

**PART II:**  
**TECHNICAL APPENDICES**

## A MORE DETAILED LOOK AT THE APPROACH

These technical appendices provide more information on the methodology used to derive the municipal priority lists. Where appropriate, examples from the Niagara Escarpment Plan Area are used to illustrate key concepts.

### *Appendix A. Jurisdictional Responsibility Scores*

Jurisdictional Responsibility scores are derived from patterns of breeding distribution. For a given spatial unit—an ecoregion, political unit, etc.—a species is assigned a JR score based on its distribution within the unit relative to other units. Species that have a large proportion of their range falling within the boundaries of the spatial unit will receive a high JR score and thus may require priority conservation action. The compilation of such lists for municipalities in southern Ontario, or for planning authorities such as the Niagara Escarpment Commission involves several steps, since JR scores at the municipal scale are linked to JR scores at broader geographical levels (e.g., region, province, and nation):

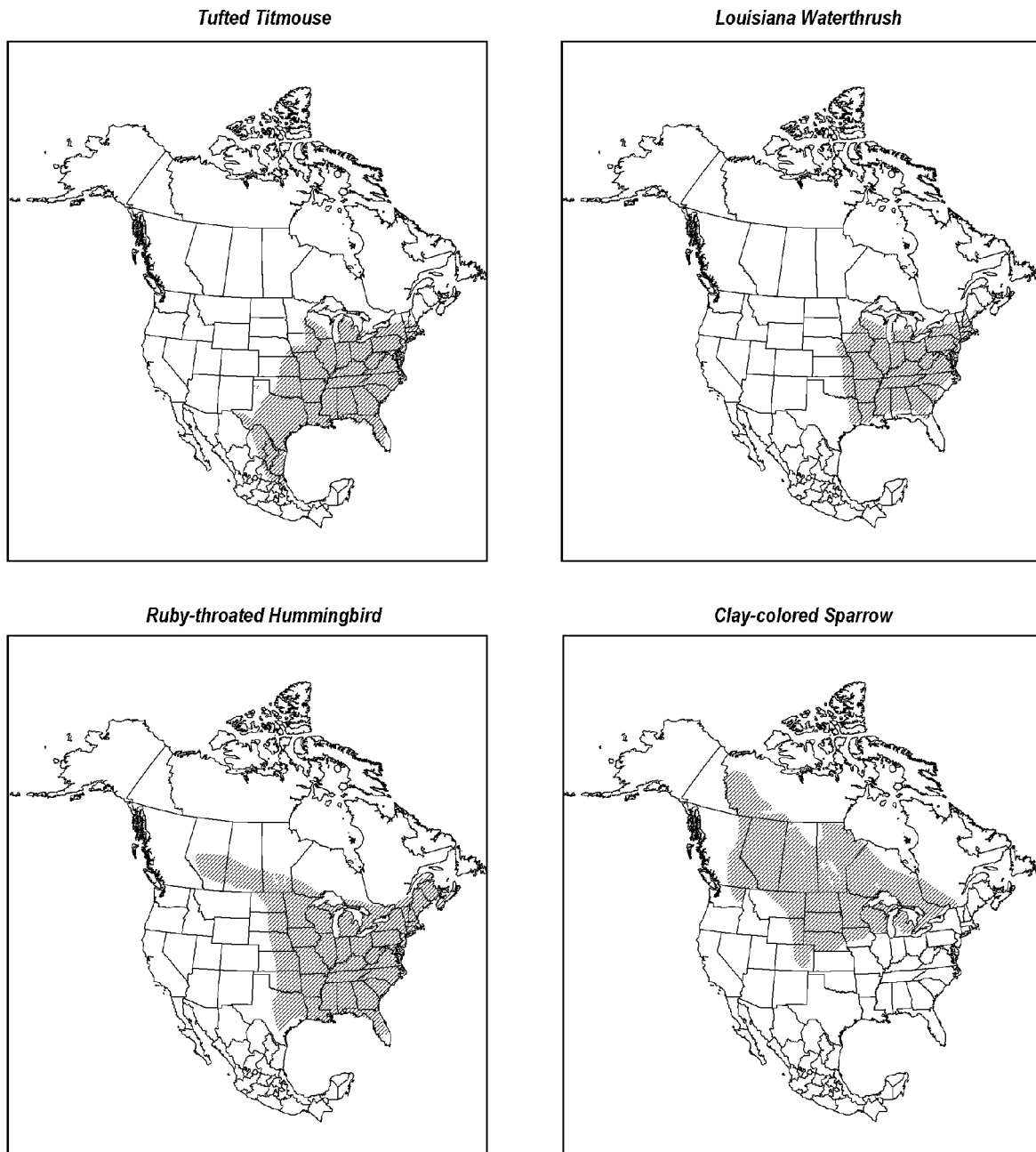
#### Step 1: Calculate JR Scores at the National Level

First, the Canadian proportion of each species’ North American breeding range was determined (e.g., 52% of the breeding range of species *x* occurs within Canada). This was accomplished by intersecting a digital range map for each species of landbird regularly breeding in Canada with a digital map of North American political units (Figure A1). Each species was assigned a Canadian breeding score based on the proportion of its breeding range which occurs in Canada; the higher the proportion, the higher the score. Scores were assigned according to the criteria shown in Table A1.

**Table A1.** Canadian Breeding Score calculation

Canadian Breeding Score	Proportion of North American Breeding Range in Canada
5	> 80%
4	> 60%-80%
3	> 40%-60%
2	> 20%-40%
1	≤ 20%

These breeding scores were then multiplied by an appropriate factor relating to the species’ North American share of its global range: a factor of 0.1 was used if a species had a peripheral or accidental distribution in North America; 0.5 was used if its North American range was less than 25% of its global range; and a factor of 1.0 was used when the species’ North



**Figure A1.** Broad scale range maps.

American range represented greater than 25% of its global range. This final, weighted, score represents the *Canadian Responsibility Score*.

*Step 2: Calculate JR Scores at the Provincial Level*

A similar procedure was used to determine breeding scores at the provincial scale, except that rather than comparing Canada to North America, we evaluated Ontario against Canada. In

fact, a comparison between two figures was made: 1) the proportion of a species' Canadian range which occurs in Ontario (from the digital range maps) and 2) the proportion of Canada's land area encompassed in Ontario (10.97%). If Ontario has a higher share of the species' range than we would expect from a proportional distribution, then this species receives a higher provincial breeding score. Breeding scores were assigned as follows:

**Table A2.** Ontario Breeding Score calculation

Breeding Score	Criteria (Note: Ontario comprises 10.97% of Canada's total area)
5	breeding range more than 2X what would be expected on the basis of proportional area alone (i.e. breeding range in Ontario > 21.93% of Canadian range).
4	breeding range 1.5 to 2X what would be expected on the basis of proportional area alone (i.e. breeding range in Ontario from 16.45% to 21.93% of Canadian range).
3	breeding range 1 to 1.5X what would be expected on the basis of proportional area alone (i.e. breeding range in Ontario from 10.97% to 16.45% of Canadian range).
2	breeding range 0.5 to 1X what would be expected on the basis of proportional area alone (i.e. breeding range in Ontario from 5.48% to 10.97% of Canadian range).
1	breeding range less than half what would be expected on the basis of proportional area alone (i.e. breeding range in Ontario less than 5.48% of Canadian range)

The logic of the approach is that, if a species breeds equally across the country, we would expect its breeding range within each province to reflect the area of the province relative to the area of Canada. Thus, if 20% of a species' breeding range is found within Ontario (which only contains 10.97% of the area of Canada), then it receives an Ontario breeding score of 4 according to the scoring system from Table A2. In effect, the breeding range of this species is disproportionately higher within Ontario than what we would expect based on the 'capture area' of Ontario, and thus, Ontario should have a proportionately higher responsibility for ensuring the welfare of the species. The *Ontario Jurisdictional Responsibility Score* for each species was calculated by averaging the provincial breeding score described above and the Canadian responsibility score. This composite score ensures that provincial responsibilities reflect national priorities.

*Step 3: Calculate JR Scores at the Regional Level (Southern Ontario -- Mixedwood Plains Ecozone)*

We also calculated Jurisdictional Responsibility scores at a regional scale. This scale of analysis was necessary because birds vary widely in their breeding distribution across the province. These patterns of breeding distribution are related to many factors, including habitat preferences and habitat availability; for example, certain birds only breed in the boreal forest region, others only in the extreme southern reaches of the province. We used the ecological

regions developed by the Ecological Stratification Working Group (1995) as units for this level of the analysis (Figure 1, shown at beginning of document).

It was determined that the North American range maps were insufficient for conservation priority setting at scales finer than that of the province. This was due to the coarse nature of the range maps, i.e., the range limits were too approximate, and could arbitrarily exclude whole counties, watersheds, etc., thus yielding inaccurate results. Consequently, at the sub-Ontario scale (regional and local), we used breeding distributions from the Ontario Breeding Bird Atlas (Cadman et al., 1987). These digital ranges (Figure A2), which provide an indication of breeding evidence in 100 square kilometre cells, produce a much better picture of breeding patterns within the province than the coarse, broad-scale range maps.

Breeding scores for the Mixedwood Plains Ecozone were calculated following the same logic as for provincial breeding scores. For each species, we first calculated the proportion of the species' Ontario breeding range encompassed in the ecozone, using transformed atlas data (Appendix B). We then compared this value to the proportion of Ontario occupied by the ecozone (8.4% or 82,720 km<sup>2</sup>) to obtain a *Regional Breeding Score*, using the same proportion-based scoring scheme as at the provincial level. The *Regional Jurisdictional Responsibility Score* was obtained by averaging the regional breeding score, the Ontario breeding score, and the Canadian responsibility score. This composite score ensures that regional scores reflect provincial and national responsibilities.

*Step 4: Calculate JR Scores at the Local Level (Upper Tier Municipalities and other planning units such as the Niagara Escarpment Plan Area)*

The Breeding Bird Atlas distributions were used to calculate breeding ranges for each species within each upper tier municipality in southern Ontario, and for the Niagara Escarpment Plan Area. The *Municipal Breeding Score* is determined by comparing 1) the proportion of the species' regional range area falling within the municipality, and 2) the proportion of the Mixedwood Plains Ecozone area captured by the municipality. Using the same scoring scheme as at the regional and provincial levels, we calculated municipal breeding scores according to values in Table A3.

Under this scoring scheme, species *x* would need to have 4.45% or more of its southern Ontario breeding range concentrated within the Niagara Escarpment Plan Area in order to receive a Municipal Breeding Score of 5 (Table A3), the highest score. At first glance, this doesn't seem like a very significant portion. However, if we consider that the Escarpment only captures 2.23% of the total area of southern Ontario, we soon realize that species *x* is twice as concentrated within the boundaries of the Escarpment as we otherwise would expect based on proportional area alone. The municipal breeding score was then averaged with the regional breeding score, the Ontario breeding score, and the Canadian responsibility score to arrive at the *Municipal Jurisdictional Responsibility Score*. This composite score ensures that local-level scores reflect regional, provincial and national responsibilities.

