with zoning PAE to have greater potential for conservation than parcels zoned residential or commercial, and thus weighted PAE lands with a value of 1. This parameter was eliminated from version 2.0 because conservation value should be independent of current zoning (Table 2).

Table 2. Model Parameters for conservation planning map version 2.0

Parameter	**Mapping Rule Version 1.0**	**Mapping Rule Version 2.0**
Distance to Roads	Within 50 m of all road types = -1	Within 50 m of Route 5 = -2 Within 50 m of Route 105 = -2 Within 50 m of residential roads = -1
Distance to Railway Line	Within 50 m = 1	Within 50 m = 1
Distance to Stream or River	Within 100 m = 1	Within 200m = 2
Distance to Lake or Pond	Within 100 m = 1	Within 200m = 1
Element Occurrence of rare species	Within 100m = 2	Within 100m = 2
Distance to Wetlands	Within 200m = 2	Within 300m = 2
Parcel Size		<2.5 acres = 1, >= 2.5 acres <25 acres=2, >= 25 acres <136 acres = 3 >=136 acres = 4
Parcels with Zone PAE	=1	Removed from model
Within Vegetated area	=1	=1

Model Development Methods

A Geographic Information System (GIS; ARC GIS v 9.0, ESRI Inc.) was used to develop the model. The map builder module was used to create the model for ease in future revisions of the model. Map weightings (Table 2) were summed across the spatial surface, and final score were partitioned into five categories of conservation value, from low to high (Figures 3 and 4). The model and spatial layers are included in accompanying CD.

