



# Kortright Conservation Area

## Fauna Inventory and Assessment

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## 1.0 Introduction

In 2012 the Toronto Region Conservation Authority (TRCA) conducted a fauna inventory of the natural cover associated with the Kortright Conservation Area (Kortright CA)(Map 1) which is a TRCA owned property. Data from this survey – primarily a breeding bird survey – is to be combined with other fauna observations made over the past decade with the main purpose of enhancing the Kortright Centre’s educational programs and initiatives. The information will also be used to help provide information for Kortright CA in land-use planning or any proposals for ecological restoration.

This was the first time since 2003 that the entire property had been surveyed for fauna, primarily for breeding birds, but also for incidental records of mammals and herpetofauna. Although there have been some changes to the inventory protocol since 2003, there is now an opportunity to make comparisons between the two surveys and to identify any major changes in breeding bird populations at the property. In addition to these two complete surveys, this report also refers to the many incidental records provided by TRCA staff over the years, and also includes records from the recently initiated long-term monitoring project stations installed within the property. These latter monitoring projects are following meadow birds and wetland birds; additional records are also included from a Forest Bird Monitoring Project route set-up by a Canadian Wildlife Service

Although the purpose of the work conducted during the 2012 field season was to collect data on fauna, the TRCA also used this opportunity to *characterize the terrestrial natural heritage features* of Kortright CA. Once characterized, the site features can then be understood within the larger regional context of the Terrestrial Natural Heritage Program of the TRCA. The question that the inventory addresses is “*How does the area surveyed at Kortright fit within the regional and watershed natural system, and how should its contribution to this system be protected and maximized?*” The important underlying message offered by this question is that the health of the natural system is measured at the regional scale and specific sites must be considered together for their benefits at all scales, from the site to the larger system.

### 1.1 TRCA’s Terrestrial Natural Heritage Program

Rapid urban expansion in the TRCA jurisdiction has led to continuous and incremental loss of natural cover and species. In a landscape that probably supported 95% forest cover prior to European settlement, current mapping shows that only 17% forest and wetland cover remains. Agricultural and natural lands are increasingly being urbanized while species continue to disappear from a landscape that is less able to support them. This represents a substantial loss of ecological integrity and ecosystem function that will be exacerbated in the future according to current urbanization trends. With the loss of natural cover, diminishing proportions of various natural vegetation communities and reduced populations of native species remain. Unforeseen

stresses are then exerted on the remaining flora and fauna in the natural heritage system. They become even rarer and may eventually be lost. This trend lowers the ability of the land to support biodiversity and to maintain or enhance human society (e.g. through increased pollution and decreased space for recreation). **The important issue is the cumulative loss of natural cover in the TRCA region that has resulted from innumerable site-specific decisions.**

In the late 1990s the TRCA initiated the Terrestrial Natural Heritage Program to address the loss of terrestrial biodiversity within the jurisdiction's nine watersheds. This work is based on two landscape-level indicators: the quality distribution of natural cover and the quantity of natural cover. The aim of the program is to create a conservation strategy that both protects elements of the natural system (vegetation communities, flora and fauna species) *before* they become rare and promotes greater ecological function of the natural system as a whole. This preventive approach is needed because by the time a community or species has become rare, irreversible damage has often already occurred. A healthy natural system capable of supporting regional biodiversity in the long term is the goal of the Terrestrial Natural Heritage Systems Strategy by setting targets – both short- and long-term (100 years) – for the two landscape indicators in order to provide direction in planning at all scales (TRCA 2007a, TRCA 2007b).

A target system that identifies a land base where natural cover should be restored is a key component of the Strategy. Although the objectives of the Strategy are based on making positive changes at all scales, the evaluation models were developed at the landscape scale using a combination of digital land cover mapping and field-collected data. Field-collected data also provides ground-level information in the application of the landscape models at the site scale. The two indicators and the targets that have been set for them are explained in Section 3.1. It is important to understand that habitat quality and distribution are interdependent. For example, neither well-distributed poor-quality natural cover nor poorly-distributed good-quality natural cover achieves the desired condition of sustainable biodiversity and social benefits across the watershed.

The natural cover at Kortright CA acts as an important link in the natural system along the Humber River as it runs its course from the Oak Ridges Moraine south to Lake Ontario. Heading upriver from the lakeshore, the Kortright-Boyd complex is the first large patch of relatively intact natural cover that any north-bound migrant bird encounters. Conversely, Kortright CA and Boyd CA present the last opportunities for many fauna species to disperse south from the rural areas in the northern half of the region before the Humber River begins its passage through the urban landscape.

## 2.0 Study Area Description

As shown in Maps 1 and 2, the study area is located in the middle reaches of the Humber watershed, on the approximate northern boundary of the urban land use zone. More recent residential developments have somewhat extended this urban limit northwards on either side of

the study area, but for the moment the land directly to the north of Kortright CA is still entirely rural. The 2012 study area was bound to the east and west by Pine Valley Drive and Islington Avenue respectively, and to the north and south by Major Mackenzie Drive and Rutherford Road. This area covers 377.5 ha and lies entirely within the Great Lakes – St. Lawrence floristic region, composed of mixed coniferous-deciduous forest. At the coarse physiographic level, the site is situated on the Peel Plain physiographic zone. Surface geology of a large proportion of the site consists primarily of clayey silt and silt glacial deposits (till), bisected by the mainly gravel sand river deposits associated with the main Humber channel.

There are several large buildings associated with the site: on the west side, just off of Islington Avenue are the Boyd Office and the Restoration Services Centre, with the extensive TRCA nursery nearby. Just east of the centre of the property are the Earth Rangers' buildings, and a little to the north of this are the main buildings of the Kortright Centre. Despite this rather large number of buildings there are still fairly extensive patches of natural cover – both forest and meadow - which are far enough removed from buildings and roads to maintain some degree of natural integrity, for example the north-west and south east quarters of the property.

The most intensive visitor use is concentrated around the buildings, but an extensive network of trails – both paved and unpaved – brings hikers, dog-walkers and cyclists to all corners of the Study Area. Trail density is high throughout the park but again the north-west and south-east quarters of the area have the lowest trail density and therefore the lowest visitor pressure. Given the long-standing popularity of Kortright it can be assumed that many of the visitors are coming from other parts of the jurisdiction, but the relatively recent increase in housing density on the east side of the property presumably has resulted in a larger proportion of local visitors.

### 3.0 Inventory Methodology

A biological inventory of Kortright CA was conducted at the habitat patch level (landscape analysis) and for breeding birds according to the TRCA methodologies for landscape evaluation (TRCA 2007c) and field data collection (TRCA 2007d). Habitat patch mapping was taken from the regional 2007/08 mapping of broadly-defined patch categories (forest, wetland, meadow and coastal) and digitized using ArcView GIS software.

A key component of the field data collection is the scoring and ranking of vegetation communities and flora and fauna species to generate local “L” ranks (L1 to L5); this process was undertaken in 1996-2000 and ranks are reviewed regularly (TRCA 2010). Fauna species are scored based on seven criteria: *local occurrence*, *local population trend*, *continent-wide population trend*, *habitat dependence*, *sensitivity to development*, *area-sensitivity*, and *patch isolation sensitivity*. With the use of this ranking system, communities or species of *regional concern*, ranked L1 to L3, now replace the idea of *rare* communities or species. *Rarity (local occurrence)* is still considered as one of many criteria that make up the L-ranks, making it possible to recognize communities or species of regional concern before they have become rare.

In addition to the L1 to L3 ranked species, a large number of currently common or secure species at the regional level are considered of concern in the urban context. These are the species identified with an L-rank of L4. Although L4 species are widespread and frequently occur in relatively intact urban sites, they are vulnerable to long-term declines. Kortright CA has elements of both the urban and rural areas of the jurisdiction. Kortright's large area and its connection to natural cover to the north and south (parts of the Boyd property) provide a rural component. Conversely, urban components are found in the form of residential housing that borders the area on the east and west sides and various public activities within the site itself. For this reason, fauna species with a ranking of L4 were mapped in order to understand the effect of disturbances due to the site's proximity to urban activities.

### 3.1 Landscape Analysis

The quality, distribution and quantity of natural cover in a region are important determinants of the species distribution, vegetation community health and the provision of "ecosystem services" (e.g. air and water quality, recreation, aesthetics) in that region.

#### Base Mapping

The first step in evaluating a natural system or an individual *habitat patch* is to interpret and map land cover using aerial photographs. The basic unit for the evaluation at all scales is the habitat patch in the region, which are then combined and evaluated as a system at any scale. A *habitat patch* is a continuous piece of habitat, as determined from aerial photo interpretation. The TRCA maps habitat according to four broad categories: *forest*, *wetland*, *meadow*, and *coastal* (beach, dune, or bluff). At the regional level, the TRCA jurisdiction is made up of thousands of habitat patches. This mapping of habitat patches in broad categories is conducted through remote-sensing and is used in the evaluation of quality, distribution and quantity of natural cover. It should not be confused with the more detailed mapping of vegetation communities obtained through field surveys and that is used to ground-truth the evaluation (see Section 3.2).

#### Quality Distribution of Natural Cover

The quality of each habitat patch is evaluated according to three criteria: *size* (the number of ha occupied by the patch), *shape* (edge-to-area ratio), and *matrix influence* (measure of the positive and negative impacts from surrounding land use) (TRCA 2007c). A total score for each patch is obtained through a weighted average of the scores for the three criteria. This total score is used as a measure of the 'quality' of a habitat patch and is translated into a local rank (L-rank) ranging from L1 to L5 based on the range of possible total scores from 3 to 15 points. Of these L-ranks, L1 represents the highest quality habitat and L5 the poorest.

Species presence or absence correlates to habitat patch quality (size, shape and matrix influence) (Kilgour 2003). The quality target is based on attaining a quality of habitat patch throughout the

natural system that would support in the very long term a broad range of biodiversity, specifically a quality that would support the region's fauna Species of Conservation Concern (Table 1).

**Table 1: Habitat patch quality, rank and species response**

Size, Shape and Matrix Influence	Patch Rank	Fauna Species of Conservation Concern
Excellent	L1	Generally found
Good	L2	Generally found
Fair	L3	Generally found
Poor	L4	Generally not found
Very Poor	L5	Generally not found

In addition to the three criteria that make up the total habitat patch score, another important measure to consider in assessing habitat patch quality is forest interior, i.e. the amount of forest habitat that is greater than 100 m from the edge of the forest patch, using 100 m increments. A recognized distance for deep interior conditions occurs at 400 m from the patch edge. Such conditions are a habitat requirement for several sensitive fauna species.

### Quantity

The amount of natural cover needed in the landscape is based on the quantity required to accommodate and achieve the quality distribution targets described above. The two targets are therefore linked to each other: it will be impossible to achieve the required distribution of natural heritage quality without the appropriate quantity of natural cover. The proportion of the region that needs to be maintained as natural cover in order to achieve the desired quality has been identified as 30%.

## 3.2 Fauna Species

Fauna species data were collected through field surveys. These surveys were done during the appropriate times of year to capture breeding status of amphibians and birds.