**Table A3.** Municipal breeding score calculation.

Municipality	Area (km <sup>2</sup> )	Percent of Ecozone	Municipal Breeding Score Values and Associated Cutoff Points for Scoring				
			1	2	3	4	5
BRANT	1122.9	1.36	< 0.68	< 1.36	< 2.04	< 2.72	≥ 2.72
BRUCE	4239.4	5.13	< 2.56	< 5.13	< 7.69	< 10.25	≥ 10.25
DUFFERIN	1499.2	1.81	< 0.91	< 1.81	< 2.72	< 3.62	≥ 3.62
DURHAM	2541.4	3.07	< 1.54	< 3.07	< 4.61	< 6.14	≥ 6.14
ELGIN	1900.4	2.30	< 1.15	< 2.30	< 3.45	< 4.59	≥ 4.59
ESSEX	1800.8	2.18	< 1.09	< 2.18	< 3.27	< 4.35	≥ 4.35
FRONTENAC	880.9	1.06	< 0.53	< 1.06	< 1.60	< 2.13	≥ 2.13
GREY	4478.7	5.41	< 2.71	< 5.41	< 8.12	< 10.83	≥ 10.83
HALDIMAND-NORFOLK	3025.7	3.66	< 1.83	< 3.66	< 5.49	< 7.32	≥ 7.32
HALTON	963.4	1.16	< 0.58	< 1.16	< 1.75	< 2.33	≥ 2.33
HAMILTON-WENTWORTH	1151.0	1.39	< 0.70	< 1.39	< 2.09	< 2.78	≥ 2.78
HASTINGS	1963.6	2.37	< 1.19	< 2.37	< 3.56	< 4.75	≥ 4.75
HURON	3432.9	4.15	< 2.08	< 4.15	< 6.23	< 8.30	≥ 8.30
KENT	2551.6	3.08	< 1.54	< 3.08	< 4.63	< 6.17	≥ 6.17
LAMBTON	3030.9	3.66	< 1.83	< 3.66	< 5.50	< 7.33	≥ 7.33
LANARK	1351.0	1.63	< 0.82	< 1.63	< 2.45	< 3.27	≥ 3.27
LEEDS & GRENVILLE	3308.9	4.00	< 2.00	< 4.00	< 6.00	< 8.00	≥ 8.00
LENOX & ADDINGTON	1200.4	1.45	< 0.73	< 1.45	< 2.18	< 2.90	≥ 2.90
MANITOULIN	2688.6	3.25	< 1.63	< 3.25	< 4.88	< 6.50	≥ 6.50
METROPOLITAN TORONTO	640.5	0.77	< 0.39	< 0.77	< 1.16	< 1.55	≥ 1.55
MIDDLESEX	3318.9	4.01	< 2.01	< 4.01	< 6.02	< 8.02	≥ 8.02
NIAGARA	1838.0	2.22	< 1.11	< 2.22	< 3.33	< 4.44	≥ 4.44
NIAGARA ESCARPMENT PLAN AREA	1840.7	2.23	< 1.11	< 2.23	< 3.34	< 4.45	≥ 4.45
NORTHUMBERLAND	2195.4	2.65	< 1.33	< 2.65	< 3.98	< 5.31	≥ 5.31
OTTAWA-CARLTON	2784.6	3.37	< 1.68	< 3.37	< 5.05	< 6.73	≥ 6.73
OXFORD	1994.9	2.41	< 1.21	< 2.41	< 3.62	< 4.82	≥ 4.82
PEEL	1245.3	1.51	< 0.75	< 1.51	< 2.26	< 3.01	≥ 3.01
PERTH	2190.9	2.65	< 1.32	< 2.65	< 3.97	< 5.30	≥ 5.30
PETERBOROUGH	2374.0	2.87	< 1.43	< 2.87	< 4.30	< 5.74	≥ 5.74
PRESCOTT & RUSSELL	2018.3	2.44	< 1.22	< 2.44	< 3.66	< 4.88	≥ 4.88
PRINCE EDWARD	1078.1	1.30	< 0.65	< 1.30	< 1.95	< 2.61	≥ 2.61
RENFREW	1344.4	1.63	< 0.81	< 1.63	< 2.44	< 3.25	≥ 3.25
SIMCOE	4653.4	5.63	< 2.81	< 5.63	< 8.44	< 11.25	≥ 11.25
STORMONT DUNDAS & GLENGARRY	3338.3	4.04	< 2.02	< 4.04	< 6.05	< 8.07	≥ 8.07
VICTORIA	2671.5	3.23	< 1.61	< 3.23	< 4.84	< 6.46	≥ 6.46
WATERLOO	1396.1	1.69	< 0.84	< 1.69	< 2.53	< 3.38	≥ 3.38
WELLINGTON	2700.3	3.26	< 1.63	< 3.26	< 4.90	< 6.53	≥ 6.53
YORK	1789.9	2.16	< 1.08	< 2.16	< 3.25	< 4.33	≥ 4.33

### *Example Calculations and Discussion*

The following examples illustrate how Jurisdictional Responsibility scores are calculated:

Example 1. The Tufted Titmouse and the Louisiana Waterthrush are most widespread in the United States, so Canada's global responsibility for them would be relatively low. This is illustrated in Table A4, where both species have a very low score for Canadian Responsibility. In Canada, these two species are restricted to Ontario (Figure A1), resulting in a high Ontario breeding score (Table A4). Within Ontario, they are more or less restricted to the south (Figure A2), again resulting in a southern Ontario breeding score of 5 (Table A4). Within southern Ontario, substantial proportions of their populations occur within the Niagara Escarpment Plan Area and, specifically, in the lower Niagara Escarpment region. Table A4 shows that 6.2% of the southern Ontario range of Louisiana Waterthrush and 5.0% of the southern Ontario range of Tufted Titmouse occurs within the Escarpment region. Since 6.2 and 5.0 are both greater than 2 times the proportional area of the Escarpment relative to southern Ontario (refer to the threshold scores in Table A3), both of these species are assigned a score of 5 at this local scale. Because both of these species are highly concentrated within the boundaries of the Escarpment relative to other areas in southern Ontario, it makes sense to assign to the Niagara region a proportionately higher level of Jurisdictional Responsibility for their welfare.

Example 2. The Ruby-throated Hummingbird is very widespread within North America (Figure A1), so the species is assigned a low Canadian responsibility score. It is not particularly concentrated within the Niagara Escarpment region (2.4% of its southern Ontario range is found within Escarpment boundaries) and thus receives a moderate municipal breeding score of 3, according to the scoring criteria outlined in Table A3. Nationally, however, the Ruby-throated Hummingbird is concentrated within Ontario (resulting in a high Ontario breeding score); and within Ontario, the majority of its range is located in southern Ontario (resulting in a high southern Ontario breeding score). So, despite having a moderate municipal breeding score and a low Canadian responsibility score, this species still ends up with a high overall Jurisdictional Responsibility score for the Niagara Escarpment and would be included on the list of priority species for this region. This example demonstrates the importance of linking conservation priorities from different geographic scales.

Example 3. The Clay-colored Sparrow is concentrated within Canada, within Ontario, and within southern Ontario. As a result, this species is assigned high values for Canadian Responsibility score, Ontario breeding score, and southern Ontario breeding score (Table A4). However, only 2.2% of its southern Ontario range is located within the Escarpment region, resulting in a municipal breeding score of 2. Overall, Clay-colored Sparrow has a high composite Jurisdictional Responsibility score (Table A4), thanks to averaging scores from higher geographical scales.

The examples above illustrate the importance of linking national and provincial responsibilities with local conservation priorities. In all of the examples above, species rank highly for overall Jurisdictional Responsibility within the Niagara Escarpment Plan Area, and would be

included on the list of important species for the region. The examples show that species can rank highly for JR for very different reasons.

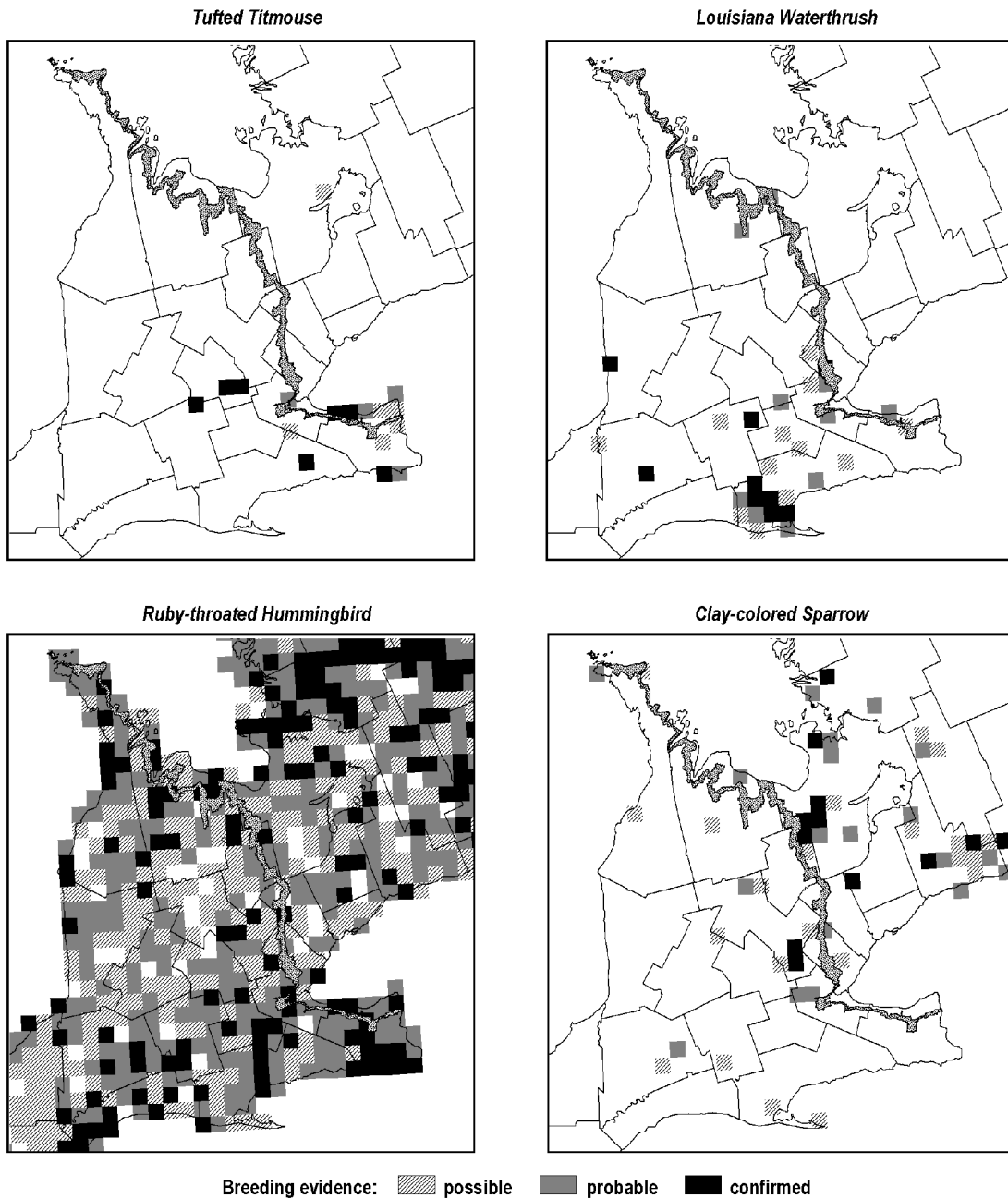


Figure A2. Raw Ontario Breeding Bird Atlas data.

**Table A4.** Jurisdictional Responsibility scores for the Niagara Escarpment Plan Area. The composite Municipal Jurisdictional Responsibility Score is derived by averaging the municipal breeding, the ecozone breeding score, the Ontario breeding score, and the Canadian responsibility score. This averaging approach ensures that local, regional, provincial, and national responsibilities are represented. Species scoring 3.5 or greater (shaded in gray) are included on the list of priority species for the Escarpment region.

Species Name	NE Breeding Area (km <sup>2</sup> )	% Ecozone Breeding Area	Municipal Breeding Score	Ecozone Breeding Score	Ontario Breeding Score	Canadian Responsibility Score	Composite Municipal JR Score
Louisiana Waterthrush	263.1	6.2	5	5	5	1	4
Dickcissel	20.4	6.0	5	5	5	1	4
Tufted Titmouse	91.8	5.0	5	5	5	1	4
Eastern Bluebird	1426.8	3.4	4	5	5	2	4
Yellow-bellied Sapsucker	1478.9	3.0	3	3	5	5	4
Northern Saw-whet Owl	507.1	2.5	3	5	5	3	4
Mourning Warbler	1308.1	2.4	3	4	5	4	4
Clay-colored Sparrow	248.2	2.2	2	5	5	4	4
Barn Owl	28.6	4.6	5	5	5	0.5	3.88
Yellow-bellied Flycatcher	161.4	5.9	5	1	4	5	3.75
Black-throated Blue Warbler	547.6	5.6	5	2	5	3	3.75
Philadelphia Vireo	97.6	5.0	5	1	4	5	3.75
Black-throated Green Warbler	1030.7	3.8	4	2	5	4	3.75
Magnolia Warbler	611.4	3.4	4	1	5	5	3.75
Canada Warbler	990.1	3.2	3	3	5	4	3.75
Brown Creeper	1232.3	3.0	3	4	5	3	3.75
Virginia Rail	1184.9	2.9	3	5	5	2	3.75
Pileated Woodpecker	1581.9	2.8	3	4	5	3	3.75
Pied-billed Grebe	699.8	2.8	3	5	5	2	3.75
Sora	1073.1	2.7	3	5	4	3	3.75
Ring-billed Gull	127.7	2.6	3	3	5	4	3.75
Sedge Wren	399.5	2.5	3	5	5	2	3.75
Blue-winged Teal	1564.1	2.4	3	5	4	3	3.75
Ruffed Grouse	1747.4	2.4	3	4	4	4	3.75
Ruby-throated Hummingbird	1777.3	2.4	3	5	5	2	3.75
American Woodcock	1762.4	2.4	3	5	5	2	3.75
Swamp Sparrow	1657.8	2.4	3	3	5	4	3.75
Eastern Phoebe	1769.2	2.4	3	5	4	3	3.75
Whip-poor-will	847.8	2.3	3	5	5	2	3.75
Bobolink	1839.7	2.2	3	5	5	2	3.75
Great Crested Flycatcher	1840.6	2.2	3	5	5	2	3.75
Gray Catbird	1839.7	2.2	3	5	5	2	3.75
Blue Jay	1840.7	2.2	3	5	5	2	3.75
American Black Duck	849.3	2.1	2	3	5	5	3.75
Black Tern	362.2	1.5	2	5	5	3	3.75
Caspian Tern	54.1	3.0	3	5	5	1.5	3.63
Rusty Blackbird	79.1	8.6	5	1	3	5	3.5
Sandhill Crane	61.3	4.8	5	1	3	5	3.5
Winter Wren	1466.3	3.5	4	2	4	4	3.5
Tennessee Warbler	49.2	3.4	4	1	4	5	3.5
Orchard Oriole	349.7	3.3	3	5	5	1	3.5
Wild Turkey	77.1	3.2	3	5	5	1	3.5
Northern Mockingbird	393.7	3.2	3	5	5	1	3.5
Henslow's Sparrow	116.3	3.2	3	5	5	1	3.5
Nashville Warbler	1519.7	3.1	3	3	5	3	3.5
Pine Warbler	654.2	3.0	3	5	5	1	3.5
Yellow-throated Vireo	930.8	2.9	3	5	5	1	3.5
Golden-winged Warbler	646.1	2.8	3	5	5	1	3.5
Purple Finch	1117.7	2.8	3	3	4	4	3.5
Northern Waterthrush	1436.3	2.7	3	3	4	4	3.5
Eastern Screech-Owl	1431.8	2.7	3	5	5	1	3.5
White-throated Sparrow	1545.7	2.6	3	2	4	5	3.5
Cooper's Hawk	457.9	2.6	3	5	5	1	3.5