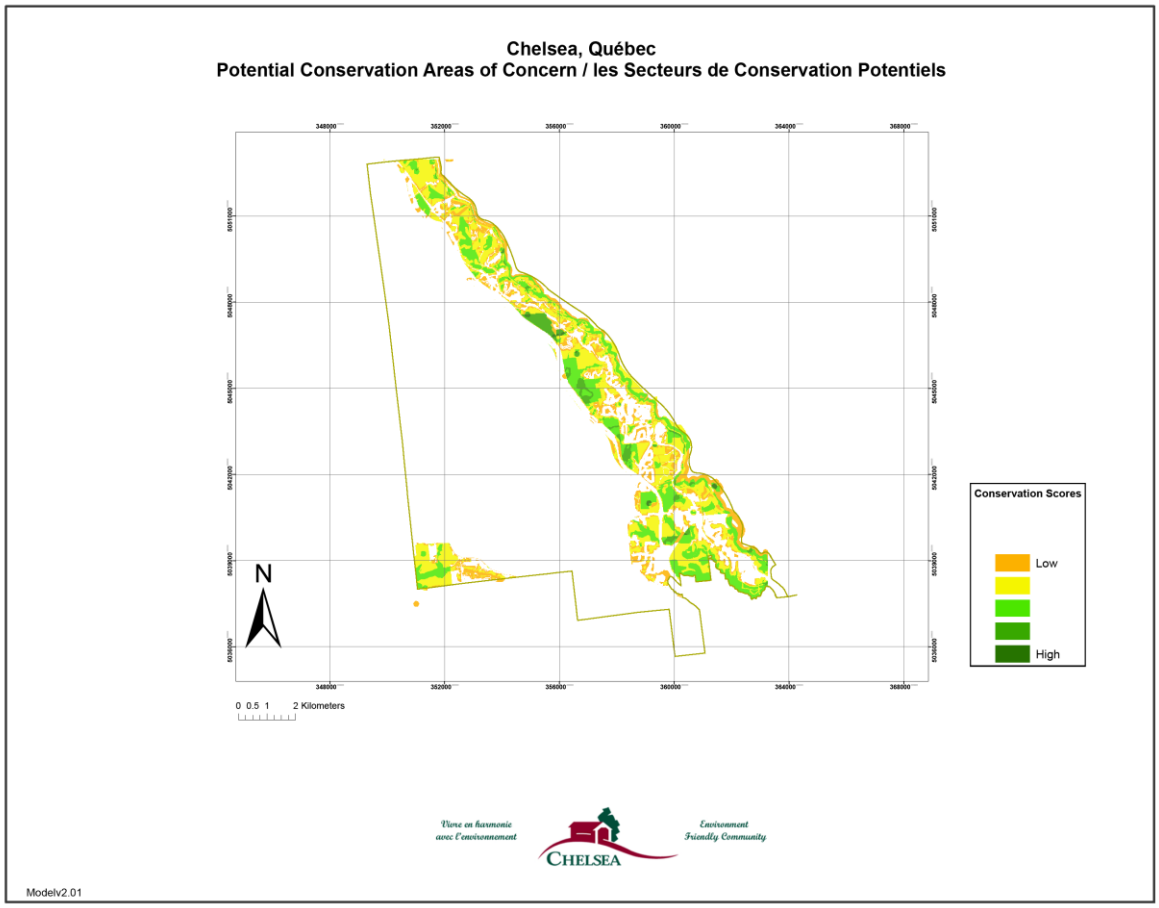

Figure 3. Conservation Planning Map version 1.0

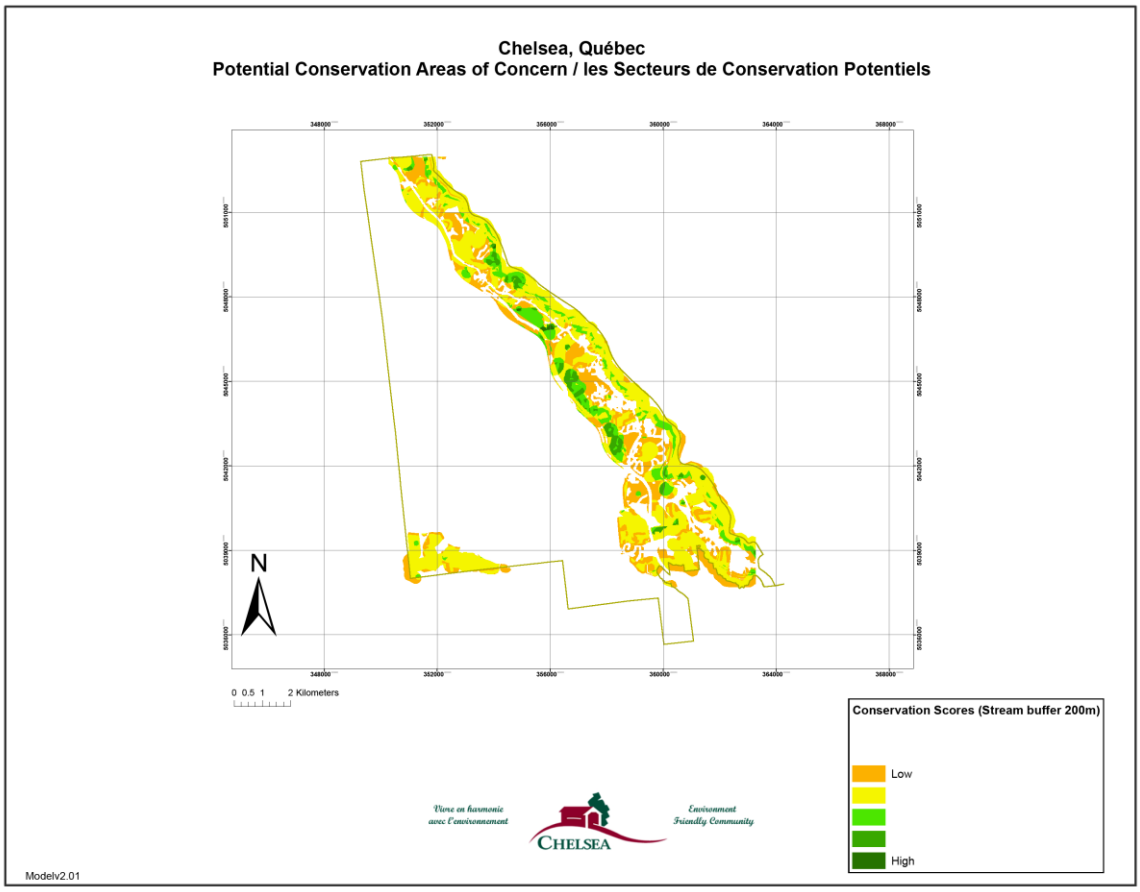

Figure 4. Conservation Planning map, version 2.0

3.1.4 Wet Areas Map

Wetlands provide rich habitat for many species of plants and animals, and also provide the critical ecological service of water filtration. The Municipality of Chelsea's wetland protection by-law imposes a 30 m set-back on the development of all roads and infrastructure surrounding wetlands of greater area than 1000 m^2. Although this by-law provides protection to wetlands, the Municipality was lacking a fine-scale map of wet areas for planning and by-law enforcement purposes. Nature Chelsea engaged the University of New Brunswick for the development of a fine scale wet areas map. Using a fine scale LiDAR satellite image donated by Terra Point, the University of New Brunswick developed and donated a wet areas map for south Chelsea (Figure 5). The Municipality of Chelsea and the National Capital Commission are collaborating on the acquisition of LiDAR images for the remainder of Chelsea. Once the images are completed, a wet areas map could be developed for the remainder of the Municipality. The digital image of the wet areas map is included in the accompanying CD.

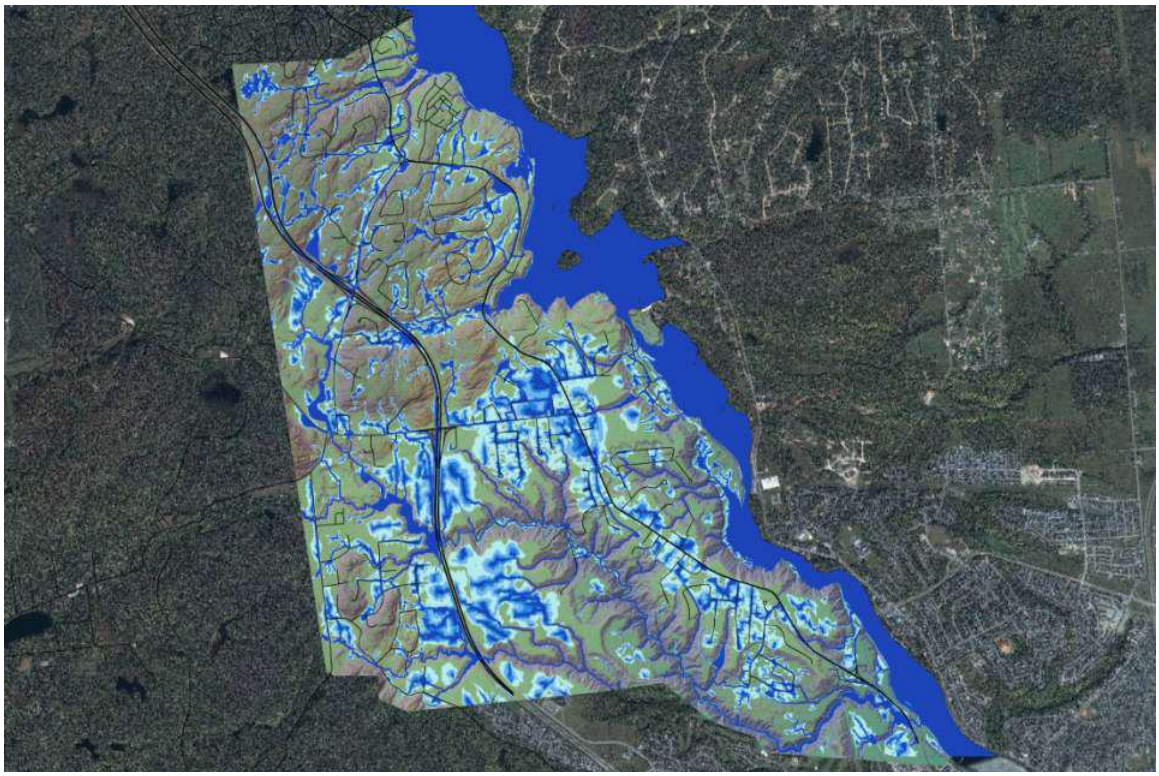

Figure 5. Wet Areas map of south Chelsea, Quebec.

3.1.5 Analysis of Habitat Change for Blandings Turtle in Chelsea.

In collaboration with the University of Ottawa, Nature Chelsea provided data and supervised a senior undergraduate thesis by Luba Reshitnyk on the distribution of potentially suitable habitat for the threatened Blanding's Turtle (*Emydoidea blandingii*), a semi-aquatic freshwater turtle in Chelsea, Québec for the years 1994 and 2007. A habitat suitability model was developed using

remotely sensed Landsat data and spatial environmental variables from the two time periods (Figure 6). The results of this study demonstrate a 10% decline in suitable habitat between 1994 and 2007 and is most likely the result of continuing urban development within the municipality. A digital copy of the thesis and presentation poster is provided in the accompanying CD.

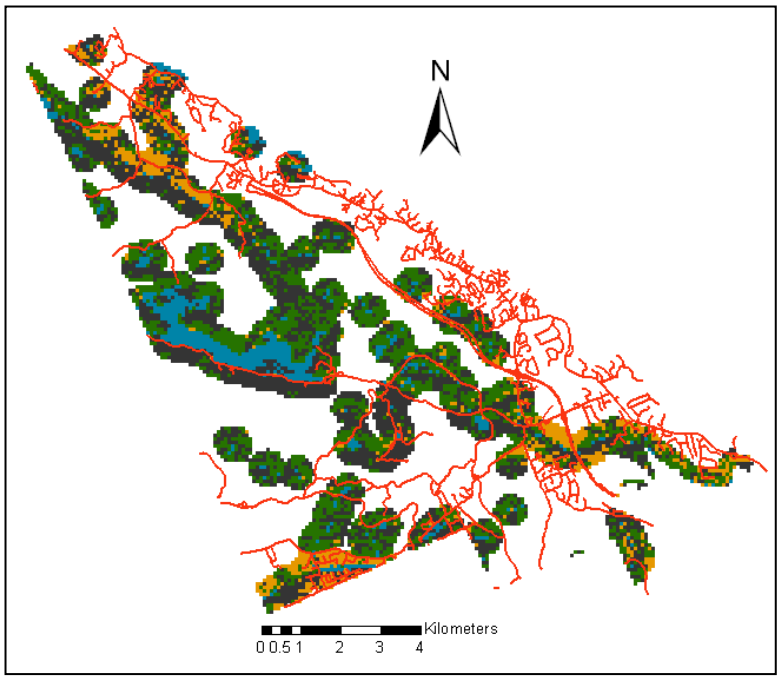

Figure 6 Available Blanding's Turtle nesting habitat in the Municipality of Chelsea. Orange indicates unsuitable habitat; green indicates suitable habitat. Roads are indicated in red and lakes and ponds in blue.