The most complete breeding bird surveys of the site were conducted by the TRCA in June, 2003 and June, 2012. An extensive amphibian survey was conducted in April, 2003, with further visits to survey select locations for frogs in several years throughout the following decade. There were no formal amphibian surveys conducted in 2012. Spring surveys searched primarily for frog species of regional concern but recorded incidentally the presence of any early-spring nocturnal bird species (owls and American woodcocks). Surveys in June were concerned primarily with the mapping of breeding bird species of regional concern. As per the TRCA data collection protocol breeding bird surveys were carried out by visiting all parts of the site at least twice during the breeding season (last week of May to mid-July) to determine the breeding status of each mapped point. The methodology for identifying confirmed and possible breeding birds follows Cadman *et*

*a/.* (2007). All initial visits were completed by the end of the third week of June. The field-season is organized so that by late June only repeat visits are being conducted. It is imperative that any visit made in the first half of June is subsequently validated by a second visit later in the season. Fauna regional species of concern (species ranked L1 to L3) were mapped as point data with each point representing a possible breeding bird. In 2012, in response to the changing local landscape matrix, L4 species were also mapped throughout the study area.

Note that the fauna data management protocol imposes a 10 year threshold on use of historical data, and therefore any species reported from TRCA fauna surveys conducted prior to 2003, and not in any subsequent year, are simply noted as “historic” in the species list prepared for this report.

**Table 2. Schedule of TRCA biological surveys at Kortright CA in 2003\* and 2012**

Survey Item	Survey Dates	Survey Effort (hours)
Patch / Landscape	2007/2008: ortho-photos	21 hours
Frogs and Nocturnal Spring Birds	2003: April 12 <sup>th</sup> – 27 <sup>th</sup> .	7 hours
Breeding Songbirds	2003: June 2 <sup>nd</sup> – 11 <sup>th</sup> . 2012: June 2 <sup>th</sup> – 29 <sup>th</sup> .	50 hours 37.5 hours

\*note that the 2003 inventory included the Boyd property to the north of Major Mackenzie Drive, i.e. approximately twice Kortright CA area. Therefore, the hours noted for 2003 surveys have been proportioned to more closely reflect effort applied only to the current study area.

## 4.0 Results and Discussion

Information pertaining to Kortright CA was collected through both remote-sensing and ground-truthing surveys. This information contains two levels of detail: habitat patch and fauna species. This section provides the information collected and its analysis in the context of the TNHS Strategy.

### 4.1 Regional Context

Based on 2007/08 ortho-photography, 25% of the land area in the TRCA jurisdiction consists of natural cover but this figure includes meadow and old field. Although historically, the region would have consisted of up to 95% forest cover, currently (i.e. 2007/08) only about 17% is covered by forest and wetland. Of the non-natural cover (i.e. the remaining 75%), 48% is urban and 27% is rural / agricultural.

The regional level analysis of habitat patches shows that the present average patch quality across the TRCA jurisdiction is “fair” (L3); forest and wetland cover is contained largely in the northern half of the TRCA jurisdiction, especially on the Oak Ridges Moraine; and the quantity is 16.7% of the surface area of the jurisdiction (Map 3). In addition, meadow cover stands at 8.1% of the

region. Thus the existing natural system stands below the quantity target that has been set for the region (30%) and also has an unbalanced distribution. The distribution of fauna species of concern is also largely restricted to the northern part of the jurisdiction; fauna species of regional concern are generally absent from the urban matrix (Map 4). The regional picture, being the result of a long history of land use changes, confirms that **all** site-based decisions contribute to the condition of a region. Kortright CA occupies an important place in the regional natural system along the Humber River, almost precisely at the interface between the rural and urban zones, just north of the point where the corridor of natural area along the Humber is highly constricted by urban development.

## **4.2 Habitat Patch Findings for Kortright Conservation Area**

The following details the study area according to the two natural system indicators used in designing the Terrestrial Natural Heritage System Strategy: the *quality distribution* and *quantity* of natural cover.

### **4.2.1 Quantity of Natural Cover**

The area of the Humber watershed is approximately 91,077 ha containing 32.0% natural cover, including 15,803 ha as forest (17.4%), 8,169 ha as meadow (9.0%) and 2078 ha as wetland (2.3%). Kortright CA contains 1.3% of the total natural cover in the Humber watershed. The study area has a high strategic importance in the natural system of the Humber watershed, the largest watershed in the TRCA jurisdiction.

The study area itself covers about 377.5 ha of land of which 345 ha is natural cover. The natural cover includes 206 ha of forest, 10.5 ha of successional habitat, 7 ha of wetland and 121.5 ha of meadow. The site also includes a large parcel of land just west of the middle of the site devoted to the TRCA Restoration Services' nursery, and several manicured areas around the various buildings.

### **4.2.2. Quality Distribution of Natural Cover**

The results for quality distribution are reported below under the headings of habitat patch size and shape, matrix influence and total score.

#### **Habitat Patch Size and Shape**

The study area consists of a rather convoluted mosaic of forest and meadow habitats, with several small wetlands scattered throughout the perimeter of the property. The most extensive forest cover is located in the northern half of the site, forest habitat in the southern half being largely fragmented by many smaller meadow patches. The main forest block at the northern end of the site, on the east side of the river, extends down to the south-east corner of the site. This is an area of continuous forest although some of the connections are pinched to very narrow corridors at certain points. Nevertheless, the size of this forest patch (107 ha) imparts an L2 rank ("good") for

size to this particular patch. The remainder of the natural habitat within the Study Area receives an L3 rank, or “fair” (Map 5). The dozen or so small wetland habitat patches range between 0.2 and 1.3 ha – ranked as “poor” (L4) and “very poor” (L5) for size - and are spread fairly evenly along the perimeter of the Study Area, with the largest patch located nearer to the centre of the site. The most extensive continuous meadow habitat patch covers 21.2 ha (“fair”), however there are several instances where smaller meadow patches are separated only by rivers and park infrastructure and therefore might justifiably be considered as single larger components. The largest forest and meadow habitat patches within the study area are ranked “poor” and “very poor” for patch shape which is not surprising given the convoluted mosaic of habitats within the site.

The variation in size and shape attributes of different habitat patches is further indicated by the concept of habitat interior, measured in 100 m increments from the edge of a habitat block. At Kortright CA the most extensive patch of forest interior is located at the northern end of the largest forest patch – away from the mosaic of meadow and forest of the southern half of the site (Map 6).

### **Habitat Patch Matrix Influence**

Analysis based on the 2007/08 ortho-photos shows that the matrix influence score for habitat in the study area (Map 7) is almost entirely “fair” (L3). This score is as expected given the rural and suburban setting, with a mix of natural, agricultural and residential land-types in the vicinity.

The TRCA measures matrix influence at the landscape level by assigning set values; positive, neutral and negative, to the type of landscape use occurring within 2 km of the subject site. It is important, however, to also understand and consider the matrix influence that occurs at the site and patch level. Such influences include those transferred to an otherwise remote natural habitat patch from a distant urban or suburban development, for example via a trail system.

### **Habitat Patch Total Score**

The combination of “fair” matrix influence with the mix of “good” to “very poor” habitat patch size and shape, results in a fairly even split between “poor” and “fair” or L4 and L3 ranked habitat patch quality (Map 8). Landscape scores are intended to be applied at the broader landscape level and therefore caution needs to be exercised when referring to such measures at the more refined site level.

## **4.5 Fauna Species Findings for Kortright CA**

### **4.5.1 Fauna Species Representation**

The TRCA fauna surveys at Kortright CA in 2012 documented a total of 75 bird species, 14 mammals, and 9 herpetofauna species, for a year total of 98 possible breeding vertebrate fauna species. An additional 12 bird species, 1 mammal, and 1 herpetofauna, can be added from the

inventory conducted in 2003. Finally, a series of staff observations made over the past decade (2 bird species, 3 mammals and 4 herpetofauna) give an overall total of 121 species. These figures are similar to those from several other larger rural sites within the TRCA jurisdiction. For example, the 2009 report for Albion Hills CA lists a total of 107 fauna species over the period 2001 to 2008, and an inventory conducted at Greenwood CA in 2002 recorded a total of 74 breeding bird species. A further eight species have been recorded historically in the Kortright area. Refer to Appendix 1 for a list of the fauna species and their corresponding L-ranks.

#### 4.5.2 Fauna Species of Concern

Fauna species are considered of regional conservation concern if they rank L1 to L3 based on their scores for the seven criteria mentioned in Section 3.0. Since the subject site is situated right at the forefront of encroaching urbanization it was considered important to assess the status of L4 ranked species as well. Species ranked as L4 are considered to be sensitive within the urban landscape. This is a proactive, preventive approach, identifying where conservation efforts need to be made before a species becomes rare.

Fauna surveys at Kortright CA over the past decade reported 25 bird species of regional concern (L1 to L3), including one L2 bird species: blue-winged warbler (*Vermivora pinus*). There were 11 herpetofauna of regional concern including the L2 ranked wood frog (*Lithobates sylvatica*), spring peeper (*Pseudacris crucifer*), grey treefrog (*Hyla versicolor*), common snapping turtle (*Chelydra serpentina*), and eastern newt (*Notophthalmus viridescens*). In addition, there were 4 mammal species of regional concern (porcupine, *Erethizon dorsatum*, northern flying squirrel, *Glaucomys sabrinus*, northern short-tailed shrew, *Blarina brevicauda*, and star-nosed mole, *Condylura cristata*) bringing the total to 40 fauna species of regional concern (Table 3) (Map 9).

**Table 3. Summary of Fauna Species of Regional Concern, Kortright CA**

Fauna	Number of Species	Number of Species of Regional Concern (L1 to L3 rank)
birds	89	25
herps	14	11
mammals	18	4
<b>TOTALS</b>	121	40

Three of the herp species and one bird species are listed under the Species at Risk legislation: bobolink (*Dolichonyx oryzivorus*) and western chorus frog (*Pseudacris triseriata*) are both listed as threatened at the federal level, with bobolink also listed as threatened provincially; common snapping turtle and milksnake (*Lampropeltis triangulum*) are considered special concern at both the federal and provincial levels. Finally, there are three species that are ranked as species of urban concern by the TRCA (ranked as L4) which are also listed as threatened at both the federal and provincial levels: eastern meadowlark (*Sturnella magna*), chimney swift (*Chaetura pelagica*), and barn swallow (*Hirundo rustica*). The latter two species present quite a special case since both species are effectively dependant on anthropogenic landscapes.

It is important to note that a further eight species of regional concern have been recorded at Kortright CA but not within the past decade. One of these species, southern flying squirrel (*Glaucomys volans*), is currently ranked as LX for the TRCA jurisdiction, LX indicating an extirpated species. Species ranked L2 that have not been reported since before 2003 are: least bittern (*Ixobrychus exilis*, a single record from 1999), ruffed grouse (*Bonasa umbellus*, last recorded in 1998), blue-winged teal (*Anas discors*, a confirmed breeding record in 1995), river otter (*Lutra canadensis*, last recorded in 1991), ermine (*Mustela erminea*, 1988), hairy-tailed mole (*Parascalops brewer*, 1997) and meadow-jumping mouse (*Zapus hudsonius*, no date available but no reports from this past decade). The latter three species could quite easily have been missed during inventories and staff visits over the past decade; small mammals are not targeted in the TRCA fauna protocol, and records of these species come almost entirely on incidental reports.

**Local occurrence** is one of seven scoring criteria for fauna species and is based on TRCA data and information from the Natural Heritage Information Centre (NHIC) of the Ontario Ministry of Natural Resources (OMNR) (NHIC 2008). Using local occurrence as a measure of regional rarity, any species that is reported as a probable or confirmed breeder in fewer than 10 of the forty-four 10x10 km UTM grid squares in the TRCA jurisdiction is considered regionally rare (i.e. scores three to five points for this criterion) (TRCA, 2010).