Species Name	NE Breeding Area (km <sup>2</sup> )	% Ecozone Breeding Area	Municipal Breeding Score	Ecozone Breeding Score	Ontario Breeding Score	Canadian Responsibility Score	Composite Municipal JR Score
Scarlet Tanager	1705.7	2.6	3	5	5	1	3.5
Eastern Towhee	1463.1	2.5	3	5	5	1	3.5
Cliff Swallow	1527.4	2.4	3	5	3	3	3.5
Northern Cardinal	1563.8	2.4	3	5	5	1	3.5
Great Horned Owl	1818.8	2.4	3	5	3	3	3.5
Red-shouldered Hawk	509.7	2.4	3	5	5	1	3.5
Yellow-billed Cuckoo	715.5	2.4	3	5	5	1	3.5
Blue-winged Warbler	347.7	2.4	3	5	5	1	3.5
Alder Flycatcher	1271.8	2.4	3	3	4	4	3.5
Field Sparrow	1699.9	2.3	3	5	5	1	3.5
Hairy Woodpecker	1833.3	2.3	3	4	4	3	3.5
Veery	1781.9	2.3	3	5	4	2	3.5
Ovenbird	1783.2	2.3	3	3	5	3	3.5
Black-capped Chickadee	1840.7	2.3	3	4	4	3	3.5
Chestnut-sided Warbler	1357.9	2.3	3	3	5	3	3.5
Least Flycatcher	1757.4	2.3	3	3	4	4	3.5
Red-headed Woodpecker	1401.1	2.3	3	5	5	1	3.5
American Redstart	1612.2	2.3	3	4	4	3	3.5
Rose-breasted Grosbeak	1839.3	2.3	3	5	3	3	3.5
Downy Woodpecker	1839.5	2.3	3	5	4	2	3.5
Indigo Bunting	1839.5	2.3	3	5	5	1	3.5
Red-tailed Hawk	1794.3	2.3	3	5	4	2	3.5
House Wren	1801.3	2.3	3	5	4	2	3.5
Green Heron	1651.0	2.2	3	5	5	1	3.5
Eastern Meadowlark	1829.1	2.2	3	5	5	1	3.5
Brown Thrasher	1828.9	2.2	3	5	5	1	3.5
Barn Swallow	1839.7	2.2	3	5	4	2	3.5
Eastern Kingbird	1839.5	2.2	3	5	4	2	3.5
American Goldfinch	1839.5	2.2	3	5	4	2	3.5
American Crow	1840.7	2.2	3	4	4	3	3.5
Wood Duck	1484.7	2.2	3	5	5	1	3.5
Black-billed Cuckoo	1445.7	2.2	2	5	5	2	3.5
Rock Dove	1729.2	2.2	2	5	5	2	3.5
Bank Swallow	1558.9	2.1	2	5	4	3	3.5
American Bittern	762.1	1.8	2	5	4	3	3.5
Common Tern	168.0	1.6	2	2	5	5	3.5
Long-eared Owl	225.8	1.4	2	5	4	3	3.5
American Coot	212.2	1.3	2	5	4	3	3.5
Mute Swan	38.1	2.5	3	5	5	0.1	3.28
Merlin	210.6	8.5	5	1	3	4	3.25
Red-breasted Merganser	311.8	7.7	5	1	3	4	3.25
Swainson's Thrush	319.3	5.9	5	1	3	4	3.25
Dark-eyed Junco	426.9	5.4	5	1	3	4	3.25
Black-backed Woodpecker	34.2	4.5	5	1	3	4	3.25
Common Merganser	638.9	4.5	5	1	3	4	3.25
Golden-crowned Kinglet	654.8	4.3	4	1	4	4	3.25
Hooded Merganser	610.5	3.6	4	2	5	2	3.25
Blackburnian Warbler	771.7	3.3	3	2	5	3	3.25
Black-and-white Warbler	1554.2	2.9	3	3	5	2	3.25
Turkey Vulture	1811.6	2.8	3	5	4	1	3.25
Ring-necked Duck	148.3	2.7	3	1	5	4	3.25
Grasshopper Sparrow	1112.7	2.7	3	5	4	1	3.25
Sharp-shinned Hawk	870.8	2.7	3	4	3	3	3.25
Northern Goshawk	347.3	2.6	3	3	3	4	3.25
Broad-winged Hawk	793.3	2.6	3	3	5	2	3.25
Canada Goose	1393.1	2.5	3	4	2	4	3.25
Common Snipe	1538.4	2.5	3	4	3	3	3.25
Northern Rough-winged Swallow	1719.2	2.4	3	5	4	1	3.25
Belted Kingfisher	1830.4	2.3	3	4	3	3	3.25
White-breasted Nuthatch	1711.8	2.3	3	5	4	1	3.25

Species Name	NE Breeding Area (km <sup>2</sup> )	% Ecozone Breeding Area	Municipal Breeding Score	Ecozone Breeding Score	Ontario Breeding Score	Canadian Responsibility Score	Composite Municipal JR Score
American Kestrel	1822.9	2.2	3	5	3	2	3.25
Mourning Dove	1839.6	2.2	3	5	4	1	3.25
Common Yellowthroat	1840.6	2.2	3	4	4	2	3.25
Brown-headed Cowbird	1839.8	2.2	3	5	3	2	3.25
Cedar Waxwing	1840.7	2.2	3	3	4	3	3.25
Common Grackle	1839.8	2.2	3	4	4	2	3.25
Yellow Warbler	1834.3	2.2	3	3	4	3	3.25
Red-winged Blackbird	1839.8	2.2	3	5	3	2	3.25
Song Sparrow	1840.7	2.2	3	3	4	3	3.25
Killdeer	1839.2	2.2	2	5	4	2	3.25
Savannah Sparrow	1822.5	2.2	2	5	3	3	3.25
Vesper Sparrow	1748.9	2.2	2	5	4	2	3.25
Eastern Wood-Pewee	1814.1	2.2	2	5	5	1	3.25
Cerulean Warbler	199.7	2.2	2	5	5	1	3.25
House Sparrow	1755.2	2.2	2	5	4	2	3.25
Wood Thrush	1678.1	2.1	2	5	5	1	3.25
Northern Harrier	1463.1	2.1	2	5	3	3	3.25
Great Blue Heron	1591.1	2.1	2	4	5	2	3.25
Chimney Swift	1377.2	2.1	2	5	5	1	3.25
Prothonotary Warbler	25.7	2.0	2	5	5	1	3.25
Cape May Warbler	28.1	2.0	2	1	5	5	3.25
House Finch	327.9	1.9	2	5	5	1	3.25
Blue-gray Gnatcatcher	395.1	1.8	2	5	5	1	3.25
Carolina Wren	57.0	1.7	2	5	5	1	3.25
Least Bittern	276.6	1.5	2	5	5	1	3.25
King Rail	21.5	1.4	2	5	5	1	3.25
Barred Owl	96.9	0.7	1	4	5	3	3.25
Common Moorhen	298.5	1.2	2	5	5	0.5	3.13
Common Raven	404.4	5.9	5	1	2	4	3
Red-breasted Nuthatch	1283.0	3.2	3	2	3	4	3
Common Loon	716.3	3.2	3	1	3	5	3
Solitary Vireo	219.4	3.0	3	1	5	3	3
Loggerhead Shrike	378.4	2.8	3	5	3	1	3
Herring Gull	488.4	2.7	3	1	3	5	3
Double-crested Cormorant	86.4	2.4	3	2	4	3	3
Upland Sandpiper	1374.3	2.3	3	5	2	2	3
Green-winged Teal	495.7	2.3	3	2	3	4	3
Spotted Sandpiper	1796.3	2.2	3	3	3	3	3
Red-eyed Vireo	1840.6	2.2	3	3	4	2	3
Chipping Sparrow	1840.6	2.2	3	4	3	2	3
Northern Flicker	1839.7	2.2	3	3	3	3	3
American Robin	1840.7	2.2	3	3	3	3	3
Mallard	1818.0	2.2	2	3	4	3	3
Gadwall	230.0	1.9	2	5	3	2	3
Purple Martin	1010.8	1.7	2	5	4	1	3
Bay-breasted Warbler	9.3	1.0	1	1	5	5	3
White-eyed Vireo	16.4	1.0	1	5	5	1	3
Red-bellied Woodpecker	103.0	0.9	1	5	5	1	3
Acadian Flycatcher	27.9	0.8	1	5	5	1	3
Northern Bobwhite	66.2	0.8	1	5	5	1	3
Hooded Warbler	17.3	0.7	1	5	5	1	3
Short-eared Owl	13.0	0.2	1	4	3	4	3
Black-crowned Night-Heron	385.2	4.7	5	5	1	0.5	2.88
Northern Parula	164.8	3.8	4	1	5	1	2.75
Western Meadowlark	257.4	3.1	3	5	2	1	2.75
Yellow-rumped Warbler	840.8	3.0	3	1	3	4	2.75
Pine Siskin	409.0	2.5	3	1	3	4	2.75
Olive-sided Flycatcher	187.4	2.3	3	1	4	3	2.75
Baltimore Oriole	1839.5	2.2	3	5	2	1	2.75
Tree Swallow	1833.5	2.2	2	3	3	3	2.75

<b>Species Name</b>	<b>NE Breeding Area (km<sup>2</sup>)</b>	<b>% Ecozone Breeding Area</b>	<b>Municipal Breeding Score</b>	<b>Ecozone Breeding Score</b>	<b>Ontario Breeding Score</b>	<b>Canadian Responsibility Score</b>	<b>Composite Municipal JR Score</b>
Horned Lark	1635.5	2.2	2	5	1	3	2.75
Marsh Wren	611.8	1.9	2	5	2	2	2.75
Red Crossbill	127.5	1.9	2	3	3	3	2.75
Common Nighthawk	837.0	1.8	2	3	4	2	2.75
Wilson's Phalarope	25.5	0.6	1	5	2	3	2.75
Evening Grosbeak	307.5	2.8	3	1	3	3	2.5
Warbling Vireo	1749.4	2.2	2	5	1	2	2.5
Hermit Thrush	378.4	2.1	2	1	3	4	2.5
Ring-necked Pheasant	549.5	1.8	2	5	2	1	2.5
Willow Flycatcher	1007.1	1.7	2	5	2	1	2.5
Ruby-crowned Kinglet	105.7	1.4	2	1	3	4	2.5
Northern Pintail	160.2	1.3	2	4	1	3	2.5
Gray Partridge	74.9	0.7	1	5	2	2	2.5
Common Goldeneye	3.0	0.3	1	1	3	5	2.5
White-winged Crossbill	1.3	0.1	1	1	3	5	2.5
Brewer's Blackbird	60.9	2.5	3	2	2	2	2.25
Yellow-breasted Chat	87.3	1.9	2	5	1	1	2.25
Osprey	99.4	0.5	1	1	3	4	2.25
Bald Eagle	2.6	0.2	1	1	3	4	2.25
Lincoln's Sparrow	4.2	0.2	1	1	3	4	2.25
Piping Plover	1.3	1.5	2	2	1	3	2
American Wigeon	136.9	1.5	2	2	1	3	2
Lesser Scaup	29.4	1.4	2	1	1	4	2

### ***Appendix B. Transformation of the Ontario Breeding Bird Atlas Data***

As noted in Appendix A, breeding distributions from the Ontario Breeding Bird Atlas (Cadman et al., 1987) were used in calculating JR scores at the sub-provincial level. However, atlas coverage is uneven in the northern portions of the province, and atlas effort (the number of hours a surveyor spent within each atlas square) varies from square to square. To address these deficiencies, we developed a method to estimate breeding distribution in areas without atlas coverage and to normalize distributions according to atlas effort.