3.1.6 Use of wildlife corridors in Chelsea by mid- to large-sized mammals

Nature Chelsea designed and initiated a study of wildlife movement corridors in Chelsea. Eight potential wildlife movement corridors were identified (Figure 7), based on habitat extending between the Gatineau River and Gatineau Park, or between Gatineau Park and the Ottawa River. The habitats delineated for potential corridors exist in areas of low road density, large patches of forest, or riparian habitats.

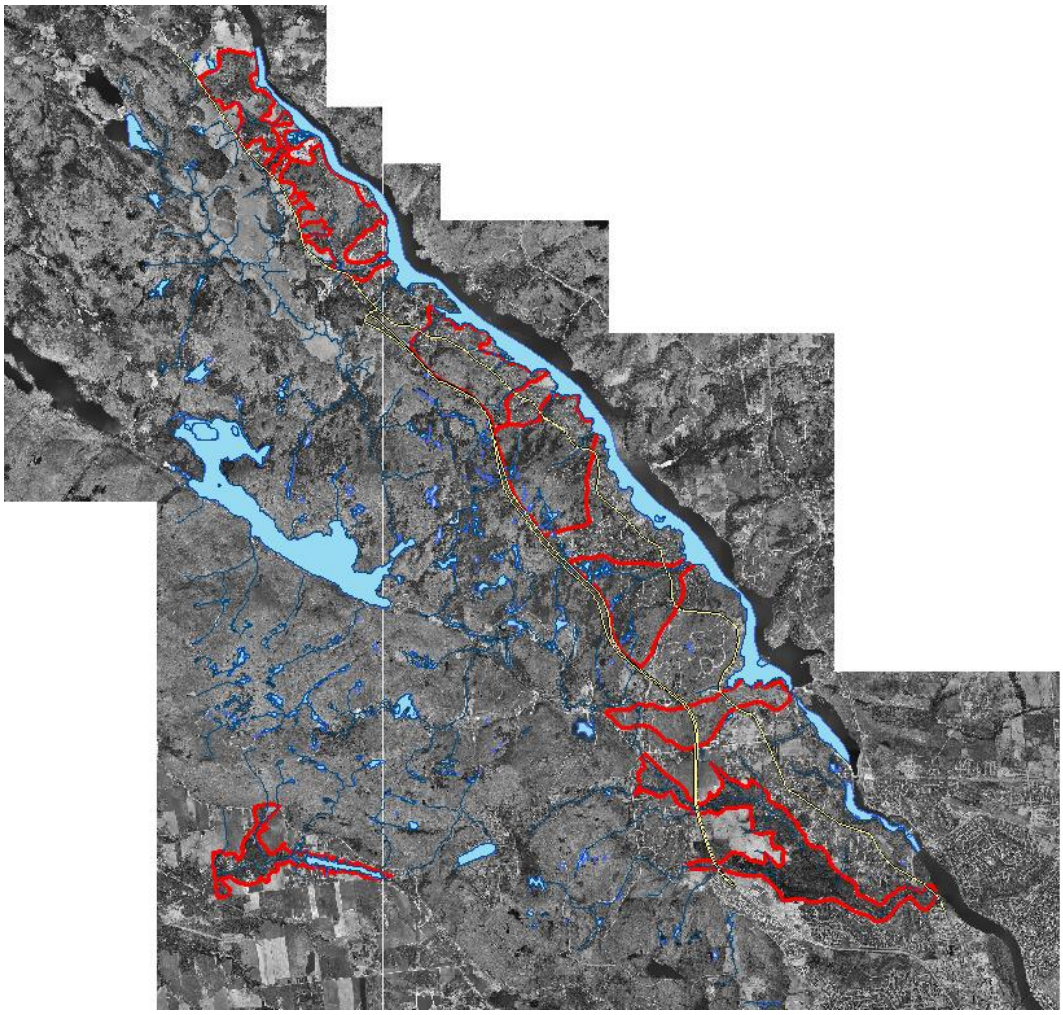

Figure 7. Potential wildlife movement corridors in Chelsea, Québec

In collaboration with the University of Ottawa, Nature Chelsea is supervising a senior honour's thesis investigating the use of four wildlife movement corridors by mid- to large-sized mammals: Chelsea Creek, Juniper, Larrimac and NCC. Four remote cameras (Reconyx) have been employed as a survey technique, supplemented by snow tracking during the winter. One remote camera is strapped to a tree in each corridor for a period of two weeks, and then moved to a new location within each corridor. The following graphs (Figures 8 – 11) indicate preliminary results of the camera surveys for each corridor. Digital photos of wildlife detected by the cameras are included in the accompanying CD. The wildlife corridor research is ongoing, and a report of the first year of the study is due to be completed by December 2010.

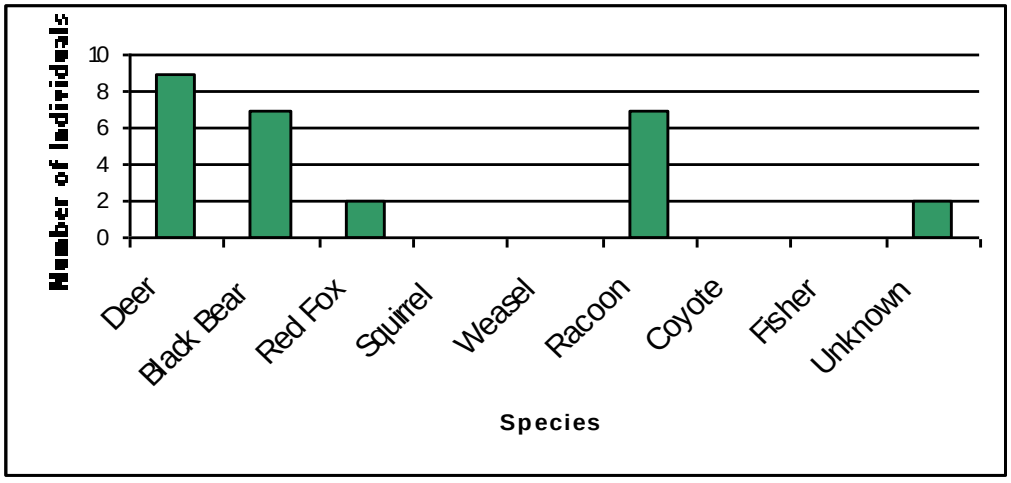

Figure 8. Number and species of wildlife recorded by Reconyx remote camera in the Chelsea Creek wildlife movement corridor during winter 2009.