At Kortright CA there are 12 species that are considered regionally rare including: blue-winged warbler, clay-coloured sparrow (*Spizella pallida*), red-bellied woodpecker (*Melanerpes carolinus*, an L4 ranked species), and several of the smaller mammals and two snake species. The mammal and snake species are likely under-reported throughout the region and their given status is consequently rather speculative. Four of the other mammal species recorded historically at Kortright are also listed as regionally rare.

**Sensitivity to development** is another criterion used to determine the L-rank of fauna species. A large number of impacts that result from local land use, both urban and agricultural, can affect the local fauna. These impacts – considered separately from the issue of actual habitat loss – can be divided into two distinct categories. The first category involves changes that arise from local urbanization that directly affect the breeding habitat of the species in question. These changes alter the composition and structure of the vegetation communities; for example, the clearing and manicuring of the habitat (e.g. by removal of dead wood and clearance of shrub understorey). The second category of impacts involves changes that directly affect individuals of the species in question. Examples include increased predation from an increase in the local population of predator species that thrive alongside human developments (e.g. blue jays, *Cyanocitta cristata*; American crows, *Corvus brachyrhynchos*; squirrels, *Sciuridae*; raccoons, *Procyon lotor*; and house cats, *Felis catus*); parasitism (from facilitating the access of brown-headed cowbirds, *Molothrus ater*, a species which prefers more open, edge-type habitat); competition (for nest-cavities with bird species such as house sparrows, *Passer domesticus*; and European starlings, *Sturnus vulgaris*); flushing (causing disturbance and abandonment of nest) and, sensitivity to pesticides.

Fauna species are considered to have a high sensitivity to development if they score three or more points (out of a possible five) for this criterion. At the study area 39 of the 40 species that are

ranked L1 to L3 receive this score and are therefore considered sensitive to one or more of the impacts associated with development (Map 7). Nine of these species (one bird, two mammals and six herp species) are ranked L2 and their presence is certainly significant; furthermore five of the species considered sensitive to development are listed as Species at Risk, either threatened or of special concern.

The L2 ranked blue-winged warbler and 14 of the sensitive L3 ranked birds are ground-nesting or low-nesting species and as such are highly susceptible to ground-borne disturbance, e.g. off-leash dog-walking. These 15 species are split between the 3 main habitat types: 6 are open habitat or meadow obligates, 5 are forest-dependant and 4 require wetland habitat.

The absence of ground-nesting ovenbirds, an excellent indicator of forest quality, suggests a forest habitat that is subject to considerable disturbance. Ground-nesting birds are highly susceptible both to increased predation from ground-foraging predators that are subsidized by local residences (house cats, raccoons) and to repeated flushing from the nest (by pedestrians, off-trail bikers and dogs) resulting in abandonment and failed breeding attempts. These same disturbances also have considerable impact on wood frogs and spring peeper in their upland summer-foraging and over-wintering habitat.

Although there are no doubt different levels of trail-related disturbance throughout the study area, the extensive trail network allows access to almost every corner of the site, both in forest and in meadow habitat. The wetland habitats are somewhat better able to buffer against such disturbances. Because the study area is close to recently developed residential suburban neighbourhoods, dog-walking is very likely to increase throughout the area (which in turn will no doubt impose off-leash dogs into the area). Thus the probability of sensitive forest and meadow bird species being recruited into the park ecosystem is very low.

Some higher ranked species are persisting at this site because the landscape to the north is still entirely rural. However, it is important to understand that negative matrix influences are not solely associated with the proximity of urban and suburban developments; many of the negative influences can be transferred deep within an otherwise intact natural matrix by extensive trail networks used by large numbers of people originating from quite distant urban and suburban centres. Extensive public use of a natural habitat can have substantial negative impact through the cumulative effects of hiking, dog-walking and biking on the site. This likely explains the fact that even before the development of the residential area on the eastern border of the park there was only a very low number of ovenbirds reported. Similarly, clearing of forest understory to accommodate trails displaces such sensitive species. It would be of considerable interest over the next few years as trail use increases, to monitor the status of sensitive ground-nesting forest-birds and other fauna such as wood frog and common snapping turtle.

Various studies have shown that many bird species react negatively to human intrusion (i.e. the mere presence of people) to the extent that nest-abandonment and decreased nest-attentiveness lead to reduced reproduction and survival. One example of such a study showed that abundance was 48% lower for hermit thrushes (a ground-nesting/foraging species) in intruded sites than in

the control sites (Gutzwiller and Anderson 1999). Elsewhere, a recent study reported that dog-walking in natural habitats caused a 35% reduction in bird diversity and a 41% reduction in abundance, with even higher impacts on ground-nesting species (Banks and Bryant 2007).

**Area sensitivity** is a scoring criterion that can be closely related to the issue of a species' need for isolation. Fauna species are scored for area sensitivity based on their requirement for a certain minimum size of preferred habitat. Species that require large tracts of habitat (>100 ha in total) score the maximum five points, while species that either show no minimum habitat requirement, or require <1 ha in total, score one point. Species scoring three points or more (require  $\geq 5$  ha in total) are deemed area sensitive species. Researchers have shown that for some species of birds, area sensitivity is a rather fluid factor, dependent and varying inversely with the overall percentage forest cover within the landscape surrounding the site where those species are found (Rosenburg *et al.* 1999).

Twenty-three of the fauna species of regional concern that were identified at Kortright CA study area are considered area sensitive, including 8 species that require at least 20 ha of habitat. Most of these species are forest species and as such are well-accommodated by the 2 largest patches of forest on the site one of which at 107 ha comprises much of the eastern half of the study area, while the second largest patch (45 ha) occupies the north-west corner of the site. Area sensitive open habitat species are represented by bobolink, blue-winged warbler, and – in 2012 – a lone sedge wren (*Cistothorus platensis*). The bobolink records from the past decade are concentrated in the three largest meadow patches two of which are located in the southern third of the property while the third patch is located in the extreme north-east corner. The lone sedge wren in 2012 was also reported from the largest of the southern patches. Although the total amount of open habitat is fairly large, much of this total consists of narrow fingers of meadow or scrub habitat in the forest gaps. Such enclosed meadow habitat extensions are unsuitable for species such as bobolink. However, it is within such smaller clearings (together with the edge habitat along the river course) that mourning warblers (*Geothlypis philadelphia*) have increased considerably in recent years, increasing from 4 mapped territories in 2003 to 13 in 2012.

Species' patch-size constraints are due to a variety of factors including foraging requirements and the need for isolation within a habitat block during nesting. In the latter case, regardless of the provision of a habitat patch of sufficient size, if that block is seriously and frequently disturbed by human intrusion, such species will be liable to abandon the site. Such a variety of habitat needs are more likely satisfied within a larger extent of natural cover. Only a small number of forest bird species (e.g. pine warbler and pileated woodpecker, *Dryocopus pileatus*) are well represented in the forest habitat at Kortright and it seems human disturbance is at such a high level that, even within the extensive forest cover patches, sensitive L3 ranked species are unable to function fully.

However, there are several non-avian species which still seem to benefit from the extensive areas of natural cover at the site: frog species such as grey treefrog, wood frog and spring peeper; eastern newt; northern flying squirrel; and porcupine. The amphibian species are considered area sensitive primarily due to their requirement for two distinct habitat elements in order to complete their life-cycles. The three frog species overwinter in upland forested habitat and then migrate to

nearby wetlands in the early spring to breed, returning to forest habitats to forage throughout the summer and fall months. The several wetlands embedded in meadow and forest habitat throughout the site present excellent opportunities for these species of regional concern. The persistence of the two mammal species is surprising but may be due largely to their nocturnal habits which perhaps result in very few interactions with human visitors. Kortright CA is the furthest south that these two species are known to occur in the west half of the region. There is a small population of flying squirrels persisting in the southern portion of Rouge Park, but otherwise this is the most urban population of this species in the Toronto region.

**Patch isolation sensitivity** in fauna measures the overall response of fauna species to fragmentation and isolation of habitat patches. One of the two main aspects of this scoring criterion is the physical ability or the predisposition of a species to move about within the landscape and is related to the connectivity of habitat within a landscape. The second main aspect is the potential impact that roads have on fauna species that are known to be mobile. Thus most bird species score fairly low for this criterion (although they prefer to forage and move along connecting corridors) whereas many herpetofauna score very high (since their life cycle requires them to move between different habitat types which may increase likelihood of road-kill). One example of how this criterion affects species populations is the need for adult birds to forage for food during the nestling and fledgling stage of the breeding season. By maintaining and improving the connectivity of natural cover within the landscape (e.g. by reforestation of intervening lands) we are able to positively influence the populations of such species, improving their foraging and dispersal potential.

Nineteen of the species of regional concern that occur at Kortright CA score high for patch isolation sensitivity, and as is fairly typical, the majority of these species (14 of the 19) are non-avian. The five bird species are wild turkey (*Meleagris gallopavo*), Virginia rail (*Rallus limicola*), sora (*Porzana carolina*), marsh wren (*Cistothorus palustris*) and sedge wren. The first of these five is highly mobile and susceptible to road-kill; however this species (the subject of a very successful re-introduction program in southern Ontario) appears to be faring very well across the region. Three of the other four bird species are wetland obligates but are highly susceptible to road-kill if their habitat is bisected by roads. Such a development scenario is unlikely within the study area and therefore these species' mobility issues are not really a concern at Kortright. However, there is a gravel roadway that bisects the ponds from Islington Avenue to the Restoration Services offices where fledged young of Virginia rail were observed on the road itself. Increased likelihood of road-kill could arise if this road were to be paved, thereby allowing an increase in the speed of cars.

The fauna species for which patch isolation sensitivity is really an issue at Kortright are the 11 species of herpetofauna and 3 mammals. All but one of the 11 herpetofaunal species are highly mobile (the one exception being western chorus frog which tends to be comparatively sedentary), moving considerable distances across the local landscape to and from breeding and wintering habitats. The network of paved and unpaved roads and trails throughout the study area put these species at some risk of becoming road-kill to either bicycles or other vehicles. The two Species at Risk, milksnake and snapping turtle, together with all of the other herps, are important to consider in any future development of roads and trails within the study area.

The wetland features at Kortright deserve further attention in this document. The majority of the more than a dozen wetlands scattered around the property are artificial in origin, created in situations either where landscape features suggested historical occurrences, or where developments provided opportunities for such wetland creation projects (e.g. associated with fill projects). Most of these artificial wetlands have existed for long enough that frog populations have established in conditions that are still providing all of the life-cycle attributes that healthy frog populations require – primarily plenty of opportunities to move between safe, fishless breeding ponds and intact upland forest habitat.

The only recent reports of porcupine have been of road-kill along Major Mackenzie Drive, and this sadly may preface the imminent loss of this species at Kortright since it is unlikely that the highways in the vicinity will become less busy in the future. The northern flying squirrel and star-nosed mole are less likely to travel so far and therefore less likely to become road-kill, however, again, any increase in the bike-use of the existing or future trail system may increase the likelihood of interactions, especially if any night-use is allowed.

Fauna species that score greater than three points under the **habitat dependence** criterion are considered habitat specialists (Map 10). These species exhibit a combination of very specific habitat requirements that range from the microhabitat (e.g. decaying logs, aquatic vegetation) and requirements for particular moisture conditions, vegetation structure or spatial landscape structures, to preferences for certain community series and macro-habitat types. Twenty fauna species that occur in the study area are considered habitat specialists: 11 forest specialists, 5 wetland specialists, and 4 herps that depend on both habitat types.