The method is as follows:

1. Each atlas survey square was given a centroid; each centroid (or point) has values for breeding evidence for each species (0=absent; 1=possible, probable or confirmed) and hours of atlas effort associated with it.
2. "Extra" centroid points were created for survey squares where either: i) the species was found, or ii) the species wasn't found, but more than 15 hours of effort were spent. This gives extra weight to these two groups of atlas squares and, in effect, decreases the relative weight of squares with minimal effort.
3. A new map of breeding distribution was created using Inverse Distance Weighting, a surface interpolation function available within Arc/Info and other GIS packages. Inverse Distance Weighting takes known values from a series of discrete points—in this case, values for breeding evidence at the centroids of each atlas square—and uses them to generate a map showing continuous values of breeding evidence. Because the input points have a value of 0 or 1, each target cell in the new map is assigned a value ranging from 0 to 1. For a given species, this value represents its probability of breeding presence (Figure A3).
4. The new range maps were used to calculate breeding scores for the Mixedwood Plains Ecozone and for each upper tier municipality (or portion thereof) using the procedures described in Appendix A.

In northern Ontario, this procedure helps to fill in gaps where atlas coverage is lacking, thus providing more reliable breeding range estimates than the raw Atlas data. In southern Ontario, the method makes virtually no difference in the total range area of a species. The differences between the raw Atlas data and the transformed Atlas data are thus minimal; the breeding distributions derived from the transformed Atlas data are probably just as accurate a portrayal of the true breeding distribution as the raw Atlas data.

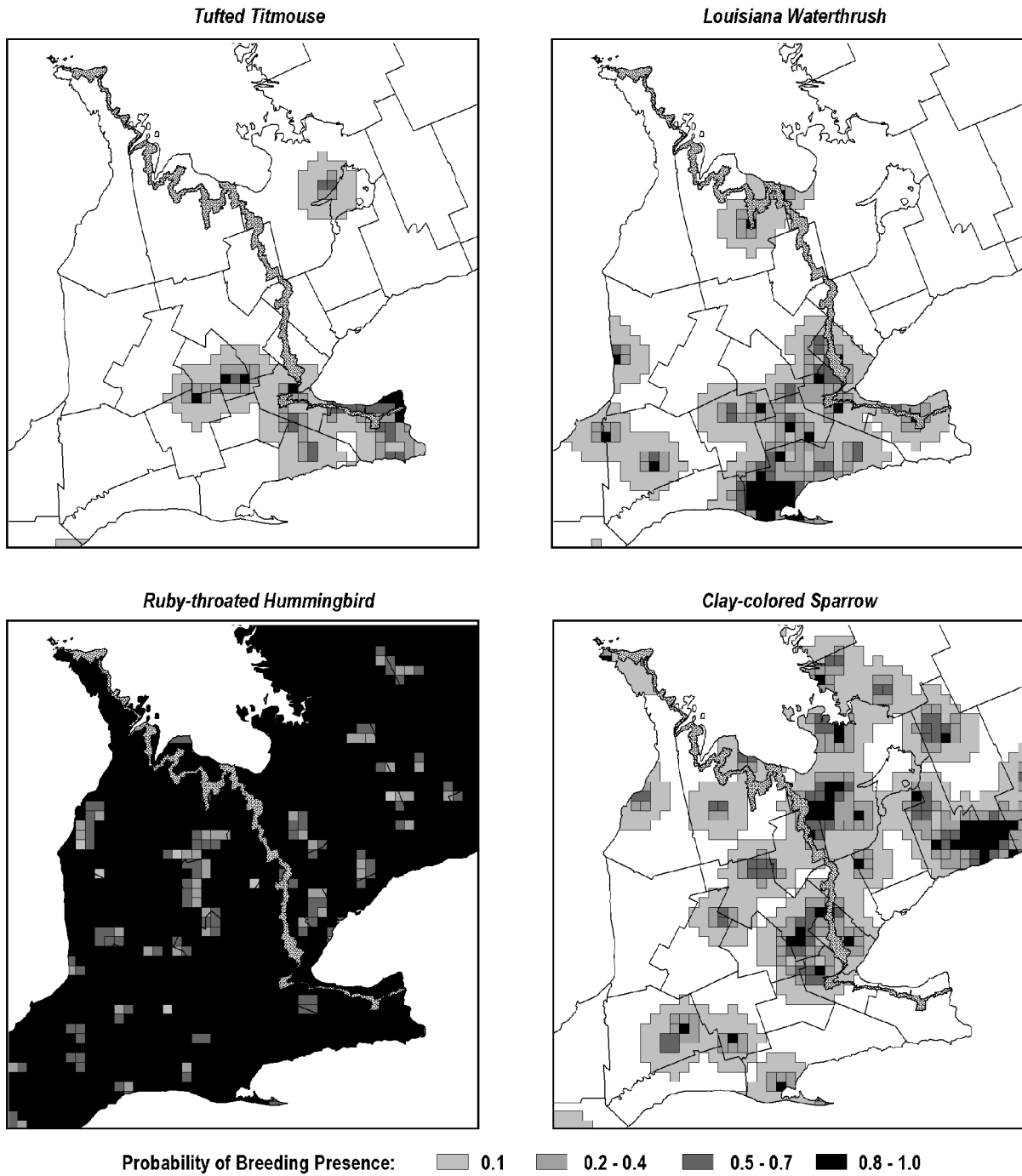


Figure A3. Breeding distribution according to transformed Atlas data.

***Appendix C. Preservation Responsibility Scores***

Each bird species regularly occurring in Ontario was assigned a Preservation Responsibility (PR) score based on its sensitivity to population change. PR scores were scaled from 1 to 5, with the most sensitive species receiving the highest score (5). Four criteria were used to calculate Preservation Responsibility scores for Ontario landbirds, using the following logic:

- abundance in Ontario: rare species score highest
- population trend over time: greatest declines score highest
- breadth of breeding or wintering range in Western Hemisphere: restricted ranges score highest
- reproductive output: smallest clutches or most infrequent breeding score highest

Compared to VTE species lists (Table 2), which identify species of highest preservation concern, PR scores also consider other factors that help to identify species that, although not currently threatened, are nonetheless sensitive to disturbance or that are declining. In effect, the PR score provides another mechanism for evaluating the susceptibility of species to environmental change.

*Abundance Score*

Scores for abundance of the species in Ontario were based on S-ranks defined by the Ontario Natural Heritage Information Centre (NHIC). In this system, the provincial status of each species is scored on a scale of one to five (Table A5). The score is based primarily on the number of extant occurrences, but other factors such as abundance, range, protection, and threats are also considered if that information is available. In addition to the numeric ranks, there are several letter codes which are occasionally used in place of a numeric rank. Most migratory birds are also assigned separate breeding and non-breeding (migration and/or wintering) status ranks which are indicated by the letter B or N following the status rank (e.g., S3B, SZN).

**Table A5.** Natural Heritage Information Centre S-rank.

Code	Description
S1 =	Critically imperiled because of extreme rarity (5 or fewer extant occurrences or very few remaining individuals) or because of some factor(s) making it especially vulnerable to extirpation or extinction;
S2 =	Imperiled because of rarity (typically 6-20 extant occurrences or few remaining individuals) or because of some factor(s) making it vulnerable to extirpation or extinction;
S3 =	Rare or uncommon (typically 21-100 occurrences); may be susceptible to large-scale disturbances; e.g. may have lost extensive peripheral populations;
S4 =	Frequent to common (greater than 100 occurrences); apparently secure but may have a restricted distribution; or there may be perceived future threats
S5 =	Common to very common; demonstrably secure and essentially ineradicable under present conditions

H =	Historical occurrence; usually not verified in the last 40 years, but with the expectation that it someday may be rediscovered
X =	Apparently extinct or extirpated, without the expectation that it will be rediscovered
R =	Reported from the province, but without persuasive documentation for either accepting or rejecting the report
A =	A species this is considered accidental or casual in province; a species that does not appear on an annual basis
E =	An exotic or introduced species to the province
Z =	Occurs in the province but as a diffuse, usually moving population; difficult or impossible to map static occurrences
B =	Breeding; the associated rank refers to breeding occurrences
N =	Non-breeding; the associated rank refers to non-breeding occurrences

For our purposes, the abundance score was derived by reversing the order of the five-point NHIC rankings. Since NHIC scores are skewed in favour of rarity, most species fall into the *common to very common* category. We thus gave intermediate ranks to species falling in more than one category (i.e., S2/S3 and S3/S4). The scoring method for Abundance is presented below.

**Table A6.** Abundance scoring method.

S-ranks	Abundance scores
S1 or S2	5
S2/S3	4.5
S3	4
S3/S4	3.5
S4	3
S4/S5	2
S5	1

### *Population Trend Score*

For each landbird species, we tried to obtain the most representative estimate of population trend in Ontario. Thus, whenever possible, we used population trends (1966-1996) calculated from Breeding Bird Survey (BBS) routes in Ontario. BBS trends were preferred over trends from migration data because they more clearly reflect population changes of provincially-breeding birds. We used BBS trends rather than trends from the Forest Bird Monitoring Program (FBMP) because BBS coverage more completely sampled the province.

For several species, even if a BBS trend estimate was available for Ontario, the variance was such that the estimate was deemed unreliable. By comparing different cut-off values, it appeared that estimates based on less than 45 routes in Ontario, or those with a variance greater than 15 units should not be used. When the population trend estimate was not available from the Ontario BBS source, or when it was not reliable, we then used either BBS trends from Eastern North America (states east of the Mississippi River and provinces of eastern Canada, including

Ontario); failing that, BBS trends from all of North America were used. Again, surveys with less than 45 routes were not considered, unless they were the best estimates available (and based on a minimum of 15 routes). When all of the 3 BBS trends were unavailable or unreliable, we used population trends calculated from the Christmas Bird Count (CBC), a winter survey conducted throughout North America, using data from the period 1959-1988. The scoring method for population trends is presented in Table A7 (a decline was considered significant when P value  $\leq$  0.10). For the few species where no population trend was available, we considered the population stable and a score of 3 was assigned.

**Table A7.** Population trend scoring method.

Population Trend Score	Criteria
5	Significant decline: 60% species with largest trends
4	Significant decline: 40% species with smallest trends
3	Non-significant decline or increase or no data available
2	Significant increase: 40% species with smallest trends
1	Significant increase: 60% species with largest trends

### *Breadth of Range*

Landbird species were scored according to the breadth of their breeding or wintering distribution in the Western Hemisphere. Species with the smallest range were assigned the highest scores because they are more likely to suffer from a local disturbance of their habitat. Breeding and wintering ranges were calculated for the 181 breeding landbirds found in Ontario using digital range maps provided by the Canadian Wildlife Service, Ontario Region. Each species was assigned a score for breadth of breeding range and for breadth of wintering range, according to the criteria described in Table A8. The maximum value of these individual scores represented the final Breadth of Range score.

**Table A8.** Breadth of range scoring method.

Breadth of Range Score	Criteria	Range (x 1,000,000 km <sup>2</sup> )	
		Breeding	Wintering
5	10% landbirds with smallest ranges	< 1.76	< 1.02
4	10% landbirds with next to smallest ranges	1.76–3.40	1.02–1.62
3	median 60%	3.40–9.67	1.62–9.00
2	10% landbirds with next to largest ranges	9.67–13.30	9.00–13.00
1	10% landbirds with largest ranges	> 13.30	>13.00

*Productivity Scores*

The productivity score is designed to identify species that have a low reproductive potential and are thus less resilient to disturbance, i.e., they have a lower ability to recover after a decline. This score is based on the average clutch size of each species (Cscore). Like other factors, clutch size is scored on a scale of 1 to 5, according to the criteria in Table A9. This initial score is modified by the age at first breeding factor (A\_mod) and the number of broods per year factor (B\_mod), based on the criteria in Table A9. The final productivity score was determined by the equation:

**Productivity = Clutch size score \* Age at first breeding factor \* Number of broods per year factor**

which was subsequently re-scaled to a value ranging from 1 to 5.