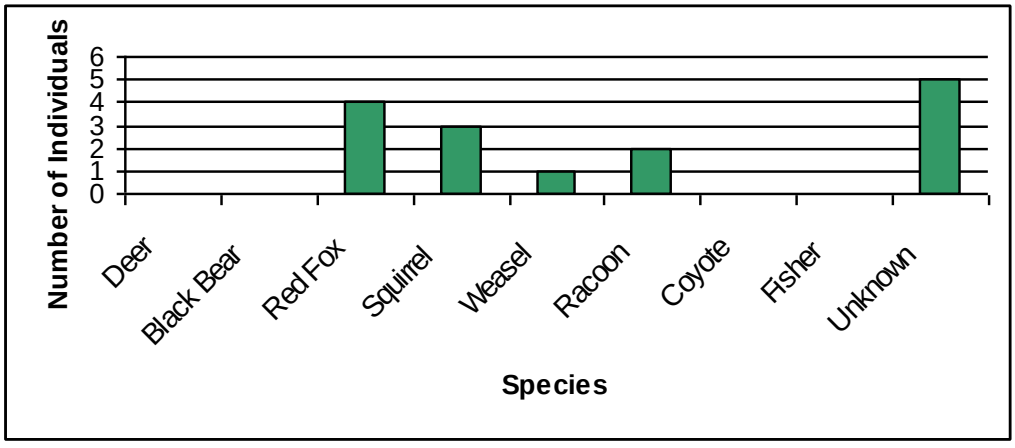

Figure 9. Number and species of wildlife recorded by Reconyx remote camera in the Juniper wildlife movement corridor during winter 2009.

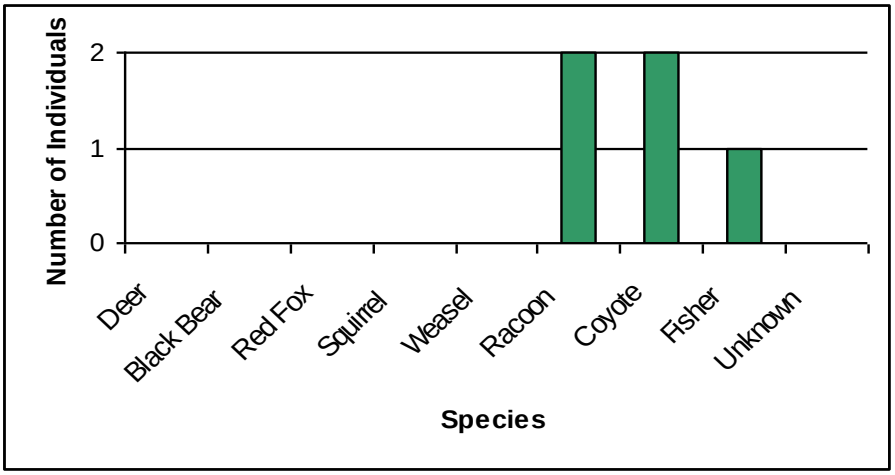

Figure 10. Number and species of wildlife recorded by Reconyx remote camera in the Larrimac wildlife movement corridor during winter 2009.

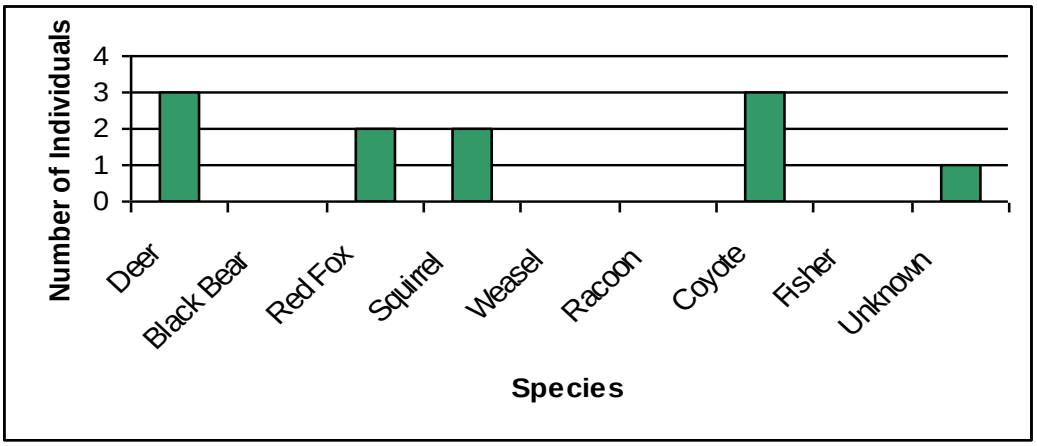

Figure 11. Number and species of wildlife recorded by Reconyx remote camera in the NCC wildlife movement corridor during winter 2009.

3.2 Outreach

The outreach component of the Nature Chelsea project is designed to sensitize Chelsea residents to the value of biodiversity and the natural habitats in Chelsea. The following is a list of programs provided by Carolyn Callaghan and volunteers from the community, Carleton University and University of Ottawa, in collaboration with science teachers from Chelsea Elementary School and Ecole du Grand Boise. Table 2 at the end of this section details the number of participants in the school programs. The accompanying CD includes details of the lesson plans and teaching resource material.

3.2.1 2008/09 Scholastic Year

On the Tracks of Wild Animals (grade four École du Grand Boise).

Carolyn led grade four students through the forest adjacent to École du Grand Boise. The outings began in the classroom to introduce tracks and tracking, then continued outdoors to search for and identify tracks.

On the Trail of Wetlands (grades 4-6, Chelsea Elementary School).
The teaching unit consisted of an introduction to wetlands, their value to biodiversity, and the species that inhabit wetlands, a field trip to local wetlands, and an in-class exam on wetlands. Teaching materials were provided by Ducks Unlimited.

Mini Bioblitz

Nature Chelsea organized a mini BioBlitz in June 2009 for both of the elementary schools in Chelsea. This event involved all students of the school and several community volunteers, with teams of students assigned to volunteer naturalists. Each team had 2 hours to record as many different species as possible. At the end of the day, all teams gathered together to make the final tally of the BioBlitz and participate in an ending ceremony.

3.2.2 2009-2010 Scholastic Year

Discover your Neighbourhood Forest Teaching Unit – Cycle 3

Chelsea Elementary School (5ieme et 6ieme année) and École du Grand Boise (5ieme année)

The forest teaching unit was a collaborative arrangement with Nature Chelsea (Carolyn Callaghan), MRC des Collines (Vincent Barrett), Chelsea Elementary School (5ieme et 6ieme année) and École du Grand Boise (5ieme année). This unit conforms with the Quebec Ministry of Education Science Curriculum for cycle 3.