Species richness is essentially the presence or absence of species at a site. Beyond mere presence of single species is the idea that a natural system can be considered as a healthy functioning system if there is an association of several species thriving within that system. Each habitat type supports particular species associations. As the quality of the habitat patch improves so will the representation of flora and fauna species within that habitat. In this way representation biodiversity is an excellent measure of the health of a natural system. The presence of the 15 breeding species which – at least for part of their life cycle - depend on forest indicates that the forest habitat in the study area is functioning but not perhaps at an especially high level. The same cannot, however, be said of the open habitats within the site since associated species are very much under-represented despite the presence of fairly extensive open habitat patches in the southern half of the site.

Since this study area straddles the border between the rural and urban zones it is important to also consider the representation of sensitive L4 species. Such species are considered secure within the rural landscape but become somewhat less abundant in the urban landscape. Several L4 bird species which rapidly become quite scarce to the south of Kortright CA are extremely well-represented at this site. The 2012 inventory mapped the following: 34 territories for indigo bunting (*Passerina cyanea*); 47 territories for common yellowthroat (*Geothlypis trichas*); 14 territories for American redstart (*Setophaga ruticilla*), and 15 territories for great-crested flycatcher (*Myiarchus crinitus*). Therefore, although the L3 ranked bird species within the site are not well-represented,

the site provides many opportunities for the L4 species which become scarce further downstream. Continuing south to Lake Ontario (a distance of over 20 km), the corridor of natural cover associated with this stretch of the Humber River has been intermittently inventoried and the following figures from all sites to the south of the Kortright/Boyd complex compared with the 2012 inventory at Kortright serve to emphasize the significance of the site: 27 indigo bunting territories, 8 common yellowthroat territories, 3 American redstart territories, 18 great-crested flycatcher territories.

This comparison between the rural site and the urban landscape to the south becomes even more compelling when the various frog species are considered. There are just four points mapped for wood frog, and zero points mapped for spring peeper and grey treefrog in the Humber watershed downstream from the Kortright/Boyd complex.

One further significant fauna feature that involves an L4 species is the presence of a fairly large bank swallow (*Riparia riparia*) colony on the large river bluff about 500 m upstream from the Rutherford Road bridge. This colony has persisted for several years and peaked at approximately 180 pairs in 2009, making it one of the largest bank swallow colonies in the region away from the Lake Ontario shoreline.

#### **4.5.3 Fauna Species Comparison from 2003 to 2012**

In both 2003 and 2012 a complete breeding bird survey was conducted throughout the entire Kortright CA. As such, the results of these two surveys are directly comparable but with the following caveats. The survey in 2003 mapped only L1 to L3 species (the surrounding matrix was still largely rural) whereas in 2012 all L1 to L4 species were recorded as mapped points. In addition, some of the ranks for a few species have changed since 2003. This is either because the species has adapted to the urban environment (e.g. Cooper's hawk, *Accipiter cooperii*), or staff biologists have acquired a better understanding of the species' ecology. Since such changes in rank have been adopted only very recently most of these species were still mapped in the 2012 survey as a precaution against any premature changes in L-rank. It is also necessary to consider the context in which comparisons are to be made: several species have undergone population changes at both the continental and regional levels and therefore any changes in a species' status within the study area may be more associated with such larger scale changes rather than in response to local causes. In comparing the two sets of data, these issues have been considered.

If a direct comparison is made between the two years when complete inventories were compiled for the study area (2003 and 2012) it is perhaps significant that for the sensitive ground-nesting species the overall number of lost territories outnumbers the total of new territories. An overall loss in the number of ground-nesting species' territories suggests that there has been a deterioration in the matrix influences impacting the site, either from neighbouring developments or from a change in the intensity of public use at the site resulting in a decrease in the number of ground-nesting species.

On the other hand if bird species which nest higher in the habitat canopy are considered (i.e. tree-nesting forest species) it appears that the number of territories gained is at least equal to the number lost. One species in particular - pine warbler (*Setophaga pinus*) increased from 4 to 11 mapped territories between 2003 and 2012. This increase is in keeping with this species' well-documented increase in population across southern Ontario, even within the urban portion of the TRCA region.

Of the species on the Kortright fauna list there are 10 that are recognized as having undergone recent regional population increases (Table 4).

**Table 4: List of bird species recorded at Kortright which also show regional increases.**

Species	Scientific name	Regional change
blue-winged warbler	<i>Vermivora pinus</i>	North-east range expansion from (declining) US core
clay-coloured sparrow	<i>Spizella pallida</i>	Eastern range expansion. Especially good numbers in 2012.
mourning warbler	<i>Geothlypis philadelphia</i>	Apparent local increase across region, primarily along riparian corridors.
pine warbler	<i>Setophaga pinus</i>	The second Atlas (2007) reports an “explosive population growth in the province”.
wild turkey	<i>Meleagris gallopavo</i>	Current high population is the result of an extremely successful introduction of the species.
American redstart	<i>Setophaga ruticilla</i>	No overall increase documented by the Atlas, but the species has definitely increased in the Toronto region, in much the same way as mourning warbler. The species is now ranked as L4 (rank changed from L3 in 2011).
blue-grey gnatcatcher	<i>Polioptila caerulea</i>	A southern species showing continual increase in the region.
Cooper's hawk	<i>Accipiter cooperii</i>	Once a rather retiring hawk of large mature forest, the species is now one of the commonest nesting raptors in urban Toronto.
red-bellied woodpecker	<i>Melanerpes carolinus</i>	A southern species showing gradual increase in the region.
orchard oriole	<i>Icterus spurius</i>	A southern species showing continual increase in the region.

Accordingly, any change noted at Kortright needs to be assessed with these bigger-picture changes in mind. All but 2 of the 10 species listed as showing regional increases were likewise found to have increased populations at Kortright. Interestingly, the only two species which did not

show such an increase were the open habitat ground-nesters, blue-winged warbler and clay-coloured sparrow. Only one territory was mapped for the latter species and therefore its absence in 2012 may not be a particularly significant change. This is true for several of the species that were missing from the 2012 inventory (e.g. ovenbird, *Seiurus auracapillus*) and in such instances subsequent absence may not be significant; a lone record of a songbird may refer to a species that is not properly established at that site.

For several other bird species on the Kortright fauna list, a population change at Kortright CA can be more appropriately attributed to local impacts. The aforementioned blue-winged warbler should be included in this list since despite a regional population increase the species was absent from Kortright in 2012. There are 12 species which show potentially significant changes in local populations, however, 3 of these species should be discounted as a result of small changes in survey timing (Table 5). American woodcock (*Scolopax minor*) was mapped at 5 points in 2003 but was not reported at all in 2012, this was no doubt as a result of there being no early season visits (when woodcocks are displaying conspicuously) in 2012; great-horned owl was not reported in 2003 but documentation of this species outside of their nocturnal calling period is rather haphazard, depending only on the flushing of birds during daytime surveys. Willow flycatcher (*Empidonax traillii*) is a generally very late migrant and as such the species may easily have been missed in the 2003 surveys which were conducted a little earlier than usual.

**Table 5: List of bird species showing potentially significant population changes at Kortright where changes may be attributed to local impacts.**

Species	Scientific Name	Population Change (positive +, negative -)	Habitat Requirement
blue-winged warbler	<i>Vermivora pinus</i>	(-) 2	Shrubby open habitat
brown thrasher	<i>Toxostoma rufum</i>	(-) 2	Shrubby open-habitat
hooded merganser	<i>Lophodytes cucullatus</i>	(+) 2	Wetland, nests in tree cavities
scarlet tanager	<i>Piranga olivacea</i>	(-) 4	Forest
sora	<i>Porzana carolina</i>	(-) 3	Wetland
eastern meadowlark	<i>Sturnella magna</i>	(-) 2	Meadow
Eastern wood-pewee	<i>Contopus virens</i>	(+) 7	Forest
field sparrow	<i>Spizella pusilla</i>	(+) 4	Meadow and shrubby open habitat
green heron	<i>Butorides virescens</i>	(+) 3	Wetlands, nests in tree canopies

Of the four open habitat/meadow species listed, all of which nest either very low or on the ground, three species were absent in 2012. Since there appears to have been little change in the total amount of meadow habitat available to these species, these declines are in keeping with the

hypothesis that increased visitor pressure at Kortright is adversely effecting sensitive ground-nesting species. Three wetland associated species showed population changes but of these, only sora actually nests in wetlands. Green heron and hooded merganser may have travelled some distance from forest nest-sites to forage in the wetland. Given that soras nest in cattail marshes and similarly wet habitats it seems unlikely that the species' absence in 2012 can be attributed to ground-borne disturbance (i.e. from hikers or dogs). The remaining two species, scarlet tanager and eastern wood-pewee, both of which nest in the canopy and sub-canopy of mature forests, show entirely opposite local trends; the tanager has declined considerably, to the extent that it has almost disappeared in 2012, while the pewee has tripled its local population. The latter is an L4 species (but was mapped in the 2003 survey due to an ongoing debate over the appropriate rank) which nests regularly and successfully within the urban landscape, whereas the tanager is an L3 species which nests very sporadically in larger urban ravines with what is suspected to be little success. Although it would certainly not be expected for the pewee population at Kortright to decline in the same way as the tanager population, the observed increase was quite surprising.

In summary, the two most significant declines appear to be in the population and representation of ground-nesting meadow and open-habitat species, and also specifically in the population of the forest-dependent scarlet tanager. It should be noted that the sole remaining tanager territory in 2012 was recorded in an area with only a small and informal access path, whereas the empty territories from 2003, including two in the ravine behind the visitors centre, all have wide and well used public trails that run through them.

## 5.0 Summary and Recommendations

The recommendations for Kortright CA are given in relation to the regional targets for natural heritage in the TRCA jurisdiction. To reach the regional targets for quality distribution and quantity of natural cover, every site will require its own individualized plan of action. Following is a short summary of Kortright CA study area within the regional context, followed by specific recommendations.

### 5.1 Site Summary

1. The site is located in the middle reaches of the Humber River, at the current interface between the rural and the urban landscapes, providing an important link along the migration and dispersal corridor of the Humber River. Kortright CA presents the first available viable breeding habitat along the Humber River for many sensitive migrant bird species heading north in the spring. Conversely, as one heads south through the Humber watershed, it is the last habitat block that can accommodate many species associated with the rural landscape (e.g. several frog species).
2. A high total of 121 vertebrate fauna species have been observed over the past decade – a total which compares favourably to several other larger rural sites within the jurisdiction. A continuous staff presence at Kortright CA and other TRCA facilities has

- no doubt benefited the knowledge of species' status at the site through multiple incidental observations. This is particularly reflected in the unusually large species' lists for herps and mammals.
3. Seven Species at Risk were observed on the site: bobolink, common snapping turtle, milksnake, western chorus frog, eastern meadowlark, barn swallow and chimney swift.
  4. The two most significant declines appear to be in the population and representation of ground-nesting meadow and open-habitat species.
  5. Although the L3 ranked species present at the site are rather sparsely represented, several L4 ranked species are present in large populations.
  6. There is a large and significant bank swallow colony on one of the taller bluffs along the Humber River, north of Rutherford Road. This species is a candidate species for consideration under the Species at Risk Act, having shown persistent decline in continental population over the past decade.
  7. The site features an extremely extensive road and trail network allowing the potential import of numerous negative matrix influences; in addition the TRCA facilities within the study area are heavily used both by staff and visitors, again presenting the potential for more negative matrix influences.
  8. Only 1 territory of scarlet tanager, an indicator species of forest quality, remains from a total of 5 territories in 2003.