**Table A9.** Productivity scoring method.

Cscore	Typical clutch size	A_mod	Age at First Breeding	B_mod	Number of Broods/Year	Prod1	Prod.S core
5	<2	0.8	< 1 year (HY)	2	< 1 brood	≥5	<b>5</b>
4	2 to < 4	1.0	1 year (SY)	1	1 brood	3 to <5	<b>4</b>
3	4 to < 6	1.2	2+ year	0.75	1 or 2 broods	3	<b>3</b>
2	6 to < 8	1.4	3+ year	0.5	2 or 3 broods	>1 to <3	<b>2</b>
1	8+	1.6	4+ year	0.33	3+ broods	≤ 1	<b>1</b>
		1.8	5+ year				
		2.0	6+ year				

*Final Preservation Responsibility Scores*

Preservation Responsibility scores were calculated as a weighted average of the four scores (each ranging from 1 to 5) described above:

**PR= Mean (Abundance + Trend + (Max (Productivity, Range)))**

Final PR scores thus also ranged from 1 to 5, and were rounded to the nearest decimal. Table A10 lists Preservation Responsibility scores for all of the bird species considered in this analysis.

**Table A10.** Preservation Responsibility scores for Ontario landbirds. Species scoring 3.5 or greater (shaded in gray) are added to municipal priority lists where appropriate.

Species Name	Abundance Score	Trend Score	Range Score	Productivity Score	Ontario PR Score
Henslow's Sparrow	5	5	5	3	5.0
Horned Grebe	5	5	5	2	5.0
Chuck-will's-widow	5	5	4	4	4.7
King Rail	5	5	4	1	4.7
Prairie Warbler	4	5	5	2	4.7
Black-crowned Night-Heron	4	5	1	4	4.3
Cerulean Warbler	4	5	4	3	4.3
Common Eider	5	3	5	3	4.3
Common Tern	3	5	3	5	4.3
Dickcissel	5	5	3	3	4.3
Golden Eagle	5	3	2	5	4.3
Great Egret	5	3	1	5	4.3
King Eider	5	3	5	3	4.3
Little Gull	5	3	5	4	4.3
Loggerhead Shrike	5	5	3	3	4.3
Northern Bobwhite	5	5	3	1	4.3
Parasitic Jaeger	5	3	4	5	4.3
Pectoral Sandpiper	5	3	5	3	4.3
Piping Plover	5	3	5	3	4.3
Prothonotary Warbler	5	4	4	2	4.3
Red-throated Loon	5	3	3	5	4.3
Ross's Goose	5	3	5	4	4.3
Whimbrel	5	3	5	3	4.3
Short-billed Dowitcher	4.5	3	5	3	4.2
Arctic Tern	4	3	3	5	4.0
Dunlin	4	3	5	3	4.0
Greater Scaup	5	3	4	1	4.0
Hudsonian Godwit	4	3	5	3	4.0
Marbled Godwit	4	3	5	3	4.0
Orchard Oriole	4	4	4	3	4.0
Pacific Loon	4	3	3	5	4.0
Peregrine Falcon	5	3	3	4	4.0
Red-headed Woodpecker	4	5	3	2	4.0
Rough-legged Hawk	5	3	3	4	4.0
Stilt Sandpiper	4	3	5	3	4.0
Tundra Swan	4	3	5	3	4.0
Western Kingbird	5	2	5	3	4.0
White-eyed Vireo	5	3	4	3	4.0
Yellow Rail	3.5	3	5	1	3.8
Acadian Flycatcher	5	2	4	3	3.7
American Pipit	3	5	3	3	3.7
Black Tern	4	3	3	4	3.7
Black-billed Magpie	4	4	3	2	3.7
Blue-winged Warbler	3	3	5	3	3.7
Brant	3	3	5	3	3.7
Canvasback	5	3	3	1	3.7
Lesser Yellowlegs	3	5	3	3	3.7
Long-eared Owl	3	4	3	4	3.7
Louisiana Waterthrush	4	3	4	3	3.7
Nelson's Sharp-tailed Sparrow	3	3	5	2	3.7
Red Knot	3	3	5	4	3.7
Ruddy Duck	5	3	3	2	3.7
Ruddy Turnstone	3	3	5	3	3.7
Short-eared Owl	5	3	3	2	3.7
Smith's Longspur	3	3	5	3	3.7
Snow Goose	3	3	5	4	3.7
Surf Scoter	5	3	3	2	3.7

Species Name	Abundance Score	Trend Score	Range Score	Productivity Score	Ontario PR Score
White-winged Scoter	5	3	3	1	3.7
Wilson's Phalarope	4	4	3	3	3.7
Great Gray Owl	3.5	3	3	4	3.5
Northern Hawk Owl	3.5	4	3	2	3.5
Yellow-breasted Chat	4.5	3	3	2	3.5
American Golden-Plover	4	3	3	3	3.3
American White Pelican	4	1	5	5	3.3
Bald Eagle	4	1	3	5	3.3
Barn Owl	5	3	1	2	3.3
Black Scoter	3	3	4	1	3.3
Black-backed Woodpecker	3	3	3	4	3.3
Black-billed Cuckoo	3	3	3	4	3.3
Bohemian Waxwing	4	3	3	3	3.3
Bonaparte's Gull	3	3	3	4	3.3
Boreal Owl	3	3	3	4	3.3
Bufflehead	4	3	3	1	3.3
Carolina Wren	4	2	4	2	3.3
Caspian Tern	4	1	5	5	3.3
Clay-colored Sparrow	3	3	4	3	3.3
Common Nighthawk	3	3	1	4	3.3
Connecticut Warbler	3	3	4	3	3.3
Eastern Towhee	3	3	4	2	3.3
Forster's Tern	4	1	5	4	3.3
Fox Sparrow	3	3	3	4	3.3
Hooded Warbler	4	1	5	2	3.3
Le Conte's Sparrow	3	3	4	3	3.3
Least Bittern	4	3	3	2	3.3
Least Flycatcher	1	5	4	3	3.3
Northern Goshawk	3	3	2	4	3.3
Northern Shrike	4	3	3	3	3.3
Oldsquaw	4	3	3	2	3.3
Olive-sided Flycatcher	1	5	4	4	3.3
Red-necked Grebe	4	3	3	3	3.3
Red-necked Phalarope	4	3	3	3	3.3
Redhead	5	1	4	1	3.3
Sanderling	2	3	5	3	3.3
Scarlet Tanager	1	5	4	3	3.3
Semipalmated Sandpiper	3	3	4	3	3.3
Sharp-shinned Hawk	3	3	1	4	3.3
Tufted Titmouse	5	2	3	3	3.3
White-crowned Sparrow	3	4	3	2	3.3
Wood Thrush	1	5	4	3	3.3
Yellow-billed Cuckoo	3	3	3	4	3.3
Yellow-headed Blackbird	4	3	3	3	3.3
American Coot	3.5	3	3	1	3.2
Gray-cheeked Thrush	3.5	3	3	3	3.2
Northern Mockingbird	3.5	4	2	2	3.2
Northern Shoveler	3.5	3	3	1	3.2
Red-bellied Woodpecker	3.5	2	4	3	3.2
American Bittern	3	3	3	3	3.0
American Black Duck	3	3	3	1	3.0
American Tree Sparrow	1	5	3	3	3.0
American Wigeon	3	3	3	1	3.0
Bay-breasted Warbler	1	3	5	3	3.0
Black-throated Blue Warbler	1	3	5	2	3.0
Blackpoll Warbler	3	3	3	2	3.0
Bobolink	3	3	3	3	3.0
Brewer's Blackbird	3	3	3	2	3.0
Brown Thrasher	1	5	3	2	3.0
Brown-headed Cowbird	1	5	3	1	3.0
Chestnut-sided Warbler	1	3	5	3	3.0

<b>Species Name</b>	<b>Abundance Score</b>	<b>Trend Score</b>	<b>Range Score</b>	<b>Productivity Score</b>	<b>Ontario PR Score</b>
Chimney Swift	1	5	3	3	3.0
Common Grackle	1	5	3	2	3.0
Common Loon	1	3	5	5	3.0
Common Redpoll	3	3	3	3	3.0
Double-crested Cormorant	3	1	4	5	3.0
Eastern Meadowlark	1	5	3	2	3.0
Golden-winged Warbler	3	1	5	3	3.0
Grasshopper Sparrow	3	3	3	3	3.0
Gray Catbird	1	5	3	2	3.0
Greater Yellowlegs	3	3	3	3	3.0
Green Heron	3	3	3	2	3.0
Green-winged Teal	3	3	3	1	3.0
Herring Gull	1	3	3	5	3.0
Horned Lark	3	3	3	3	3.0
Killdeer	1	5	3	2	3.0
Lapland Longspur	3	3	3	3	3.0
Least Sandpiper	3	3	3	3	3.0
Lesser Scaup	3	3	3	1	3.0
Magnolia Warbler	1	3	5	3	3.0
Mourning Warbler	1	4	4	4	3.0
Northern Parula	3	1	5	3	3.0
Northern Pintail	1	5	3	1	3.0
Northern Saw-whet Owl	2	3	3	4	3.0
Orange-crowned Warbler	3	3	3	3	3.0
Philadelphia Vireo	1	3	5	3	3.0
Pine Grosbeak	3	3	3	3	3.0
Red-shouldered Hawk	3	2	4	4	3.0
Ring-necked Duck	3	3	3	1	3.0
Rusty Blackbird	1	5	3	3	3.0
Semipalmated Plover	3	3	3	3	3.0
Sharp-tailed Grouse	3	3	3	1	3.0
Solitary Sandpiper	3	3	3	3	3.0
Sora	3	3	3	1	3.0
Three-toed Woodpecker	3	3	3	3	3.0
Upland Sandpiper	3	3	3	3	3.0
Veery	1	5	3	2	3.0
Vesper Sparrow	1	5	3	3	3.0
Virginia Rail	3	3	3	1	3.0
Western Meadowlark	3	3	3	2	3.0
Willow Flycatcher	1	3	5	4	3.0
Willow Ptarmigan	3	3	3	2	3.0
Yellow-bellied Flycatcher	1	3	5	4	3.0
Yellow-throated Vireo	3	3	3	3	3.0
Alder Flycatcher	1	3	3	4	2.7
American Goldfinch	1	4	3	2	2.7
American Kestrel	1	3	1	4	2.7
American Woodcock	1	3	4	3	2.7
Baltimore Oriole	1	4	3	3	2.7
Barred Owl	3	1	3	4	2.7
Belted Kingfisher	1	5	2	2	2.7
Black-throated Green Warbler	1	3	4	3	2.7
Blackburnian Warbler	1	3	4	3	2.7
Blue-gray Gnatcatcher	3	2	3	2	2.7
Broad-winged Hawk	1	3	3	4	2.7
Common Snipe	1	4	1	3	2.7
Common Yellowthroat	1	4	3	2	2.7
Cooper's Hawk	3	1	3	4	2.7
Dark-eyed Junco	1	5	2	2	2.7
Eastern Bluebird	2	3	3	2	2.7
Eastern Kingbird	1	3	3	4	2.7
Eastern Screech-Owl	1	3	3	4	2.7