The teaching unit complies with the following Quebec Education Program (QEP) Broad Areas of Learning:

1. Personal and Career Planning
2. Environmental Awareness and Consumer Rights and Responsibilities

The teaching unit complies with the following QEP cross-curricular Competencies:

1. *Intellectual Competencies*: To use information; To solve problems; To use creativity
2. *Methodological Competencies*: To adopt effective work methods
3. *Personal and Social Competencies*: To cooperate with others
4. *Communication-Related Competencies*: To communicate properly

The teaching unit complies with the following QEP science competencies:

1. To proposed explanation for solutions to scientific and technological problems
2. To make the most of scientific and technological tools, objects and procedures
3. To communicate in the language used in science and technology

The teaching unit complies with the following QEP mathematics competencies:

1. To reason using mathematical concepts and processes
2. To communicate using mathematical language

Goal: To help students gain an appreciation of forests as habitat for biodiversity

Objectives:

1. Students will learn about the concept of habitat and the importance of the eastern deciduous forest as habitat to wildlife in Chelsea
2. Students will learn to identify 6 species of trees by leaves, bark, and twig
3. Students will learn the parts of a tree and how to age a tree by its rings
4. Students will learn what species of mammals use the forest in winter and how to recognize the tracks of 10 mammal species
5. Students will learn the importance of trees to cavity nesters (barn owl), and will learn how to identify small mammal prey species of barn owls.

Teaching Unit Components

This unit began in the fall before the leaves fall off the trees, and concluded in the winter. The program included the following elements:

Fall (September – mid-October):

Introduction

In-class introduction to the teaching unit, the eastern deciduous forest, and the value of forests as habitat for biodiversity (1 hour presentation by Carolyn)

Forest Outing

Outing to the forest near the school. Students observed trees and learned to recognize 6 species of trees by their leaf, bark, and branches. Students collected leaves for their own hebarium collection. (2 hour trip led by Vincent Barrett and Carolyn Callaghan).

Leaf Collection

Using the leaves collected during the outing, students created their own herbarium collection of the species of trees, shrubs and flowers that they are required to learn. Students labelled the leaves with the correct scientific name and common name of each species.

(Activity led by teacher 1 – 2 weeks after the field trip. Total time 1 – 2 hours).

Identification Test

Students were tested on their ability to recognize species of trees by their leaves
(Test led by teacher. 30 minutes)

Winter (January –March 2010)

In Class Tree Ring Activity

Students learned the parts of a tree, including heartwood, sapwood, cambium, and bark. Students learned to age a tree by counting the rings, and learned the elements that influence the growth of a tree (sunlight, soil, moisture conditions). Teaching materials purchased from Acorn Naturalists (2 hour activity, led by a Parlons Science volunteer from University of Ottawa).

Mammals of the Forest

In-class introduction to mammals and their taxonomy. Students select a mammal to research their taxomony as a homework assignment. (1 hour activity led by Carolyn)

Mammal Outing

Outing to the forest near the school. Students learned to recognize tracks of wild animals that live in the forest during winter. (2 hour activity, led by Carolyn Callaghan)

In Class Owl Pellet Activity

Owls are an important part of our forest ecosystem. Students dissected an owl pellet and learn how to identify small mammal bones that are contained within the owl pellet as

well as how to recognize the call of local owls. This activity occurred during owl breeding season (February or March). (2 hr activity, led by Carolyn)

Table 3. Educational Workshops offered by Nature Chelsea in the elementary schoolsAteliers éducatifs offrir par Nature Chelsea a les écoles et au communautaire.

Date	School	Workshop	Number of students
May 2009	Chelsea Elementary School	Introduction des Milieux Humides	50
May 2009	Chelsea Elementary School	Sortie au Milieux Humides et rassemblement des données	50
May 2009	Chelsea Elementary School	Milieux Humides Examen	50
June 2009	Chelsea Elementary School	BioBlitz	450
June 2009	Chelsea Community	BioBlitz Événement (tente public, les promenades, ateliers des scientifiques)	300
October 2009	Chelsea Elementary School	Introduction des forets	48
October 2009	Chelsea Elementary School	Sortie au foret pour faire l'identification des feuilles et instruction pour faire les herbiers	48
February 2009	Chelsea Elementary School	Introduction des traces des animaux sauvage et sortie pour voir les traces des animaux sauvages	48
March 2010	Chelsea Elementary School	Pellets de régurgitation des chouettes	48
June 2009	École du Grand Boise	BioBlitz	400
October 2009	École du Grand Boise	Introduction des forets	49
October 2009	École du Grand Boise	Sortie au foret pour faire l'identification des feuilles et instruction pour faire les herbiers	49
November 2009	École du Grand Boise	Identification des conifères	49

February 2010	École du Grand Boise	Introduction des traces des animaux sauvage et sortie pour voir les traces des animaux sauvages	49
April 2010	École du Grand Boise	Introduction des cernes des arbres	49
April 2009	Communautaire Chelsea	Fête de terre kiosque	
June 2009	Communautaire Chelsea	BioBlitz Événement (tente public, les promenades, ateliers des scientifiques)	300
March 2010	Communautaire Chelsea	Présentation de Nature Chelsea	25
April 2010	Communautaire Chelsea	Fête de terre kiosque	40
April 2010	Communautaire Chelsea	Pollinisation kiosque	20

3.2.3 Outreach for the general public

Nature Chelsea engaged in many activities designed to increase the public awareness of biodiversity in Chelsea. The Nature Chelsea website, www.naturechelsea.ca was developed, with detailed information on biodiversity. An on-line bio-mapping component allows participants to send species observation data to Nature Chelsea. Once the data is received, Nature Chelsea can develop species occurrence maps and project them on the web site. Details of the Nature Chelsea web site are shown in Figures 12 and 13.

