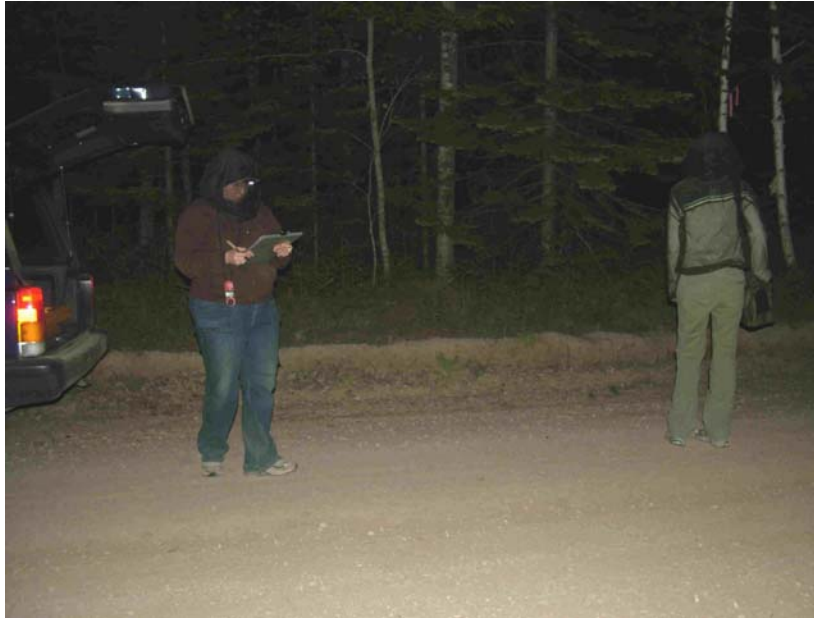


# Whip-poor-will and Common Nighthawk Surveys in Support of the Michigan Breeding Bird Atlas II - 2006



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Wildlife Division, Natural Heritage Program

October 31, 2006

Report Number 2006-20



MICHIGAN STATE  
UNIVERSITY  
EXTENSION



**Cover Photo:** Barbara J. Barton

**Recommended Citation:** Barton, B. J. 2006. Whip-poor-will and Common Nighthawk Surveys in Support of the Michigan Breeding Bird Atlas II – 2006. Report Number MNFI 2006-20. Report to the Michigan Department of Natural Resources, Wildlife Division, Lansing, MI. 11 pp + appendices.

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## EXECUTIVE SUMMARY

In 2004 the Michigan Natural Features Inventory proposed a three-year statewide survey of Nightjars to increase the data available for the Michigan Breeding Bird Atlas (MBBA) II project. This report presents the result of the second year of the surveys. Twenty-eight (28) randomly selected North American Breeding Bird Survey (BBS) routes in the Central and Western part of the State were surveyed in 2006 from mid-May to the end of June. Ten point count stations were situated at approximately 1.6-km (1.0-mi) intervals within each route. Surveys began exactly at sunset and continued for a minimum of two hrs. We avoided surveys during high winds or rain. At each point we recorded the wind speed, temperature, noise level, precipitation, and moon phase. Each station consisted of a one-min silent period followed by a two-min broadcast period for each species. The broadcasts contained two series of calls for each species, and the series and calls were separated by 30-sec silent periods. The calls were broadcasted using an electronic game caller. We noted the period of first response and estimated the location of each bird using compass bearings and distance categories. The data recorded at survey points were summarized by quarter-township (nine mi<sup>2</sup>) MBBAII survey blocks.

We heard 101 Whip-poor-wills and 26 Common Nighthawks during the route surveys. The highest observation rates for Whip-poor-wills occurred during the second period in the Upper Peninsula (UP), and for Common Nighthawks during the first period in the Northern Lower Peninsula (NLP). Six bird species were recorded incidentally on 14 survey blocks. Barred Owl and American Woodcock were the most commonly observed incidental species.