## 5.2 Site Recommendations

The primary reason for conducting the inventory in 2012 is to provide information to enhance the Kortright Centre's educational programs and initiatives. This updated information on the locations of various fauna species, in addition to the type of species present, will provide an excellent opportunity to deliver various educational programs on the ecology and conservation of a variety of bird, amphibian and mammals that inhabit Kortright. In addition, this information provides an opportunity to inform any future management conducted at Kortright.

In order to maintain a healthy level of biodiversity at Kortright CA, the overall integrity of the natural heritage system that includes the site must be protected. Therefore, habitat patch size and shape needs to be optimized so as to provide large enough habitat patches with interior habitat to support sensitive flora and fauna sustainably. In addition, connectivity between natural habitats within and beyond the study area must be improved.

Furthermore, given the existing use of the trail system and TRCA facilities, habitat quality and integrity must be protected from the negative matrix influences described in the body of the report.

This includes strategic placement of any envisaged new facilities, managing public use, allowing healthy dynamic natural processes to proceed, and controlling invasive species.

The following recommendations address the above natural heritage concerns, with an emphasis upon bolstering the existing high-quality features on site. Thus, we recommend overall that 1) existing habitats and features be protected and enhanced; 2) that public use be managed; 3) that invasive species be controlled; and 4) that further assessment and monitoring be undertaken.

## 1. Protect and Enhance Existing Features

The first priority should be to focus on ***maintaining conditions that allow existing communities or species of conservation concern to thrive***. This is true of all the various habitat types within the study area, each of which supports its own unique fauna community.

- a. Any future expansion of TRCA facilities should be concentrated around the existing buildings and manicured areas rather than being distributed across the property.
- b. Management zones should be delineated for the study area in a plan that emphasizes protection of existing natural heritage features, i.e. vegetation communities, plant or animal species of high conservation rank.
- c. Natural cover should be increased through strategic plantings and restoration of manicured areas. Although limited, such opportunities present themselves in areas adjacent to TRCA buildings. This will improve habitat patch size and shape, and potentially help reduce negative matrix influences. Other considerations are buffering existing communities or species of conservation concern (maintaining conditions that allow these species to thrive and expand); and increasing interior forest conditions. Expectations for the return of such sensitive forest species as ovenbird need to be realistic, concentrating instead on species which are known to be able to persist in urban landscapes where forest cover is still extensive.
- d. An assessment of the density of standing dead wood and dying trees in the forest habitat throughout the site should be conducted. Such features provide important nesting and foraging opportunities for many different bird and mammal species (including woodpeckers, owls, cavity-nesting ducks and flying-squirrels). Unfortunately, in an area with high public use, standing dead wood is a safety issue and many such features are removed. A degree of mitigation of such removals can be achieved by implementing an extensive and long-term nest-box project (with an extensive program of maintenance and monitoring).

- e. It is important that the connections between the wetlands and upland forest patches are maintained and enhanced as much as possible, ensuring that migrating and dispersing amphibians are not impacted by any increase in public use. One example is the movement of animals between the wetlands installed on either side of the Restoration Services access road on the west side of the site. Turtles and frogs have been recorded crossing this access road and there is an obvious risk for these animals. This situation may provide an excellent opportunity to investigate possible road ecology mitigation strategies, ensuring effective and adequate passage (e.g. tunnels, or boardwalks) for amphibians and mammals across or under roads and trails throughout the site where appropriate.
- f. A study should be implemented to determine the highest density crossing points (e.g. for migrating frogs) on the network of roads and trails throughout the site. The results of such a study will aid in the design of mitigation strategies.

## 2. Manage Public Use

Although landscape metrics indicate that the matrix influence at this rural site is largely neutral, this does not take into account the disturbance that occurs along the extensive network of roads and trails. Visitor pressure is likely to increase and ***it is important to preempt any potential increase in user pressure by designing the trail network to minimize negative impacts on sensitive forest species.***

- a. Any future trail planning needs to consider the locations of flora and fauna species of concern and to direct visitor pressure away from these areas. Likewise, restoration activities should target non-sensitive areas.
- b. Consider reducing the excessive number of trails that provide access to considerable areas of the site. A balance between access in the form of trails for purposes of education (nature interpretation) and the various disturbances that are transferred deep into natural habitat must be reached.
- c. Installation of board-walks as opposed to typical ground-borne trails should be considered as a means of protecting the sensitive flora and fauna species that occur throughout the various habitat patches on the site. Raised boardwalks, even in dry forest and meadow situations will reduce the direct impact of feet and wheels upon the substrate, allow continued safe passage for any terrestrial fauna, and ease the job of enforcing the dog-leash by-law.
- d. Dogs should be either excluded from the site or, at the very least, the leash-by-law should be properly enforced, bolstered by effective interpretive signs. During the 2012 inventory field-work dogs were routinely encountered that were off leash. This

was especially the case on the path running southward from Major Mackenzie Drive and on the west side of the river.

- e. In situations where a reduction in trail access, particularly to dog-walkers, is required, one effective action may be to close or restrict parking opportunities at the trailhead, e.g. the trail head at Major Mackenzie Drive, west of the river.
  - f. One of the two floating walkways on the small kettle lake in NE corner of the site should be removed. Wetland breeding birds were observed as being highly agitated when staff used these walkways to survey this site?
3. Control Invasive Species

Several invasive plant species are threats to the native biodiversity at Kortright CA. ***It is essential that well-planned and realistic measures be undertaken to control invasive species.*** Management for invasive species will need to be tailored to the individual species in question, depending on how wide-spread and established they are.

- a. Surveys need to be conducted to identify the highest-priority invasive species at Kortright. Some of them may be managed through mechanical and/or chemical.
  - b. Invasive species control should be undertaken as a proactive measure prior to planting around any fields that are being targeted for restoration.
4. Assessment and Monitoring

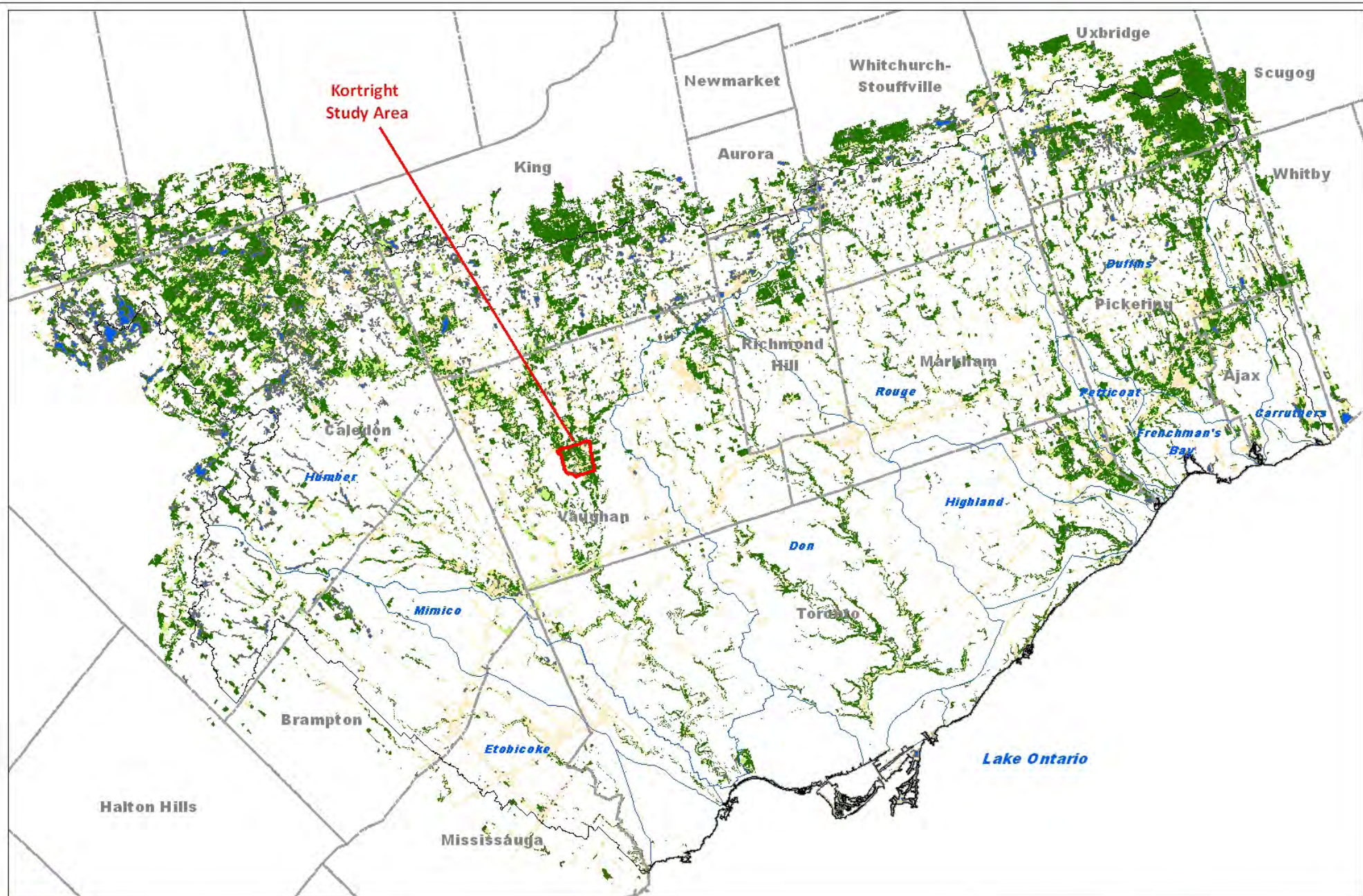
In order to address some remaining questions as well as to assess the impacts trail management and efficacy of restoration work, ***some monitoring projects should be initiated or maintained at Kortright.***

- a. Existing long-term monitoring plots should be maintained at Kortright including the TRCA's wetland bird and frog plots, the meadow bird plot and the Canadian Wildlife Service's Forest Bird Monitoring Project route.
- b. Monitoring for fauna crossings over Major Mackenzie Drive and along Pine Valley Drive on the eastern border of the site needs to be conducted so as to fully understand the potential for road-kill hotspots. It is important to maintain easy passage for fauna species travelling up and down the Humber watershed, however, such ease of connection may not be so desirable on the east and west boundaries since this would potentially simply improve the access for subsidized predators (e.g. domestic cats; raccoons; Virginia opossum, *Didelphis virginiana*).

- c. The existing bank swallow colony on the large river bluff just north of Rutherford Road should be carefully monitored to help in understanding both local and national trends in this declining species.