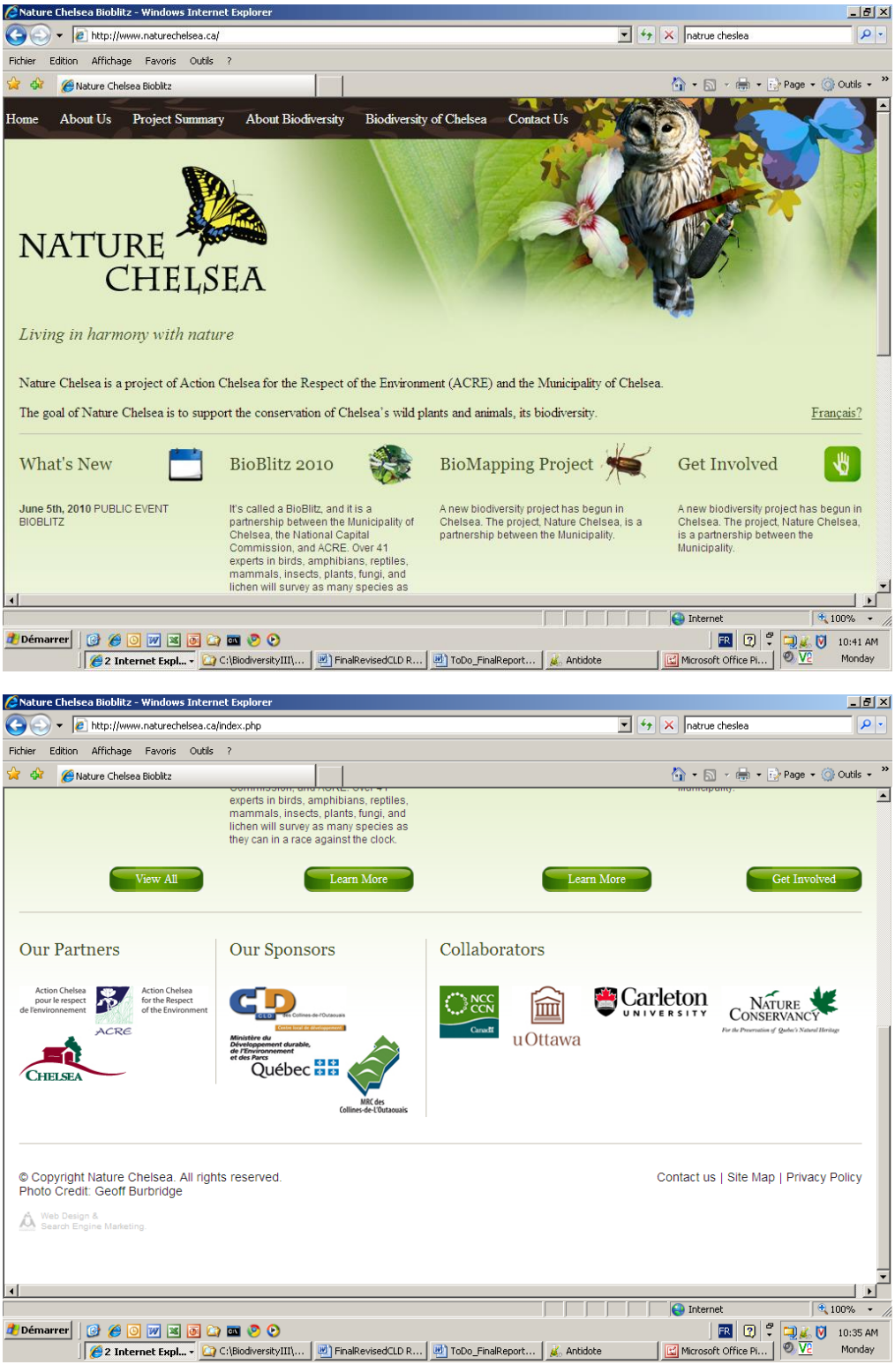

Figure 12. Nature Chelsea website, home page.

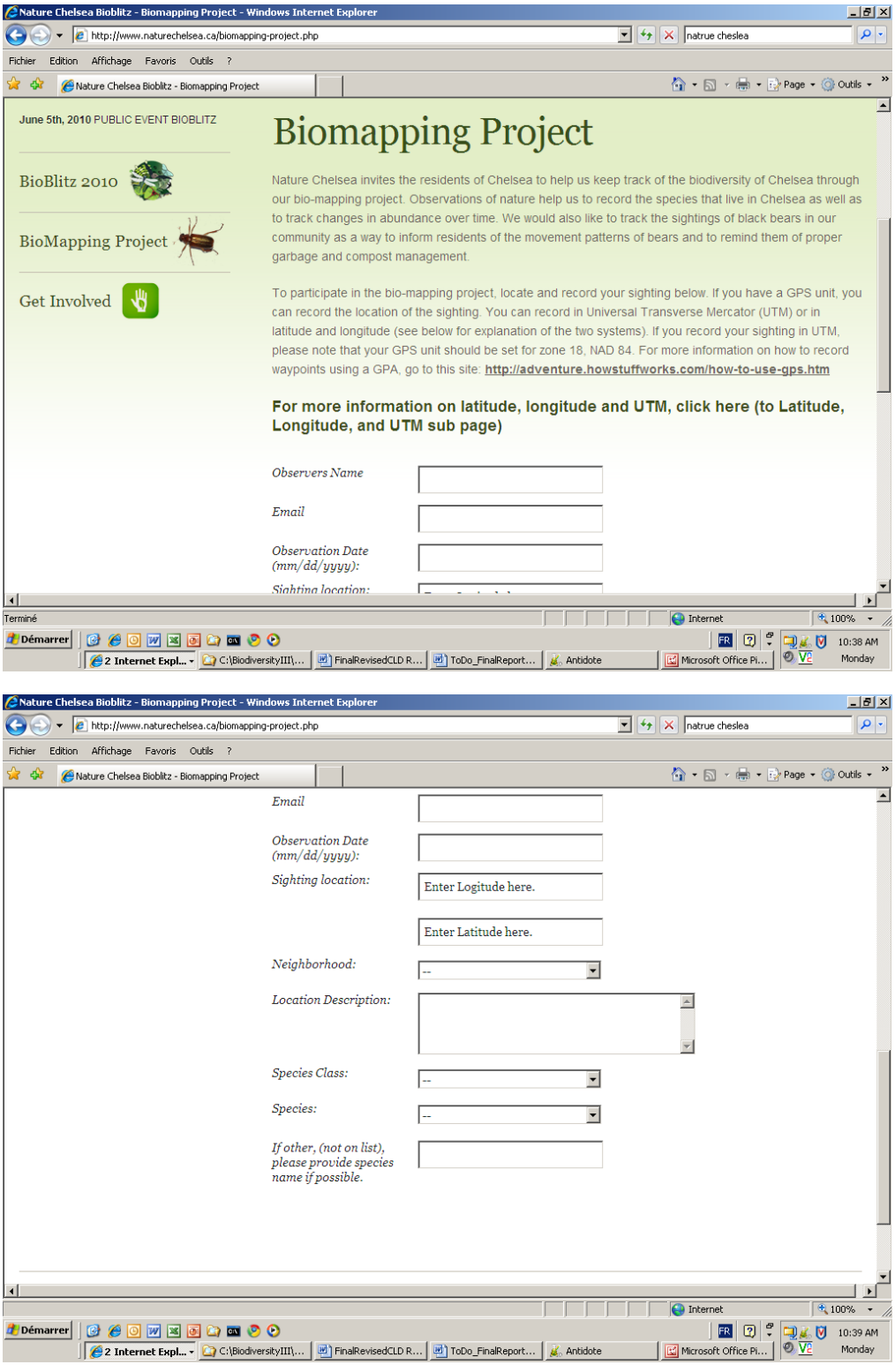

Figure 13. Nature Chelsea Bio-Mapping project on the Nature Chelsea website.