Species Name	Abundance Score	Trend Score	Range Score	Productivity Score	Ontario PR Score
Eastern Wood-Pewee	1	3	3	4	2.7
Gray Jay	1	3	3	4	2.7
Great Crested Flycatcher	1	3	4	3	2.7
Great Horned Owl	1	3	1	4	2.7
Indigo Bunting	1	3	4	2	2.7
Marsh Wren	2	3	3	2	2.7
Merlin	3	1	3	4	2.7
Nashville Warbler	1	3	4	3	2.7
Northern Harrier	3	1	1	4	2.7
Osprey	3	1	3	4	2.7
Pied-billed Grebe	3	3	1	2	2.7
Pine Warbler	1	3	4	2	2.7
Purple Martin	2	3	3	3	2.7
Red-tailed Hawk	1	3	3	4	2.7
Red-winged Blackbird	1	3	3	4	2.7
Rose-breasted Grosbeak	1	4	3	2	2.7
Ruby-crowned Kinglet	1	4	3	2	2.7
Ruby-throated Hummingbird	1	3	4	3	2.7
Sandhill Crane	3	1	4	4	2.7
Savannah Sparrow	1	4	3	2	2.7
Sedge Wren	3	1	4	2	2.7
Song Sparrow	1	4	3	3	2.7
Swainson's Thrush	1	3	3	4	2.7
Tree Swallow	1	3	4	3	2.7
Turkey Vulture	3	1	1	4	2.7
White-throated Sparrow	1	4	3	2	2.7
Wild Turkey	3.5	1	3	1	2.5
American Crow	1	3	3	3	2.3
American Redstart	1	3	3	3	2.3
Bank Swallow	1	3	3	3	2.3
Barn Swallow	1	4	2	2	2.3
Black-capped Chickadee	1	3	3	2	2.3
Blue Jay	1	3	3	3	2.3
Boreal Chickadee	1	3	3	2	2.3
Brown Creeper	1	3	3	3	2.3
Canada Goose	1	3	3	3	2.3
Canada Warbler	1	3	3	3	2.3
Cape May Warbler	1	1	5	2	2.3
Chipping Sparrow	1	3	3	2	2.3
Cliff Swallow	1	3	3	3	2.3
Common Goldeneye	1	3	3	1	2.3
Common Merganser	1	3	3	1	2.3
Common Moorhen	3	3	1	1	2.3
Eastern Phoebe	1	3	3	2	2.3
Evening Grosbeak	1	3	3	3	2.3
Field Sparrow	1	3	3	2	2.3
Gadwall	3	1	3	1	2.3
Golden-crowned Kinglet	1	3	3	1	2.3
Hermit Thrush	1	3	3	2	2.3
Hooded Merganser	3	1	3	1	2.3
Lincoln's Sparrow	1	3	3	3	2.3
Mallard	1	3	3	1	2.3
Northern Flicker	1	4	2	2	2.3
Northern Rough-winged Swallow	1	3	3	2	2.3
Northern Waterthrush	1	3	3	3	2.3
Palm Warbler	1	1	5	2	2.3
Pine Siskin	1	3	3	3	2.3
Purple Finch	1	3	3	2	2.3
Red-breasted Merganser	1	3	3	1	2.3
Red-breasted Nuthatch	1	3	3	3	2.3
Ruffed Grouse	1	3	3	1	2.3

<b>Species Name</b>	<b>Abundance Score</b>	<b>Trend Score</b>	<b>Range Score</b>	<b>Productivity Score</b>	<b>Ontario PR Score</b>
Solitary Vireo	1	3	3	3	2.3
Spotted Sandpiper	1	3	1	3	2.3
Swamp Sparrow	1	3	3	2	2.3
Tennessee Warbler	1	3	3	3	2.3
Whip-poor-will	1	3	3	3	2.3
White-breasted Nuthatch	1	3	3	2	2.3
White-winged Crossbill	1	3	3	3	2.3
Wilson's Warbler	1	3	3	3	2.3
Yellow Warbler	1	3	2	3	2.3
Yellow-bellied Sapsucker	1	3	3	3	2.3
Yellow-rumped Warbler	1	3	3	2	2.3
American Robin	1	2	3	2	2.0
Black-and-white Warbler	1	2	3	3	2.0
Blue-winged Teal	1	3	2	1	2.0
Cedar Waxwing	1	2	3	2	2.0
House Wren	1	3	2	1	2.0
Ovenbird	1	2	3	3	2.0
Pileated Woodpecker	2	1	3	3	2.0
Red Crossbill	1	1	3	4	2.0
Red-eyed Vireo	1	2	3	3	2.0
Ring-billed Gull	1	1	3	4	2.0
Warbling Vireo	1	1	4	3	2.0
Common Raven	1	1	1	3	1.7
Downy Woodpecker	1	1	2	3	1.7
Great Blue Heron	1	1	3	3	1.7
Hairy Woodpecker	1	1	2	3	1.7
Northern Cardinal	1	1	3	2	1.7
Spruce Grouse	1	1	3	2	1.7
Winter Wren	1	1	3	3	1.7
Wood Duck	1	1	3	1	1.7
Mourning Dove	1	1	2	2	1.3

### ***Appendix D. Area Sensitivity Scores***

The Area Sensitivity component is based on the concept that some species require larger amounts of habitat than others in order to consistently breed within a given region. An example of an area-sensitive species is the Black-and-white Warbler (Figure A4), which tends to breed in areas containing high percentages of forest cover. Other species aren't particularly sensitive to habitat amount, and will breed almost everywhere in southern Ontario, regardless of percent forest cover. An example of such a species is the American Robin (Figure A4).

We used breeding distributions from the Ontario Breeding Bird Atlas (Cadman et al., 1987) and habitat distribution information from OMNR's provincial land cover (PLC) imagery to determine associations between the breeding presence/absence of a species and the amount of breeding habitat available in 10 x 10 km Atlas squares. First, we assigned a broad, breeding habitat identifier to each bird species: forest, grassland/open country, and marsh. Land cover values from the PLC were aggregated to match these broad categories, and estimates of each habitat type were calculated for each Atlas square within the Mixedwood Plains ecozone (squares falling within Manitoulin Island were excluded from the analysis). Each species was also assigned a region identifier so that only Atlas squares within the species' habitual breeding range were used in the analysis for that species. For species identified as "south" (e.g., Acadian Flycatcher), only Atlas squares within the Carolinian zone of southern Ontario were used in the analysis. For species identified as "north", only Atlas squares within the non-Carolinian zone were used (e.g., Blackburnian Warbler). For species identified as "both", all squares were used.

In addition to these conditions, additional criteria were used to filter Atlas squares for the analysis: 1) Atlas squares with less than 20 hours of survey effort were excluded from the analysis; and 2) for forest and grassland birds, squares with more than 10% non-terrestrial habitat were excluded from the analysis; for marsh birds, squares with more than 75% non-terrestrial habitat were excluded. We then used logistic regression with these sub-sets of squares to model the relationship of breeding presence/absence and habitat cover. Two techniques were used to score each species for Area Sensitivity:

- a) Differences in the modelled probability of presence at 20% habitat cover and 80% habitat cover were determined for each species. Essentially, these figures indicate the probability of a bird to be found breeding within an Atlas square when there is 20% habitat cover and when there is 80% habitat cover. The larger the difference, the more area-sensitive the species. The top 20% of differences received a score of 5, the next 20% a score of 4, the middle 20% a score of 3, and so on.
- b) The lowest percentile group in which a species occurred most frequently was calculated for each species. The concept is that, if a species reaches its maximum presence at low percentages of habitat cover, then it is not area-sensitive. If, however, its presence builds gradually as habitat cover increases, and reaches its maximum at higher percentages of habitat cover, then the species can be deemed area-sensitive. A scoring scheme similar to

that of a) was used: the top 20% of values received a score of 5, the next 20% a score of 4, the middle 20% a score of 3, and so on.

The final Area Sensitivity score represents the greater score of the two techniques (Table A11). If a species occurred in less than 10 Atlas squares, it was deemed to have insufficient data for the purposes of the analysis and was assigned the median score (3) for both methods. Species scoring 4 or higher were deemed “area-sensitive”. Whenever these species were found to be breeding within a municipality they were included on the municipal priority list regardless of their JR or PR score.

**Table A11.** Area Sensitivity scores for southern Ontario breeding birds. Species scoring 4 or greater (shaded in gray) are included on municipal priority lists where appropriate. Shorebirds are not area-sensitive and were thus excluded from the analysis and were assigned an area sensitivity score of 1 (except Piping Plover, which was scored a 3 because it occurred in less than 10 Atlas squares).

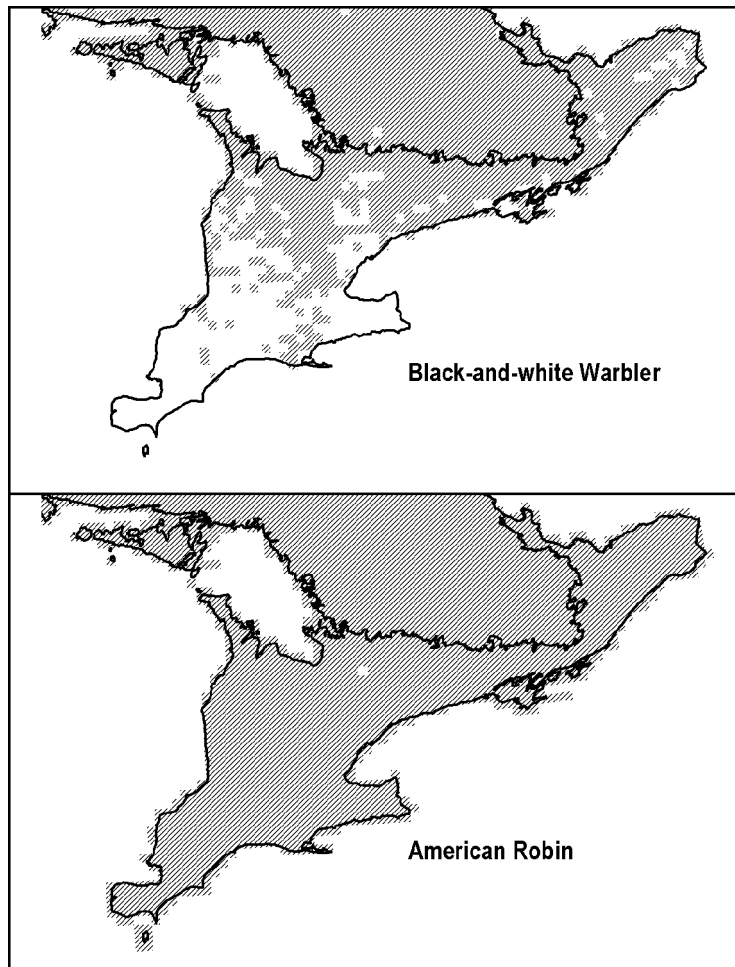
Forest Birds				Open Country Birds			
Species Name	Method 1	Method 2	Final AS	Species Name	Method 1	Method 2	Final AS
American Redstart	4	5	5	American Kestrel	5	4	5
Barred Owl	4	5	5	Bank Swallow	5	4	5
Black-and-white Warbler	5	5	5	Brown Thrasher	5	4	5
Blackburnian Warbler	5	5	5	Clay-colored Sparrow	5	5	5
Brown Creeper	5	5	5	Common Nighthawk	5	4	5
Black-throated Green Warbler	5	5	5	Eastern Bluebird	1	5	5
Broad-winged Hawk	5	5	5	Eastern Kingbird	1	5	5
Blue-winged Warbler	5	5	5	Northern Mockingbird	3	5	5
Canada Warbler	5	5	5	Northern Rough-winged Swallow	4	5	5
Chestnut-sided Warbler	5	5	5	Savannah Sparrow	5	4	5
Evening Grosbeak	4	5	5	Spotted Sandpiper	5	4	5
Golden-crowned Kinglet	5	5	5	Upland Sandpiper	2	5	5
Golden-winged Warbler	4	5	5	Western Meadowlark	3	5	5
Hermit Thrush	5	5	5	American Goldfinch	3	4	4
Hooded Warbler	5	3	5	Barn Swallow	4	4	4
Long-eared Owl	3	5	5	Brown-headed Cowbird	4	4	4
Louisiana Waterthrush	5	5	5	Bobolink	2	4	4
Magnolia Warbler	5	5	5	Cliff Swallow	3	4	4
Nashville Warbler	5	5	5	Eastern Kingbird	4	4	4
Northern Waterthrush	5	4	5	Eastern Meadowlark	4	4	4
Northern Saw-whet Owl	5	5	5	Field Sparrow	2	4	4
Olive-sided Flycatcher	5	4	5	Grasshopper Sparrow	4	4	4
Pileated Woodpecker	5	4	5	Horned Lark	3	4	4
Purple Finch	5	5	5	Loggerhead Shrike	1	4	4
Red-breasted Nuthatch	5	5	5	Northern Bobwhite	2	4	4
Red-shouldered Hawk	4	5	5	Vesper Sparrow	2	4	4
Solitary Vireo	3	5	5	Brewer’s Blackbird	3	3	3
Winter Wren	5	5	5	Barn Owl	3	3	3
Whip-poor-will	5	5	5	Dickcissel	3	3	3
White-throated Sparrow	5	2	5	Le Conte’s Sparrow	3	3	3
Yellow-bellied Sapsucker	5	4	5	Sharp-tailed Grouse	3	3	3
Yellow-rumped Warbler	5	5	5	Killdeer	1	1	1
Acadian Flycatcher	3	4	4				
Alder Flycatcher	4	4	4				
Black-billed Cuckoo	3	4	4				
Black-throated Blue Warbler	4	4	4				
Cooper’s Hawk	3	4	4				
Common Raven	3	4	4				

Marsh Birds			
Species Name	Method 1	Method 2	Final AS
American Bittern	5	5	5
American Coot	3	5	5