## 6.0 References

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Date: November 2012

\* Landscape analysis based on 2007/2008 Orthophotography

### Map 1: Kortright Study Area in the Context of Regional Natural Cover

Natural Cover *		Legend	
	Forest		Kortright Study Area Boundary
	Successional		TRCA Jurisdiction
	Meadow		Watershed
	Wetland		Municipal Boundary
	Beach/Bluff		



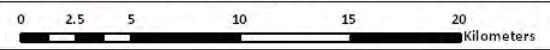
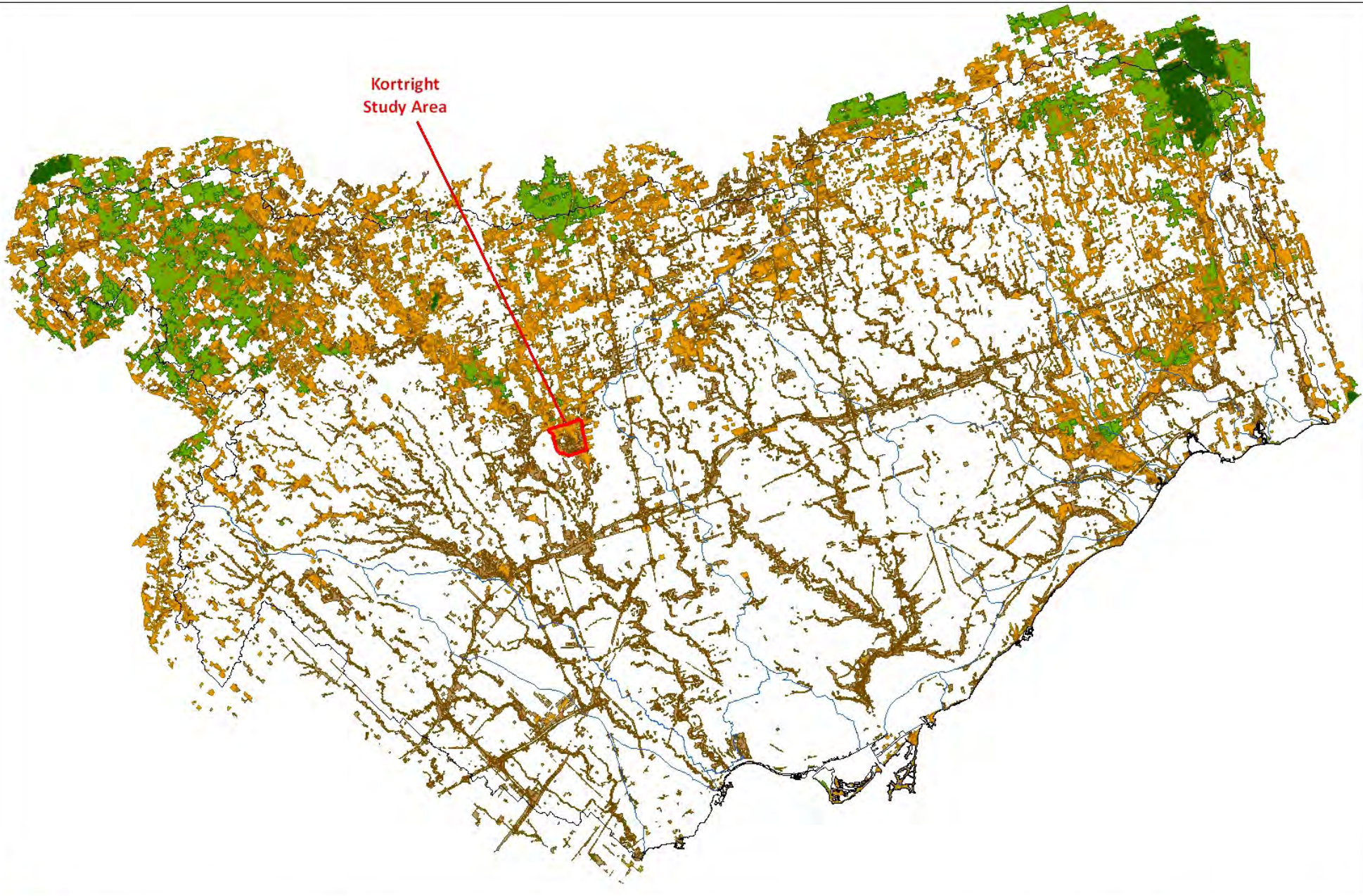
0 75 150 300 450 600 Meters

Date: November 2012  
Orthophoto: Spring 2011, First Base Solutions Inc.

### Map 2: Kortright Study Area

### Legend

 Kortright Study Area Boundary

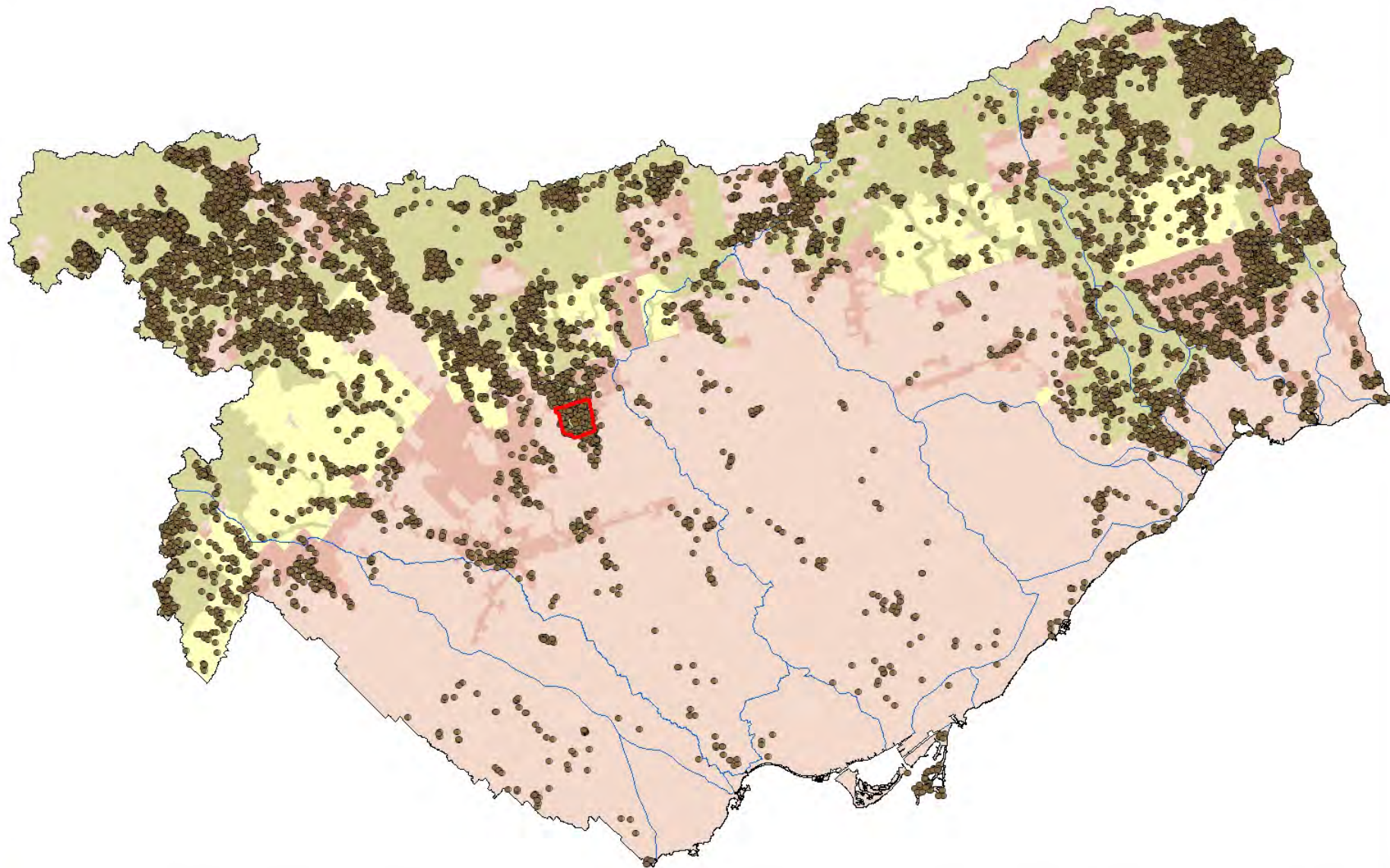


Date: November 2012

\* Landscape analysis based on 2007/2008 Orthophotography









### Map 3: Regional Natural System Habitat Patch Quality

Habitat Patch Quality *		Legend	
	L1 - Excellent		Kortright Study Area Boundary
	L2 - Good		TRCA Jurisdiction
	L3 - Fair		Watershed
	L4 - Poor		
	L5 - Very Poor		



**Map 4:**  
**Distribution of Fauna**  
**Regional Species of Concern**

**Legend**

-  Fauna Species of Concern (L1 - L3)
-  Kortright Study Area Boundary
-  TRCA Jurisdiction
-  Watershed
-  Agricultural & Rural Area
-  Built-up Area
-  Designated Greenfield Area
-  Greenbelt Area



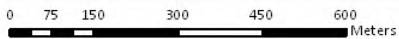
**Fauna Area Sensitivity Scores**

- ▲ 5 - >100ha
- ▲ 4 - >20ha
- ▲ 3 - > 5ha
- ▲ 2 - > 1ha
- ▲ 1 - < 1ha

- △ Fauna Species
- Frog Species

**Habitat Patch Size Scores \***

- 5 - Excellent
- 4 - Good
- 3 - Fair
- 2 - Poor
- 1 - Very Poor



Date: November 2012  
 Orthophoto: Spring 2011, First Base Solutions Inc.  
 \* Landscape analysis based on 2007/2008 Orthophotography

**Map 5:  
 Habitat Patch Size  
 Scores with Fauna Area  
 Sensitivity Scores**

**Legend**

- Kortright Study Area Boundary

NOTE: All fauna species with their associated scores for area sensitivity can be found in Appendix #3.




0 75 150 300 450 600 Meters

Date: November 2012  
 Orthophoto: Spring 2011, First Base Solutions Inc.  
 \* Landscape analysis based on 2007/2008 Orthophotography

### Map 6: Interior Forest at Kortright

#### Legend

-  Kortright Study Area Boundary
-  Forest
- Forest Interior**
-  100m-200m
-  400m-500m
-  200m-300m
-  500m-600m
-  300m-400m
-  600m-700m

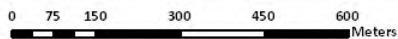


**Fauna Sensitivity to Development Scores**

- ▲ ■ 5 - Species receives severe negative impact from development-related disturbances
- ▲ ■ 4 - Species receives moderately severe negative impact from development-related disturbances
- ▲ ■ 3 - Species receives significant negative impact from development-related disturbances
- ▲ ■ 2 - Species receives slight negative impact from development-related disturbances
- ▲ ■ 1 - Species experiences no overall benefit or detriment from development-related disturbances (neutral)
- ▲ ■ 0 - Species benefits significantly from development-related disturbances

NOTE: All fauna species with their associated scores for sensitivity to development can be found in Appendix #3.