In addition to the Nature Chelsea website, outreach activities for the general public include:

1. Newspaper Articles: A bi-weekly column in the local newspaper, the Low Down, featuring local species (2009 – 2010). In addition, numerous articles

2. BioBlitz: A public outreach component was organized for the 2009 and 2010 BioBlitz, including an exhibitor's tent and outreach activities including guided naturalist walks, a mini BioBlitz with scientists, a bird banding display, and a display of night insect surveys. In 2009, approximately 20 volunteers and 300 members of the public participated in the public event component of the BioBlitz. In 2010, 170 people attended special events during the BioBlitz and approximately 150 additional people visited the exhibits during the event. In 2009, the BioBlitz was covered by CBC radio, Radio Canada, and the Low Down. In 2010, the BioBlitz was covered by the Ottawa Citizen, CBC Radio, and the Low Down.

3. A speaker series on biodiversity, including a presentation on the Nature Chelsea project

4. A booth for the annual Earth Day celebration in 2009 and 2010, a Chelsea gardener's meeting, a Gatineau Valley Historical Society meeting, and a photography exhibit

5. A bearwise evening program, designed to bring awareness of how to avoid habituating bears to human settlements (Chelsea Municipaction program).

6. Two programs for the Chelsea Library reading club

7. A presentation for the Chelsea summer camp

3.3 Land Stewardship

Land Stewardship can be defined as a coordinated approach to a range of activities by landowners that ensure the land use is consistent with the capacity of the land to support biodiversity and supply ecological goods and services. The term implies that landholders are rewarded for the ecosystem services they provide. Being a steward of the land is manifested in a sense of responsibility for the well-being of the land; a land ethic, as Aldo Leopold coined it (1949).

Many conservation groups and governments are engaging in Land Stewardship programs for the purpose of sustaining provision of public benefits from private land, including ecological goods and services, maintaining specific landscape features, of sustaining species at risk. There are many ways to reward landowners for the provision of these benefits, and some projects have been more successful than others. Nature Chelsea collaborated with the University of Ottawa to review the existing literature and assess the ways in which local stakeholders have actively participated in the protection and maintenance of biodiversity, natural landscapes, and threatened species recovery. This review interprets evidence on effective ways in which local governments, non-governmental organizations, landowners, and the wider public can collaborate in biodiversity conservation. The report provides a summary of the effective and ineffective methods of engaging communities in conserving planning and threatened species recovery using

several case studies; identifies the barriers to landowner and community involvement in conservation planning and threatened species recovery; and identifies strategies to overcome barriers to landowner and community engagement in conservation planning and threatened species recovery. The report and a database of published studies, including bibliographic information, are available on the accompanying CD.

4.0 Project Budget

4.1 Summary

The Protocole d'Entente between le centre local de développement des Collines-de-l'Outaouais (CLD) and the Municipality of Chelsea was signed on June 11, 2008. At the signing of the Protocole d'Entente, the forecast budget for Year One of the Nature Chelsea project was $142 000 and $92 000 for Year 2, for a total of $ 234 000 (see Entente budget in accompanying CD). Nature Chelsea received a total of $100 500 in cash donations and $115 000 In Kind support, for a total of $215 500 over two years (Tables 4 – 6).

Table 4. Source of funds for the Nature Chelsea Project, 2008 – 2010.

Source of Funds	**Sum YR1**	**Sum YR2**	**Total**
CLD Fonds du Pacte rural	30000	30000	60000
Fonds du MDDEP	30000	0	30000
Municipalité de Chelsea	6000	6000	12000
Action Chelsea (ACRE)	10500	10500	21000
Agence Parcs Canada	3000	3000	6000
Institut de l'environnement, Université d'Ottawa	2000	4000	6000
TerraPoint – données LIDAR	10000	0	10000
BioBlitz - Scientists	22500	15000	37500
Conservation de la nature Canada	3000	7000	10000
MRC Volet II	1750	8750	10500
CCN - Bioblitz	5000	5000	10000
Université de Nouveau Brunswick	0	2500	2500
Total	**$123,750**	**$91,750**	**$215,500**

Table 5. Source of In Kind Funding Nature Chelsea Project

Source of Funds	**Sum YR1**	**Sum YR2**	**Total**
Cheslea	6000	6000	12000
ACRE	10500	10500	21000
Parks Canada	3000	3000	6000
University of Ottawa	2000	4000	6000
Nature Conservancy	3000	7000	10000
Terra Point	10000	0	10000
University of New Brunswick	0	2500	2500
BioBlitz Taxonomists	22500	15000	37500
National Capital Commission	5000	5000	10000
TOTAL	**$62,000**	**$53,000**	**$115,000**

Table 5. Source of Cash Donations Nature Chelsea Project.

Source of Funds	**Sum YR1**	**Sum YR2**	**Total**
CLD Fonds du Pacte rural	30000	30000	60000
Fonds du MDDEP	30000	0	30000
MRC (Volet II)	1750	8750	10500
Total	**$61,750**	**$38,750**	**$100,500**

The Entente was signed on June 11, 2008, thus the first year of the project was June 11, 2008 – June 10, 2009. Although the forecast budget for Year One of the project Protocole d'Entente was $143,750, the project actually received $123,750 and spent $94,444. The reason that less funding was spent than was available was due to the initiatives starting later in the first year. The coordinator was hired in October 2008. Please APPENDIX 2 for budget details.

The second year of the project was 11 June 2009 – 10 June 2010. The forecast budget for Year Two in the Protocole d'Entente was $93,750. The project received $91,750 for the second year and spent $108,980. Note that due to the late start of the project, second year of the project had more spending than the projected annual budget expenditures.

In total, the project received $215,500 and spent $203,424. The remaining funding totals $12,076. This funding will be spent between June 12 and October 9, 2010, when Phase One of the project is due to be completed. See APPENDIX 2 for budget details.

4.2 Web Site Costs

The original project proposal included $50,000 for the development of a sophisticated interactive species occurrence mapping component. Funding was proposed from Geoconnections ($42000) and MDDEP/CLD ($8000). ACRE was not successful in obtaining funding from Geoconnections for the on-line mapping component; however, a web site with an interactive component for species occurrence data was developed (www.naturechelsea.ca). The bilingual website features a component that allows users to upload the location and information on their observations of species in Chelsea. Information on species locations is automatically sent to Nature Chelsea, and we are able to project this information on maps, which can later be posted on the website. The total cost of the web site development was $5,609. The remainder of the funding ($2,391) was spent on other outreach costs; specifically, to cover costs of holding the BioBlitz of 2010.

5.0 Applying Lessons Learned to Other Municipalities

The steps outlined in this report that were used in Chelsea will be broadly applicable to other municipalities. The details may be different but the recommendations below should be considered as guidance for attaining biodiversity conservation in other municipalities.

1. In all cases, we recommend using a focus on 3 elements of biodiversity conservation 1) a sound scientific understanding, 2) a program of public education and 3) a program of land stewardship. All three elements must be present to ensure success.