Dark-eyed Junco	4	2	4	American Wigeon	3	5	5
Eastern Phoebe	4	4	4	Black-crowned Night-Heron	3	5	5
Hooded Merganser	4	4	4	Black Tern	5	5	5
Mourning Warbler	4	4	4	Blue-winged Teal	5	5	5
Northern Goshawk	4	2	4	Common Loon	5	5	5
Ovenbird	4	3	4	Common Snipe	5	2	5
Pine Warbler	4	4	4	Gadwall	3	5	5
Red-bellied Woodpecker	4	2	4	King Rail	2	5	5
Ruby-crowned Kinglet	4	4	4	Least Bittern	4	5	5
Red Crossbill	3	4	4	Lesser Scaup	3	5	5
Eastern Towhee	2	4	4	Marsh Wren	5	5	5
Ruby-throated Hummingbird	3	4	4	Osprey	5	3	5
Ruffed Grouse	4	3	4	Pied-billed Grebe	4	5	5
Scarlet Tanager	4	4	4	Purple Martin	4	5	5
Sharp-shinned Hawk	4	4	4	Sedge Wren	3	5	5
Swainson's Thrush	3	4	4	Sora	4	5	5
Turkey Vulture	3	4	4	Swamp Sparrow	5	2	5
Veery	4	3	4	Virginia Rail	5	5	5
Wood Duck	4	3	4	American Black Duck	4	3	4
Yellow-bellied Flycatcher	4	3	4	Common Moorhen	4	3	4
American Woodcock	3	3	3	Northern Pintail	4	2	4
Bald Eagle	3	3	3	Ring-necked Duck	4	2	4
Bay-breasted Warbler	3	3	3	Green-winged Teal	3	3	3
Black-backed Woodpecker	3	3	3	Canvasback	3	3	3
Black-capped Chickadee	3	2	3	Green Heron	2	3	3
Blue-gray Gnatcatcher	1	3	3	Great Blue Heron	2	3	3
Carolina Wren	3	3	3	Horned Grebe	3	3	3
Cerulean Warbler	3	3	3	Northern Harrier	3	3	3
Cape May Warbler	3	3	3	Piping Plover	.	.	3
Common Goldeneye	3	3	3	Red-necked Grebe	3	3	3
Common Merganser	3	1	3	Rusty Blackbird	3	3	3
Connecticut Warbler	3	3	3	Sandhill Crane	3	3	3
Chuck-will's-widow	3	3	3	Short-eared Owl	1	3	3
Tufted Titmouse	3	3	3	Yellow Rail	3	3	3
Gray Jay	3	3	3	Yellow-headed Blackbird	3	3	3
Hairy Woodpecker	3	3	3	Belted Kingfisher	2	1	2
Least Flycatcher	3	3	3	Common Yellowthroat	2	1	2
Merlin	3	3	3	Wilson's Phalarope	2	2	2
Northern Parula	2	3	3	Canada Goose	1	1	1
Philadelphia Vireo	3	3	3	Caspian Tern	.	.	1
Pine Siskin	3	2	3	Common Grackle	1	1	1
Prairie Warbler	3	3	3	Common Tern	.	.	1
Prothonotary Warbler	3	3	3	Double-crested Cormorant	.	.	1
Red-breasted Merganser	3	3	3	Herring Gull	.	.	1
Red-eyed Vireo	3	2	3	Mallard	1	1	1
Solitary Sandpiper	3	3	3	Ring-billed Gull	.	.	1
Spruce Grouse	3	3	3	Red-winged Blackbird	1	1	1
Tennessee Warbler	3	3	3				
Three-toed Woodpecker	3	3	3				
White-breasted Nuthatch	3	3	3				
White-eyed Vireo	3	3	3				
Wild Turkey	3	3	3				
Wilson's Warbler	3	3	3				
White-winged Crossbill	3	3	3				
Yellow-breasted Chat	2	3	3				
Yellow-billed Cuckoo	1	3	3				
Palm Warbler	3	3	3				
Yellow-throated Vireo	1	3	3				
American Crow	2	2	2				
American Robin	1	2	2				
Blue Jay	1	2	2				
Cedar Waxwing	2	2	2				
Chipping Sparrow	2	2	2				

Chimney Swift	1	2	2
Downy Woodpecker	1	2	2
Eastern Screech-Owl	1	2	2
Eastern Wood-Pewee	2	2	2
Great Crested Flycatcher	2	2	2
Great Horned Owl	1	2	2
Gray Catbird	2	2	2
House Wren	2	2	2
Indigo Bunting	1	2	2
Lincoln's Sparrow	2	2	2
Mourning Dove	2	2	2
Northern Cardinal	1	2	2
Northern Flicker	2	2	2
Baltimore Oriole	2	2	2
Orchard Oriole	1	2	2
Rose-breasted Grosbeak	2	2	2
Red-headed Woodpecker	1	2	2
Red-tailed Hawk	1	2	2
Song Sparrow	1	2	2
Tree Swallow	2	2	2
Warbling Vireo	1	2	2
Willow Flycatcher	1	2	2
Wood Thrush	2	2	2
Yellow Warbler	2	2	2



**Figure A4.** Area Sensitivity examples. Hatching indicates breeding presence.

### ***Appendix E. Supplemental Niagara Escarpment Information***

This Appendix is for use by upper tier municipalities bordering on the Niagara Escarpment Plan Area: Bruce, Grey, Simcoe, Dufferin, Peel, Halton, Hamilton-Wentworth, and Niagara. In addition to a list tailored specifically to each individual municipality supplied earlier in this document, this appendix provides a list of priority species pertaining to the Niagara Escarpment Plan Area as a whole (Table A12). Because of its high ecological value, the Niagara Escarpment has been recognized by the United Nations as a World Biosphere Reserve. By identifying species that are a priority for the Escarpment unit, it is hoped that municipalities will work together to ensure the welfare of these species, while at the same time, paying special attention to the species that may be especially high priority within their own municipal boundaries.

The list of priority species for a given municipality will be slightly different than that for the entire Escarpment region. Generally, they will be quite similar, with species switching from “very high priority” on the Escarpment list to “high priority” on the municipal list, and vice versa. However, potentially very different mixes of species could appear on a southern municipality’s list (e.g., Regional Municipality of Niagara) than on a northern municipality’s list (e.g., Bruce County). This is not surprising, since ecological conditions vary substantially from the southern portion of the Escarpment to the northern, thus supporting different types of bird communities.

As discussed earlier, all planning authorities in the province must “have regard to” the guidelines and principles set forth in the Provincial Policy Statement (Government of Ontario, 1996) regarding the conservation of natural heritage features and values. In addition to these broad policy directives, the Niagara Escarpment Commission (NEC), by authority of the *Niagara Escarpment Planning and Development Act*, has developed its own set of rules with respect to development within Escarpment lands via “The Niagara Escarpment Plan” (NEC, 1994). In essence, the Plan’s purpose is to “provide for the maintenance of the Niagara Escarpment and land in its vicinity substantially as a continuous natural environment, and to ensure only such development occurs as is compatible with that natural environment (NEC, 1994:4).” The list of priority species will provide planners with a tool for coordinating conservation efforts for the diversity of habitats found within the Niagara Escarpment region.

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Government of Ontario. 1990. Niagara Escarpment Planning and Development Act. Revised Statutes of Ontario, 1990, Chapter N.2. Queen’s Printer for Ontario, Toronto.

Niagara Escarpment Commission. 1994. The Niagara Escarpment Plan. Office Consolidation, December 12, 1997. Niagara Escarpment Commission, Georgetown.

**Table A12.** Priority species for the Niagara Escarpment Plan Area. Please note that forest birds, marsh birds, and open country birds are listed separately and that the list is sorted alphabetically within each priority category (level one through level four): thus, there is no difference in importance among species within a given category. It should be noted that all species on the list are deemed priority species and that the designation of level one, level two, level three and level four is a relative ranking within the overall group. Non-VTE species that rely on human structures such as buildings, bridges, etc., should be deemed a priority only when found nesting in natural habitats. These species include: Barn Swallow, Chimney Swift, Cliff Swallow, Common Nighthawk, Eastern Bluebird, Eastern Phoebe and Purple Martin. Symbols: (++) denotes “endangered” or “threatened” status at the provincial or federal level; (\*) denotes “vulnerable” status at the provincial or federal level. Please refer to Table 2 to determine precise designations. At a minimum, **municipalities must protect the habitat of endangered and threatened species.** Contact OMNR staff for additional advice. Nesting habitat information for all species breeding within southern Ontario is provided in Appendix F. Appendix G provides the rationale for the inclusion of each species on the list.

<b>FOREST</b>	<b>MARSH</b>	<b>OPEN COUNTRY</b>
<b>LEVEL ONE</b>	<b>LEVEL ONE</b>	<b>LEVEL ONE</b>
<b>Species Name</b>	<b>Species Name</b>	<b>Species Name</b>
Acadian Flycatcher++ Bald Eagle++ Black-throated Green Warbler Blue-winged Warbler Cerulean Warbler* Chestnut-sided Warbler Golden-winged Warbler Hooded Warbler++ Long-eared Owl Louisiana Waterthrush* Magnolia Warbler Nashville Warbler Northern Saw-whet Owl Prothonotary Warbler++ Red-headed Woodpecker* Red-shouldered Hawk* White-throated Sparrow Yellow-bellied Sapsucker Yellow-breasted Chat*	American Bittern American Coot Black Tern* Black-crowned Night-Heron King Rail++ Least Bittern* Pied-billed Grebe Piping Plover++ Sedge Wren Short-eared Owl* Sora Virginia Rail	Barn Owl++ Brown Thrasher Clay-colored Sparrow Dickcissel Eastern Bluebird Henslow’s Sparrow++ Loggerhead Shrike++ Northern Bobwhite++ Northern Mockingbird
<b>LEVEL TWO</b>	<b>LEVEL TWO</b>	<b>LEVEL TWO</b>
<b>Species Name</b>	<b>Species Name</b>	<b>Species Name</b>
American Redstart Barred Owl Black-billed Cuckoo Black-throated Blue Warbler Blackburnian Warbler Broad-winged Hawk Brown Creeper Canada Warbler Eastern Towhee Golden-crowned Kinglet Mourning Warbler Northern Goshawk Northern Waterthrush Olive-sided Flycatcher Pileated Woodpecker	American Black Duck Blue-winged Teal Common Loon Common Snipe Marsh Wren Purple Martin Swamp Sparrow	American Kestrel Bank Swallow Bobolink Common Nighthawk Eastern Meadowlark Northern Rough-winged Swallow Savannah Sparrow Upland Sandpiper Western Meadowlark

Purple Finch Ruby-throated Hummingbird Scarlet Tanager Sharp-shinned Hawk Veery Whip-poor-will Yellow-bellied Flycatcher		
<b>LEVEL THREE</b>	<b>LEVEL THREE</b>	<b>LEVEL THREE</b>
<b>Species Name</b>	<b>Species Name</b>	<b>Species Name</b>
Alder Flycatcher Black-and-white Warbler Cooper's Hawk Dark-eyed Junco Eastern Phoebe Evening Grosbeak Hermit Thrush Least Flycatcher Philadelphia Vireo Pine Warbler Red-bellied Woodpecker Red-breasted Nuthatch Ruffed Grouse Solitary Vireo Swainson's Thrush Tufted Titmouse Turkey Vulture White-eyed Vireo Winter Wren Yellow-billed Cuckoo Yellow-rumped Warbler	American Wigeon Gadwall Lesser Scaup Osprey Ring-necked Duck	American Goldfinch Barn Swallow Cliff Swallow Eastern Kingbird Field Sparrow Grasshopper Sparrow Horned Lark Spotted Sandpiper Vesper Sparrow
<b>LEVEL FOUR</b>	<b>LEVEL FOUR</b>	<b>LEVEL FOUR</b>
<b>Species Name</b>	<b>Species Name</b>	<b>Species Name</b>
American Woodcock Black-capped Chickadee Common Raven Gray Catbird Hooded Merganser Orchard Oriole Ovenbird Red Crossbill Ruby-crowned Kinglet Tennessee Warbler Wild Turkey Wood Duck Yellow-throated Vireo	Common Moorhen Common Tern Green Heron Northern Pintail Rusty Blackbird Sandhill Crane	

## Appendix F. Nesting Habitat Information

**Table A13.** Nesting habitat information for southern Ontario breeding birds. Nesting habitat data is generously provided by WILDSPACE, Canadian Wildlife Service, modified slightly to suit the southern Ontario situation. For more life history information, users are advised to investigate the WILDSPACE web page at [www.cciw.ca/green-lane/wildlife/wildspace/intro-e.html](http://www.cciw.ca/green-lane/wildlife/wildspace/intro-e.html). The information provided here is general in nature and relates to the broad scale habitat needs of the species.