- △ Fauna Species
- Frog Species



Date: November 2012  
 Orthophoto: Spring 2011, First Base Solutions Inc.  
 \* Landscape analysis based on 2007-2008 Orthophotography

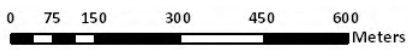
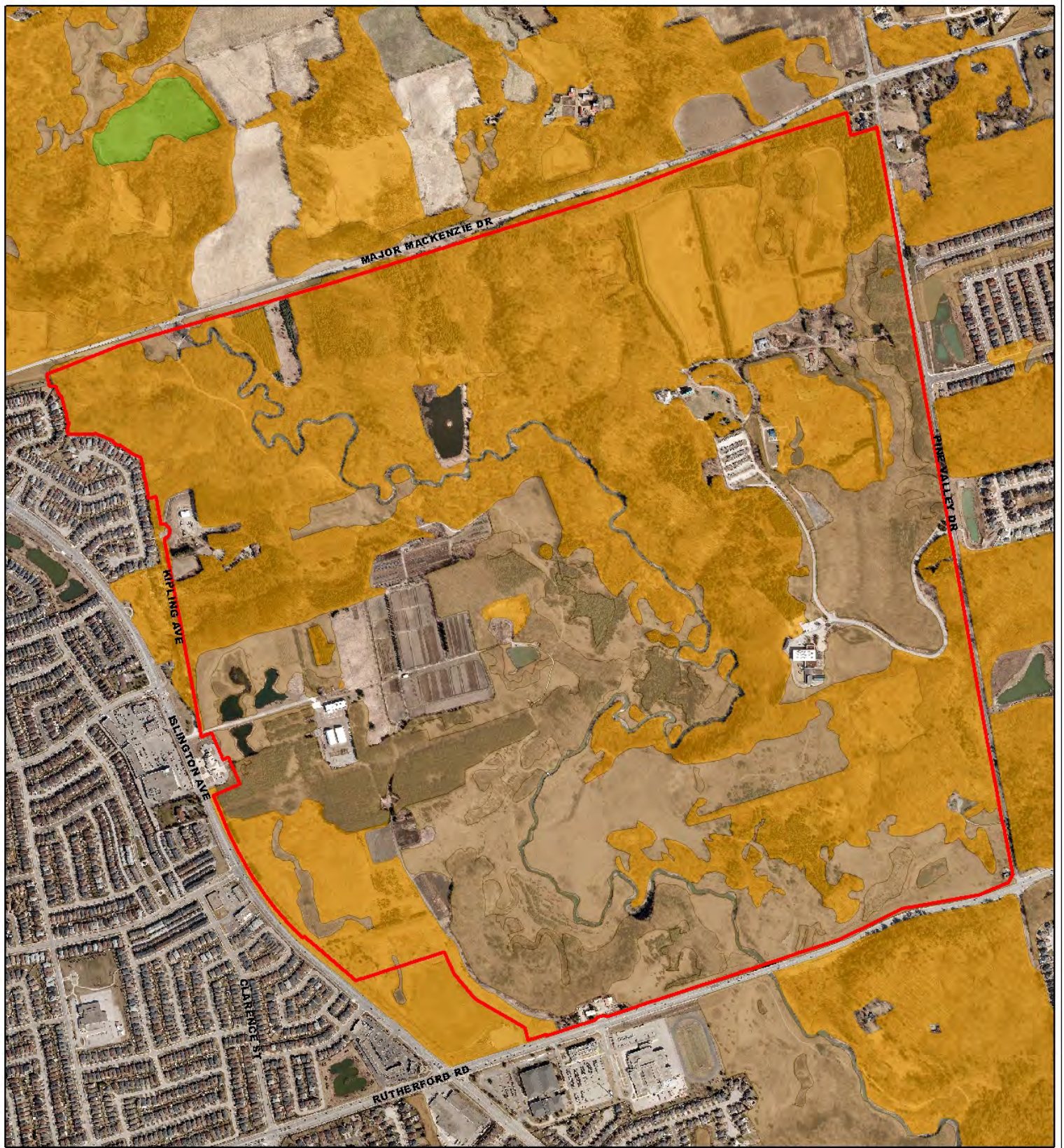
**Map 7:  
 Scores for Matrix Influence  
 with Fauna Sensitivity to  
 Development**

**Legend**

**Habitat Matrix Influence Scores \***

- 5 - Excellent
- 4 - Good
- 3 - Fair
- 2 - Poor
- 1 - Very Poor

□ Kortright Study Area Boundary



### Map 8: Habitat Patch Quality

#### Legend


##### Habitat Patch Quality \*


- L1 - Excellent
- L2 - Good
- L3 - Fair
- L4 - Poor
- L5 - Very Poor

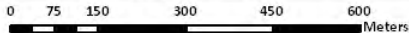
Kortright Study Area Boundary

Date: November 2012  
 Orthophoto: Spring 2011, First Base Solutions Inc.  
 \* Landscape analysis based on 2007/2008 Orthophotography




**Toronto and Region Conservation**  
*for The Living City*






Date: November 2012  
 Orthophoto: Spring 2011, First Base Solutions Inc.

## Map 9: Locations of Fauna Species of Concern

**Legend**

Fauna Species of Concern

- ▲ L1
 ▲ L3
- ▲ L2

 Kortright Study Area Boundary



**Fauna Habitat Dependence Scores**

- ▲ ■ 5 - Extreme habitat specialist
- ▲ ■ 4 - Strong habitat specialist
- ▲ ■ 3 - Moderate habitat specialist
- ▲ ■ 2 - Moderate habitat generalist
- ▲ ■ 1 - Strong habitat generalist
- ▲ ■ 0 - Extreme habitat generalist

NOTE: All fauna species with their associated scores for habitat dependence can be found in Appendix #3.



0 75 150 300 450 600 Meters

Date: November 2012  
 Orthophoto: Spring 2011, First Base Solutions Inc.

**Map 10:  
 Fauna Species  
 Habitat Dependence  
 Scores**

**Legend**

- Kortright Study Area Boundary
- △ Fauna Species
- Frog Species

Appendix 1: Vertebrate Fauna List for Kortright Conservation Area.

Common Name	Scientific Name	pre-03	'03	'04	'08	'09	'10	'11	'12	count	LO	PTn	PTt	AS	PIS	HD	StD	+	TS	L-Rank
<b>Survey Species:</b> species for which the TRCA protocol effectively surveys.																				
<b>Birds</b>																				
blue-winged teal	<i>Anas discors</i>	1								historic	4	3	3	3	2	2	3	0	20	L2
blue-winged warbler	<i>Vermivora pinus</i>	2	2							2	3	3	2	3	1	2	5	1	20	L2
least bittern	<i>Ixobrychus exilis</i>	1								historic	4	2	3	4	2	3	4	0	22	L2
ruffed grouse	<i>Bonasa umbellus</i>	2								historic	1	3	3	3	2	2	5	1	20	L2
American woodcock	<i>Scolopax minor</i>		5							5	0	2	3	3	2	2	4	0	16	L3
black-billed cuckoo	<i>Coccyzus erythrophthalmus</i>		1							1	0	3	2	3	1	3	3	0	15	L3
bobolink	<i>Dolichonyx oryzivorus</i>	1	1				1	1	1	4	0	3	3	3	1	1	5	1	17	L3
brown thrasher	<i>Toxostoma rufum</i>		2							2	0	3	3	2	2	1	4	0	15	L3
chestnut-sided warbler	<i>Setophaga pensylvanica</i>		2						1	2	2	2	2	3	1	1	4	0	15	L3
clay-coloured sparrow	<i>Spizella pallida</i>		1							1	3	3	2	2	1	1	4	0	16	L3
eastern towhee	<i>Pipilo erythrophthalmus</i>					1			1	2	2	3	2	2	2	1	4	0	16	L3
golden-crowned kinglet	<i>Regulus satrapa</i>							1	1	2	3	2	2	3	1	3	3	0	17	L3
hooded merganser	<i>Lophodytes cucullatus</i>	1	1		1	1	2	1	3	3	2	2	2	4	2	2	2	0	16	L3
marsh wren	<i>Cistothorus palustris</i>			2						2	2	2	2	3	3	3	3	0	18	L3
mourning warbler	<i>Geothlypis philadelphia</i>	2	4						13	14	0	3	2	2	2	2	4	0	15	L3
Nashville warbler	<i>Oreothlypis ruficapilla</i>		2							2	2	1	2	2	1	2	5	1	16	L3
northern waterthrush	<i>Parkesia noveboracensis</i>		1						1	2	1	2	2	3	1	4	5	1	19	L3
ovenbird	<i>Seiurus aurocapillus</i>		1							1	0	2	3	4	2	4	4	0	19	L3
pie-billed grebe	<i>Podilymbus podiceps</i>								1	1	3	2	2	2	1	4	4	0	18	L3
pileated woodpecker	<i>Dryocopus pileatus</i>	1	2		1			1	2	3	0	2	2	4	1	3	3	0	15	L3
pine warbler	<i>Setophaga pinus</i>	2	4					3	11	13	0	2	2	4	1	3	3	0	15	L3
scarlet tanager	<i>Piranga olivacea</i>	2	5					1	1	6	0	2	2	4	1	3	4	0	16	L3
sedge wren	<i>Cistothorus platensis</i>								1	1	3	2	2	3	3	1	4	0	18	L3
sharp-shinned hawk	<i>Accipiter striatus</i>	1				1				1	1	2	2	4	1	3	3	0	16	L3
sora	<i>Porzana carolina</i>		3							3	1	2	2	2	3	3	4	0	17	L3
Virginia Rail	<i>Rallus limicola</i>		2	1				1	2	5	0	2	2	2	3	3	4	0	16	L3
wild turkey	<i>Meleagris gallopavo</i>		1		1			1	1	3	0	1	0	4	3	4	3	0	15	L3
wood thrush	<i>Hylocichla mustelina</i>	1	2		1			2	3	7	0	3	2	3	2	2	4	0	16	L3
American redstart	<i>Setophaga ruticilla</i>		4		1				14	17	0	2	2	3	1	2	4	0	14	L4
American kestrel	<i>Falco sparverius</i>		1							1	1	2	3	1	1	2	0	0	10	L4
bank swallow	<i>Riparia riparia</i>		x		30	180	50		60	colony	1	3	2	1	1	3	3	0	14	L4
barn swallow	<i>Hirundo rustica</i>		x						1	1	0	2	3	1	1	2	1	0	10	L4

Appendix 1: Vertebrate Fauna List for Kortright Conservation Area.