2. Spatial conservation models can be very powerful tools to inform decision makers, and engage the public. There are many different approaches to developing conservation models and municipalities should choose one that fits their needs and level of expertise. In the Chelsea example we had high level access to universities and organizations. Most municipalities can have similar access simply by approaching university professors, who are only to happy to have their students engaged in real world applications. All areas of Canada have some level of free GIS coverage, which can be accessed by the web. Topographic maps are free at http://atlas.nrcan.gc.ca/site/english/index.html and Landsat coverage is available free at http://geogratis.cgdi.gc.ca/geogratis/en/index.html. Species at risk data for Quebec is available at www.cdpnq.gouv.qc.ca/. From these data sets it is possible to construct a basis conservation model. In addition forest cover information and land ownership information is available through the MRC. From these data sets it is possible to construct a basis conservation model using the steps outlines in this report.

3. The Nature Chelsea project used a straightforward approach for public education and engagement, including schools, public lectures and community newspapers. The holding

of a “Bioblitz” was especially engaging for the public. A guide to conducting a Bioblitz is available at http://wiki.laptop.org/go/BioBlitz_guide.

6.0 Literature Cited

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Appendix 1

Table 1. Metadata for the Nature Chelsea Conservation Plan.

Type	Year	Source	Agreement Req'd	Comments	Contact
Orthophotos	2001	MRC			
Orthophotos	2004	MRC			
Orthophotos	2007	MRC			
Landsat 5	2003?	Gatineau Park	Yes	classified veg. data.	Sandra Cook / Biologiste Parc de la Gatineau Commission de la capitale nationale (819) 827-6022 scook@ncc-ccn.ca
LiDAR	2006	TerraPoint	Yes	lower 2/3rds of municiplaity.	Phyllis Cross | Director, Client Program Management Terrapoint 1 Antares Drive, Suite 140 | Ottawa, ON Canada K2E 8C4 tel: 613-820-4545 x224 cell: 613-355-2820 | fax: 613-820-9772 site: www.terrapoint.com
Watershed shp		MRC			
Cadastred Land Ownership.shp		MRC		size, ownership	
Soils .shp		MRC			
Wetland.shp		MRC		incomplete layer	
Ecoforestier 2007.shp		MRC		3rd edition	
road.shp		MRC		1y,2y,3y rds	
hydrology.shp		MRC			
topography.shp		MRC			
gatineau park boundary.shp		MRC			
Chelsea Municipal boundary.shp		MRC			
occurrence data rare spp		MRNF Quebec	Yes	Flora and Fauna occurrence records.	Chantal Picard, Biologiste, Ministère de Développement Durable, de l'Environnement et des Parcs

occurrence data rare spp		Gatineau Park	Yes	Flora and Fauna occurrence records.	Sandra Cook / Biologiste Parc de la Gatineau Commission de la capitale nationale (819) 827-6022 scook@ncc-ccn.ca
occurrence data spp of interest		Can Mus Nature	Yes	Flora and Fauna occurrence records.	Roger Baird, Director/ Directeur Services des collections Musée canadien de la nature B.P. 3443 Succ. D Ottawa ON K1P 6P4 613.364.4138 rbaird@mus-nature.ca www.nature.ca
BioBlitz data	2009	ACRE		Occurrence 653 spp. June 6-7 2009 on 4 parcels of land in Chelsea. Provided to MRC	
GP hydrology.shp		NCC			
GP forest cover.shp		NCC			
GP soils.shp		NCC			
Wet Areas Map	2009	University New Brunswick		Provided to MRC	Dr. Paul A. Arp Faculty of Forestry and Environmental Management 28 Dineen Drive University of New Brunswick, P.O.Box 44555 Fredericton, New Brunswick Canada E3B 6C2 Tel. 506 453 4931 Fax 506 453 3538 E-mail: arp2@unb.ca http://watershed.for.unb.ca/
Conservation Planning Map	2009	ACRE NatureChelsea		jpeg of model, model builder and model layers provided to MRC	

APPENDIX 2. Project Budget

Description des coûts	Première année forcast	Première année réelle	Dispense	Deuxième année forcast	Deuxième année réelle	Dispense	Somme Reportée	Source assurée	COMMENTS
Local à bureaux, matériel et équipement, appui du projet et soutien administratif du personnel comptable de la Municipalité	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$0	Municipalité de Chelsea	Unchanged from original budget
Conception et analyse scientifiques, présentations publiques, consultation du conseil d'administration, stratégies de promotion, collecte et saisie des données sur la conservation	$10,500	$10,500	$10,500	$10,500	$10,500	$10,500	$0	ACRE	Unchanged from original budget
Utilisation d'un SIG et d'un logiciel de télédétection, équipement (caméra GPS, p. ex.) et GPS	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$0	Agence Parcs Canada	Unchanged from original budget

Conseils d'ordre scientifique	$2,000	$2,000	$2,000	$2,000	$4,000	$4,000	$0	Institut de l'environnement, Université d'Ottawa	Increased
Coordonnateur de programme	$50,000	$50,000	$26,694	$50,000	$34,645	$41,951	$12,000	Année 1: CLD Pacte rural, fond MDDEP, MRC Volet II. Année 2: CLD Pact Rural MRC Volet II.	Changed.
Botaniste de projet et Ecogifts	$3,000	$3,000	$3,000	$7,000	$7,000	$7,000	$0	Conservation de la nature Canada et Institut de l'env.	Unchanged from original budget
Technicien en bases de données	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	$0	CLD Pacte rural, MDDEP	Unchanged from original budget
Achat de données lidar	$20,000	$10,000	$10,000	$0	$0	$0	$0	TerraPoint	Changed- Full Donation from TerraPoint
Site Web interactif	$42,000	$0	$0	$8,000	$8,000	$5,609	$2,391	CLD Pacte Rural, MDDEP,	Changed
Sensibilitisation (somme raportee de site web interactif)	$0	$0	$0	$0	$2,391	$2,675	-$284	CLD Pacte Rural	NEW - used for BioBlitz 2010 costs
Rapport annuel - accounting	$1,500	$0	$0	$1,500	$0	$0	$0		Unchanged from original budget

Planification de la conservation (cartographie des habitats et des espèces)	$1,750	$1,750	$1,750	$1,750	$1,750	$1,745	$5	Volet II	New - represents costs associated with conservation planning
cartographie des zones humides	$0	$0	$0	$0	$2,500	$2,500	$0	University de Nouveau Brunswick	New Donation
Les biologistes de la recherche	$0	$22,500	$22,500	$0	$15,000	$15,000	$0	BioBlitz	New Donation
BioBlitz Planification d'evenement	$0	$5,000	$5,000	$0	$5,000	$5,000	$0	CCN	New Donation
Coûts Total :	$143,750	$117,750	$94,444	$93,750	$103,786	$108,980	$14,112		

* Premiere année le 11 Juin 2008 jusque a le 10 Juin 2009. Deuxième année le 11 Juin 2009 jusque a le 10 Juin 2010

costs funded by CLD, MDDEP and MRC Volet II. Total Income = $100,500. Total Expenses = $100424

additions or changes from original budget