### Forest Birds

Species Name	Primary Nesting Habitat	Secondary Nesting Habitat
Acadian Flycatcher	Deciduous woodlands	Treed swamp
Alder Flycatcher	Treed/shrubby swamp	Early successional
American Crow	Woodlands	Agricultural
American Redstart	Deciduous woodlands	Mixed woodlands
American Robin	Urban	Woodlands
American Woodcock	Early successional	Agricultural
Bald Eagle	Lakes/ponds/rivers	Islands
Baltimore Oriole	Deciduous woodlands	Open woodlands
Barred Owl	Mixed woodlands	Deciduous woodlands
Bay-breasted Warbler	Coniferous woodlands	Mixed woodlands
Black-and-white Warbler	Mixed woodlands	Deciduous woodlands
Black-backed Woodpecker	Coniferous woodlands	Mixed woodlands
Black-billed Cuckoo	Early successional	Open woodlands
Blackburnian Warbler	Coniferous woodlands	Mixed woodlands
Black-capped Chickadee	Mixed woodlands	Deciduous woodlands
Black-throated Blue Warbler	Mixed woodlands	Deciduous woodlands
Black-throated Green Warbler	Coniferous woodlands	Mixed woodlands
Blue Jay	Woodlands	Mixed woodlands
Blue-gray Gnatcatcher	Deciduous woodlands	Mixed woodlands
Blue-winged Warbler	Early successional	Woodlands
Broad-winged Hawk	Mixed woodlands	Deciduous woodlands
Brown Creeper	Mixed woodlands	Deciduous woodlands
Canada Warbler	Deciduous woodlands	Mixed woodlands
Cape May Warbler	Coniferous woodlands	Mixed woodlands
Carolina Wren	Open woodlands	Deciduous woodlands
Cedar Waxwing	Open woodlands	Early successional
Cerulean Warbler	Deciduous woodlands	Treed swamp
Chestnut-sided Warbler	Early successional	Deciduous woodlands
Chimney Swift	Urban	Agricultural
Chipping Sparrow	Coniferous woodlands	Urban
Chuck-will's-widow	Mixed woodlands	Deciduous woodlands
Common Goldeneye	Lakes/ponds/rivers	Woodlands
Common Merganser	Lakes/ponds/rivers	Streams
Common Raven	Woodlands	Cliffs
Connecticut Warbler	Bogs	Coniferous woodlands
Cooper's Hawk	Deciduous woodlands	Mixed woodlands
Dark-eyed Junco	Coniferous woodlands	Mixed woodlands
Downy Woodpecker	Deciduous woodlands	Mixed woodlands
Eastern Phoebe	Woodlands	Riparian woodlands
Eastern Screech-Owl	Woodlands	Treed swamp
Eastern Towhee	Open woodlands	Mixed woodlands
Eastern Wood-Pewee	Deciduous woodlands	Mixed woodlands
Evening Grosbeak	Mixed woodlands	Coniferous woodlands
Golden-crowned Kinglet	Coniferous woodlands	Mixed woodlands
Golden-winged Warbler	Early successional	Woodlands
Gray Catbird	Early successional	Open woodlands
Gray Jay	Coniferous woodlands	Mixed woodlands
Great Crested Flycatcher	Deciduous woodlands	Mixed woodlands
Great Horned Owl	Deciduous woodlands	Mixed woodlands
Hairy Woodpecker	Mixed woodlands	Deciduous woodlands
Hermit Thrush	Coniferous woodlands	Mixed woodlands

Hooded Merganser	Lakes/ponds/rivers	Treed/shrubby swamp
Hooded Warbler	Deciduous woodlands	Mixed woodlands
House Wren	Early successional	Open woodlands
Indigo Bunting	Open woodlands	Early successional
Least Flycatcher	Deciduous woodlands	Mixed woodlands
Lincoln's Sparrow	Bogs	Early successional
Long-eared Owl	Coniferous woodlands	Mixed woodlands
Louisiana Waterthrush	Riparian woodlands	Treed swamp
Magnolia Warbler	Mixed woodlands	Coniferous woodlands
Merlin	Coniferous woodlands	Mixed woodlands
Mourning Warbler	Open woodlands	Woodlands
Nashville Warbler	Mixed woodlands	Coniferous woodlands
Northern Cardinal	Woodlands	Early successional
Northern Flicker	Mixed woodlands	Deciduous woodlands
Northern Goshawk	Coniferous woodlands	Mixed woodlands
Northern Parula	Mixed woodlands	Coniferous woodlands
Northern Saw-whet Owl	Deciduous woodlands	Mixed woodlands
Northern Waterthrush	Treed/shrubby swamp	Riparian woodlands
Olive-sided Flycatcher	Bogs	Burned/logged areas
Orchard Oriole	Open woodlands	Early successional
Ovenbird	Deciduous woodlands	Mixed woodlands
Palm Warbler	Bogs	Early successional
Philadelphia Vireo	Deciduous woodlands	Mixed woodlands
Pileated Woodpecker	Mixed woodlands	Deciduous woodlands
Pine Siskin	Coniferous woodlands	Mixed woodlands
Pine Warbler	Coniferous woodlands	Mixed woodlands
Prairie Warbler	Early successional	Coniferous woodlands
Prothonotary Warbler	Treed swamp	Riparian woodlands
Purple Finch	Coniferous woodlands	Mixed woodlands
Red Crossbill	Coniferous woodlands	Mixed woodlands
Red-bellied Woodpecker	Deciduous woodlands	Woodlands
Red-breasted Merganser	Islands	Lakes/ponds/rivers
Red-breasted Nuthatch	Coniferous woodlands	Mixed woodlands
Red-eyed Vireo	Deciduous woodlands	Mixed woodlands
Red-headed Woodpecker	Woodlands	Deciduous woodlands
Red-shouldered Hawk	Deciduous woodlands	Mixed woodlands
Rose-breasted Grosbeak	Deciduous woodlands	Mixed woodlands
Ruby-crowned Kinglet	Coniferous woodlands	Bogs
Ruby-throated Hummingbird	Woodlands	Agricultural
Ruffed Grouse	Mixed woodlands	Deciduous woodlands
Scarlet Tanager	Deciduous woodlands	Mixed woodlands
Sharp-shinned Hawk	Coniferous woodlands	Mixed woodlands
Solitary Sandpiper	Bogs	Lakes/ponds/rivers
Solitary Vireo	Mixed woodlands	Coniferous woodlands
Song Sparrow	Early successional	Open woodlands
Spruce Grouse	Bogs	Coniferous woodlands
Swainson's Thrush	Mixed woodlands	Coniferous woodlands
Tennessee Warbler	Bogs	Coniferous woodlands
Three-toed Woodpecker	Coniferous woodlands	Bogs
Tree Swallow	Treed/shrubby swamp	Marsh
Tufted Titmouse	Deciduous woodlands	Mixed woodlands
Turkey Vulture	Cliffs	Woodlands
Veery	Mixed woodlands	Deciduous woodlands
Warbling Vireo	Open woodlands	Deciduous woodlands
Whip-poor-will	Woodlands	Mixed woodlands
White-breasted Nuthatch	Deciduous woodlands	Mixed woodlands
White-eyed Vireo	Early successional	Open woodlands
White-throated Sparrow	Early successional	Coniferous woodlands
White-winged Crossbill	Coniferous woodlands	Mixed woodlands
Wild Turkey	Deciduous woodlands	Woodlands
Willow Flycatcher	Shrubby swamp	Early successional
Wilson's Warbler	Treed/shrubby swamp	Bogs
Winter Wren	Coniferous woodlands	Mixed woodlands

Wood Duck	Marsh	Lakes/ponds/rivers
Wood Thrush	Deciduous woodlands	Mixed woodlands
Yellow Warbler	Early successional	Lakes/ponds/rivers
Yellow-bellied Flycatcher	Bogs	Coniferous woodlands
Yellow-bellied Sapsucker	Mixed woodlands	Deciduous woodlands
Yellow-billed Cuckoo	Early successional	Woodlands
Yellow-breasted Chat	Early successional	Open woodlands
Yellow-rumped Warbler	Coniferous woodlands	Mixed woodlands
Yellow-throated Vireo	Deciduous woodlands	Mixed woodlands

### **Marsh / Water Birds**

<b>Species Name</b>	<b>Primary Nesting Habitat</b>	<b>Secondary Nesting Habitat</b>
American Bittern	Marsh	Treed/shrubby swamp
American Black Duck	Marsh	Lakes/ponds/rivers
American Coot	Marsh	Meadows
American Wigeon	Marsh	Lakes/ponds/rivers
Belted Kingfisher	Lakes/ponds/rivers	None
Black Tern	Marsh	Lakes/ponds/rivers
Black-crowned Night-Heron	Islands	Treed/shrubby swamp
Blue-winged Teal	Agricultural	Marsh
Canada Goose	Tundra	Lakes/ponds/rivers
Canvasback	Marsh	Lakes/ponds/rivers
Caspian Tern	Islands	Beaches
Common Grackle	Woodlands	Marsh
Common Loon	Lakes/ponds/rivers	None
Common Moorhen	Marsh	Meadows
Common Snipe	Marsh	Meadows
Common Tern	Islands	Beaches
Common Yellowthroat	Marsh	Bogs
Double-crested Cormorant	Islands	Cliffs
Gadwall	Lakes/ponds/rivers	Marsh
Great Blue Heron	Treed/shrubby swamp	Islands
Green Heron	Treed/shrubby swamp	Marsh
Green-winged Teal	Marsh	Lakes/ponds/rivers
Herring Gull	Islands	Lakes/ponds/rivers
Horned Grebe	Lakes/ponds/rivers	Marsh
King Rail	Marsh	Lakes/ponds/rivers
Least Bittern	Marsh	Lakes/ponds/rivers
Lesser Scaup	Lakes/ponds/rivers	Islands
Mallard	Marsh	Lakes/ponds/rivers
Marsh Wren	Marsh	Lakes/ponds/rivers
Northern Harrier	Marsh	Treed/shrubby swamp
Northern Pintail	Agricultural	Marsh
Osprey	Marsh	Treed/shrubby swamp
Pied-billed Grebe	Marsh	Lakes/ponds/rivers
Piping Plover	Beaches	Islands
Purple Martin	Lakes/ponds/rivers	Urban
Red-necked Grebe	Lakes/ponds/rivers	Marsh
Red-winged Blackbird	Marsh	Agricultural
Ring-billed Gull	Islands	Lakes/ponds/rivers
Ring-necked Duck	Marsh	Meadows
Rusty Blackbird	Woodlands	Bogs
Sandhill Crane	Bogs	Marsh
Sedge Wren	Meadows	Marsh
Short-eared Owl	Prairie/grasslands	Agricultural
Sora	Marsh	Lakes/ponds/rivers
Swamp Sparrow	Marsh	Lakes/ponds/rivers
Virginia Rail	Marsh	Lakes/ponds/rivers
Wilson's Phalarope	Marsh	Meadows
Yellow Rail	Meadows	Marsh
Yellow-headed Blackbird	Marsh	Lakes/ponds/rivers

## Open Country Birds

Species Name	Primary Nesting Habitat	Secondary Nesting Habitat
American Goldfinch	Early successional	Agricultural
American Kestrel	Agricultural	Woodlands
Bank Swallow	Lakes/ponds/rivers	Agricultural
Barn Owl	Prairie/grasslands	Agricultural
Barn Swallow	Agricultural	Lakes/ponds/rivers
Bobolink	Agricultural	Prairie/grasslands
Brewer's Blackbird	Agricultural	Early successional
Brown Thrasher	Early successional	Open woodlands
Brown-headed Cowbird	Agricultural	Woodlands
Clay-colored Sparrow	Early successional	Burned/logged areas
Cliff Swallow	Urban	Agricultural
Common Nighthawk	Woodlands	Urban
Dickcissel	Agricultural	Early successional
Eastern Bluebird	Agricultural	Open woodlands
Eastern Kingbird	Early successional	Agricultural
Eastern Meadowlark	Agricultural	Early successional
Field Sparrow	Early successional	Agricultural
Grasshopper Sparrow	Prairie/grasslands	Agricultural
Henslow's Sparrow	Agricultural	Prairie/grasslands
Horned Lark	Agricultural	Prairie/grasslands
Killdeer	Agricultural	Beaches
Le Conte's Sparrow	Meadows	Marsh
Loggerhead Shrike	Early successional	Agricultural
Mourning Dove	Early successional	Agricultural
Northern Bobwhite	Agricultural	Prairie/grasslands
Northern Mockingbird	Early successional	Urban
Northern Rough-winged Swallow	Lakes/ponds/rivers	Agricultural
Red-tailed Hawk	Agricultural	Woodlands
Savannah Sparrow	Agricultural	Prairie/grasslands
Sharp-tailed Grouse	Burned/logged areas	Bogs
Spotted Sandpiper	Beaches	Lakes/ponds/rivers
Upland Sandpiper	Agricultural	Early successional
Vesper Sparrow	Agricultural	Prairie/grasslands
Western Meadowlark	Prairie/grasslands	Agricultural