Common Name	Scientific Name	pre-03	'03	'04	'08	'09	'10	'11	'12	count	LO	PTn	PTt	AS	PIS	HD	StD	+	TS	L-Rank
belted kingfisher	<i>Ceryle alcyon</i>		x						3	3	0	3	2	2	1	2	2	0	12	L4
blue-grey gnatcatcher	<i>Poliophtila caerulea</i>	2	2			1			4	5	0	1	1	3	1	1	3	0	10	L4
chimney swift	<i>Chaetura pelagica</i>								1	1	1	3	3	1	1	1	1	0	11	L4
cliff swallow	<i>Petrochelidon pyrrhonota</i>								x	colony	1	2	2	1	1	2	1	0	10	L4
common yellowthroat	<i>Geothlypis trichas</i>		x		2	1	1	3	47	47	0	2	2	1	2	1	4	0	12	L4
Cooper's hawk	<i>Accipiter cooperii</i>	1		1	1			2	1	3	0	2	1	4	1	3	2	0	13	L4
eastern bluebird	<i>Sialia sialis</i>		x			1		1	3	4	2	2	2	2	1	2	2	0	13	L4
eastern kingbird	<i>Tyrannus tyrannus</i>				1	2	1		12	13	0	4	2	2	1	1	3	0	13	L4
eastern meadowlark	<i>Sturnella magna</i>	1	2			2				3	0	3	2	3	1	1	3	0	13	L4
eastern screech-owl	<i>Megascops asio</i>	1	1							1	0	2	2	1	2	3	3	0	13	L4
eastern wood-pewee	<i>Contopus virens</i>	1	3						10	10	0	4	2	2	1	1	3	0	13	L4
field sparrow	<i>Spizella pusilla</i>		7		1	4	1		11	16	0	3	2	2	1	1	4	0	13	L4
great-crested flycatcher	<i>Myiarchus crinitus</i>	1	x		2				15	17	0	2	2	3	1	2	2	0	12	L4
great-horned owl	<i>Bubo virginianus</i>								2	2	0	2	2	2	2	1	2	0	11	L4
green heron	<i>Butorides virescens</i>							1	3	3	0	3	2	2	1	2	4	0	14	L4
grey catbird	<i>Dumetella carolinensis</i>		x		1		2	1	25	27	0	2	2	1	1	1	3	0	10	L4
hairy woodpecker	<i>Picoides villosus</i>	2	x			1			9	10	0	2	2	3	1	2	2	0	12	L4
indigo bunting	<i>Passerina cyanea</i>		x		1	2			34	35	0	2	2	1	1	2	4	0	12	L4
northern flicker	<i>Colaptes auratus</i>		x		1	1	1	1	9	10	0	3	2	1	1	2	3	0	12	L4
northern rough-winged swallow	<i>Stelgidoptery x serripennis</i>		x				2		2	3	0	1	2	1	1	3	2	0	10	L4
red-bellied woodpecker	<i>Melanerpes carolinus</i>								1	1	3	1	2	2	1	1	2	0	12	L4
red-breasted nuthatch	<i>Sitta canadensis</i>		x						6	6	0	1	2	3	1	1	2	0	10	L4
red-eyed vireo	<i>Vireo olivaceus</i>		x						26	26	0	2	2	2	1	1	3	0	11	L4
rose-breasted grosbeak	<i>Pheucticus ludovicianus</i>		x		1	1	1	1	15	16	0	2	2	3	1	2	3	0	13	L4
ruby-throated hummingbird	<i>Archilochus colubris</i>		x						1	1	0	2	2	1	1	2	2	0	10	L4
savannah sparrow	<i>Passerculus sandwichensis</i>		x			1	1		5	5	0	3	2	1	1	1	4	0	12	L4
spotted sandpiper	<i>Actitis macularia</i>	1	x				1	1	4	5	0	2	3	1	2	1	4	0	13	L4
swamp sparrow	<i>Melospiza georgiana</i>	2	x				1		8	8	0	1	2	1	2	1	5	1	13	L4
tree swallow	<i>Tachycineta bicolor</i>		x						4	4	0	2	2	1	1	2	2	0	10	L4
white-breasted nuthatch	<i>Sitta carolinensis</i>	1	x						6	6	0	2	2	3	1	2	2	0	12	L4
willow flycatcher	<i>Empidonax traillii</i>	1							2	2	0	4	2	1	1	1	3	0	12	L4
wood duck	<i>Aix sponsa</i>	1	1	1				1	1	4	0	2	1	3	2	2	4	0	14	L4
American Crow	<i>Corvus brachyrhynchos</i>		x						x	x	0	1	2	1	1	0	0	0	5	L5
American goldfinch	<i>Carduelis tristis</i>		x						x	x	0	2	2	1	1	0	1	0	7	L5
American robin	<i>Turdus migratorius</i>		x						x	x	0	1	2	1	1	0	1	0	6	L5

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Common Name	Scientific Name	pre-03	'03	'04	'08	'09	'10	'11	'12	count	LO	PTn	PTt	AS	PIS	HD	StD	+	TS	L-Rank
Baltimore oriole	<i>Icterus galbula</i>		x						x	x	0	2	2	1	1	0	1	0	7	L5
black-capped chickadee	<i>Parus atricapillus</i>		x						x	x	0	1	2	1	1	0	1	0	6	L5
blue jay	<i>Cyanocitta cristata</i>		x						x	x	0	4	2	1	1	0	1	0	9	L5
brown-headed cowbird	<i>Molothrus ater</i>		x						x	x	0	2	2	1	1	0	1	0	7	L5
Canada goose	<i>Branta canadensis</i>		x						x	x	0	1	1	1	2	1	0	0	6	L5
cedar waxwing	<i>Bombycilla cedrorum</i>		x						x	x	0	1	2	1	1	0	1	0	6	L5
chipping sparrow	<i>Spizella passerina</i>		x						x	x	0	2	2	1	1	0	2	0	8	L5
common grackle	<i>Quiscalus quiscula</i>		x						x	x	0	3	2	1	1	0	1	0	8	L5
downy woodpecker	<i>Picoides pubescens</i>		x						x	x	0	3	2	1	1	1	1	0	9	L5
eastern phoebe	<i>Sayornis phoebe</i>		x						3	3	0	2	2	1	1	2	1	0	9	L5
house wren	<i>Troglodytes aedon</i>		x						x	x	0	2	2	1	2	1	1	0	9	L5
killdeer	<i>Charadrius vociferus</i>		x						x	x	0	2	2	1	2	0	2	0	9	L5
mallard	<i>Anas platyrhynchos</i>		x						x	x	0	2	2	1	2	0	1	0	8	L5
mourning dove	<i>Zenaida macroura</i>		x						x	x	0	2	2	1	1	0	0	0	6	L5
northern cardinal	<i>Cardinalis cardinalis</i>		x						x	x	0	2	2	1	1	1	2	0	9	L5
northern mockingbird	<i>Mimus polyglottos</i>		x							x	0	2	0	1	1	1	1	0	6	L5
orchard oriole	<i>Icterus spurius</i>					1		1	3	4	1	2	1	1	1	0	1	0	7	L5
red-tailed hawk	<i>Buteo jamaicensis</i>		x						x	x	0	2	2	2	1	1	1	0	9	L5
red-winged blackbird	<i>Agelaius phoeniceus</i>		x						x	x	0	2	2	1	1	0	2	0	8	L5
song sparrow	<i>Melospiza melodia</i>		x						x	x	0	2	2	1	2	0	2	0	9	L5
warbling vireo	<i>Vireo gilvus</i>		x						x	x	0	1	2	1	1	1	2	0	8	L5
yellow warbler	<i>Setophaga petechia</i>		x						x	x	0	1	2	1	1	1	3	0	9	L5
European starling	<i>Sturnus vulgaris</i>		x						x	x										L+
rock dove	<i>Columba livia</i>		x						x	x										L+
trumpeter swan	<i>Cygnus buccinator</i>								1	1										L+
<b>Herpetofauna</b>																				
grey treefrog	<i>Hyla versicolor</i>	5	1			2	2	2	2	7	0	3	3	3	4	2	5	1	21	L2
northern spring peeper	<i>Pseudacris crucifer crucifer</i>	x	x	x	x	x	x	x	x	x	0	2	3	3	4	3	5	1	21	L2
striped chorus frog	<i>Pseudacris triseriata</i>	3		1						1	3	3	3	2	4	3	5	1	24	L2
wood frog	<i>Lithobates sylvatica</i>	x	x	x	x	x	x	x	x	x	0	2	3	3	4	3	5	1	21	L2
eastern red-backed salamander	<i>Plethodon cinereus</i>		x							x	0	2	2	1	4	3	4	0	16	L3
northern leopard frog	<i>Lithobates pipiens</i>								x	x	0	3	2	1	4	2	5	1	18	L3
American toad	<i>Anaxyrus americanus</i>		x						x	x	0	3	2	1	4	0	4	0	14	L4

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Common Name	Scientific Name	pre-03	'03	'04	'08	'09	'10	'11	'12	count	LO	PTn	PTt	AS	PIS	HD	StD	+	TS	L-Rank
green frog	<i>Lithobates clamitans</i>		x						x	x	0	2	2	1	3	1	4	0	13	L4
<b>Incidental Species:</b> species that are reported on as incidental to the TRCA protocol.																				
<b>Mammals</b>																				
northern flying squirrel	<i>Glaucomys sabrinus</i>					1				1	3	2	3	3	3	3	4	0	21	L2
porcupine	<i>Erethizon dorsatum</i>								1	1	2	2	2	4	4	3	3	0	20	L2
river otter	<i>Lutra canadensis</i>	1								historic	4	2	1	5	3	2	5	2	24	L2
ermine	<i>Mustela erminea</i>	1								historic	4	2	2	3	3	1	3	0	18	L3
hairy-tailed mole	<i>Parascalops breweri</i>	1								historic	4	2	2	1	4	1	4	0	18	L3
meadow jumping mouse	<i>Zapus hudsonius</i>	1								historic	3	2	2	2	3	2	3	0	17	L3
northern short-tailed shrew	<i>Blarina brevicauda</i>					1				1	3	2	2	1	2	2	4	0	16	L3
star-nosed mole	<i>Condylura cristata</i>								1	1	4	2	2	1	4	1	4	0	18	L3
beaver	<i>Castor canadensis</i>								x	x	1	2	1	2	3	1	3	0	13	L4
eastern chipmunk	<i>Tamias striatus</i>		x						x	x	0	2	2	2	3	1	3	0	13	L4
eastern cottontail	<i>Sylvilagus floridanus</i>		x						x	x	0	2	2	1	3	1	2	0	11	L4
meadow vole	<i>Microtus pennsylvanicus</i>		x							x	2	2	2	1	2	1	2	0	12	L4
mink	<i>Mustela vison</i>	2					1			1	1	2	2	3	3	0	3	0	14	L4
muskrat	<i>Ondatra zibethicus</i>		x						1	1	0	2	2	1	3	1	3	0	12	L4
red squirrel	<i>Tamiasciurus hudsonicus</i>		x						x	x	0	2	2	1	3	1	2	0	11	L4
Virginia opossum	<i>Didelphis virginiana</i>								1	1	2	2	1	1	3	1	1	0	11	L4
white-tailed deer	<i>Odocoileus virginianus</i>		x						x	x	0	2	1	3	2	2	1	0	11	L4
coyote	<i>Canis latrans</i>		x						x	x	0	2	2	1	3	0	1	0	9	L5
grey squirrel	<i>Sciurus carolinensis</i>								x	x	0	2	2	1	3	0	0	0	8	L5
raccoon	<i>Procyon lotor</i>								x	x	0	2	2	1	3	1	0	0	9	L5
striped skunk	<i>Mephitis mephitis</i>								x	x	1	2	2	1	3	0	0	0	9	L5
southern flying squirrel	<i>Glaucomys volans</i>	2								historic	5	3	3	2	3	3	4	0	23	LX
domestic cat	<i>Felis catus</i>								x	x										L+
<b>Herpetofauna</b>																				
common snapping turtle	<i>Chelydra serpentina</i>		1		1					2	0	3	3	1	5	2	5	2	21	L2
eastern newt	<i>Notophthalmus viridescens</i>	1				1				x	3	2	2	3	4	3	5	1	23	L2
eastern milksnake	<i>Lampropeltis triangulum</i>	1				1		1		1	3	3	2	2	4	1	3	0	18	L3
midland painted turtle	<i>Chrysemys picta marginata</i>		x						2	2	0	2	2	1	5	1	4	1	16	L3

Appendix 1: Vertebrate Fauna List for Kortright Conservation Area.

Common Name	Scientific Name	pre-03	'03	'04	'08	'09	'10	'11	'12	count	LO	PTn	PTt	AS	PIS	HD	StD	+	TS	L-Rank	
northern red-bellied snake	<i>Storeria occipitomaculata</i>	1				2				2	3	2	2	2	3	1	5	1	19	L3	
eastern gartersnake	<i>Thamnophis sirtalis sirtalis</i>		x						x	x	0	2	2	1	3	0	3	0	11	L4	
<b>Invertebrates</b>																					
"chimney" crayfish	<i>Fallicambarus fodiens</i>								x	x	1	3	3	1	4	2	5	1	20	L2	
<b>LEGEND</b>																					
LO = local occurrence		PIS = Patch Isolation Sensitivity										LX = extirpated									
PTn = population trend, continent-wide		STD = sensitivity to development										L+ = non-native/introduced									
PTt = population trend, TRCA		+ = additional points																			
HD = habitat dependence		TS = total score																			
AS = area sensitivity		L-rank = TRCA Rank, October, 2008																			