## INTRODUCTION

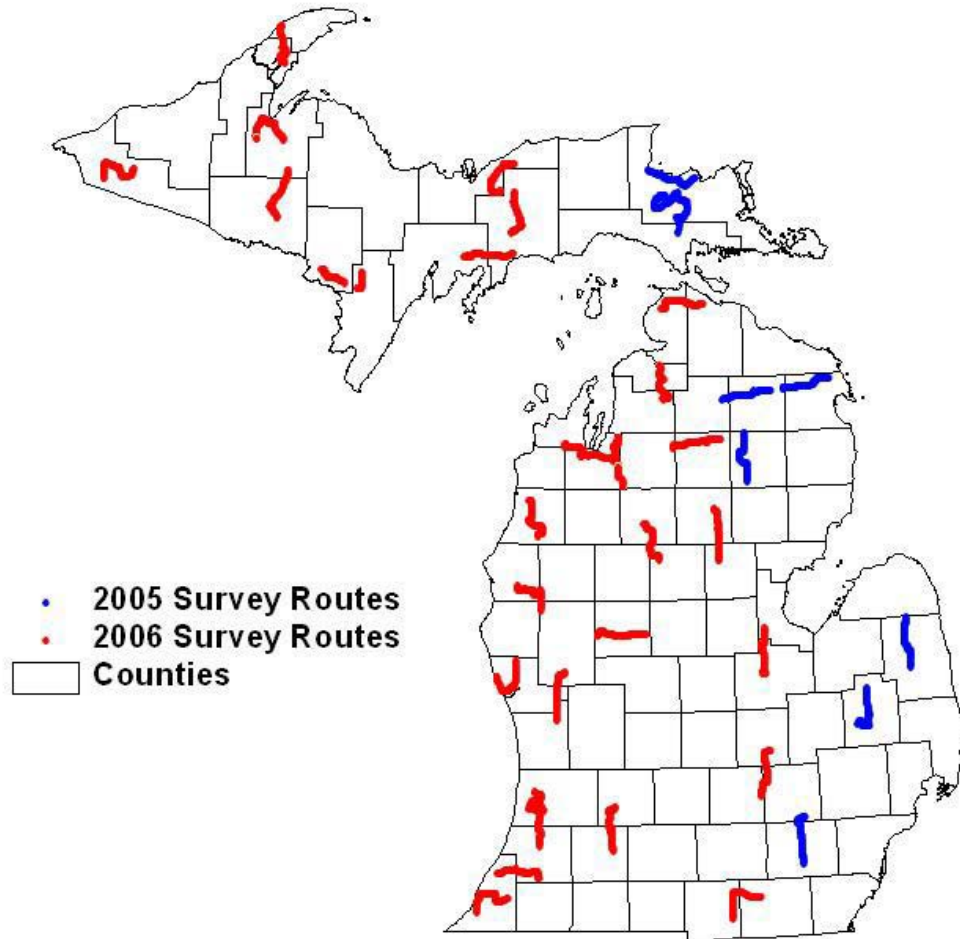
The Michigan Natural Features Inventory proposed to conduct a three-year statewide survey of Nightjars (Caprimulgidae) in 2004. The primary objective of this survey is to gather increased data on Whip-poor-will (*Caprimulgus vociferus*) and Common Nighthawk (*Chordeiles minor*) for the Michigan Breeding Bird Atlas II project. Species that are largely nocturnal or crepuscular are typically underrepresented in large-scale breeding bird surveys, such as state atlas projects and the North American Breeding Bird Survey (BBS). Due to the difficulty of data collection and recent concerns about possible population declines, special surveys for these species are warranted. Focused surveys will increase our knowledge of breeding distributions and relative abundance of these species in Michigan. This survey also provides an opportunity to collect baseline data that could be used for future monitoring, evaluate survey protocols, and investigate potential trends in landscape level habitat use.

## METHODS

### *Routes and Points Selection*

Routes established by the BBS were utilized for this study. The State was divided into three zones: Southern-lower Peninsula (SLP), Northern-lower Peninsula (NLP), and Upper Peninsula (UP), which were further divided into three study areas per zone (Fig.1). Five routes were randomly selected in the SLP and NLP and four in the UP per zone in the central and western two-thirds of the State (the eastern third was surveyed in 2005, see Fig. 1). In order to maximize survey efforts, criteria were established to disqualify unsuitable routes. The land cover types present within a one-quarter kilometer buffer around each point on a route was evaluated in a GIS using the Michigan Department of Natural Resources (MDNR) Integrated Forest Monitoring Assessment and Prescription (IFMAP) land coverage. Points were noted if they contained 75% or more unsuitable habitat such as urban, farmland, orchard,

park, golf course, or open water coverage. The percentage of points on each route that contained 75% or more unsuitable habitat was then calculated. A route containing  $\geq 70\%$  of these points was considered an unsuitable route and discarded.



**Figure 1.** 2005-2006 Nocturnal Bird Survey routes in Michigan.

Due to the limited amount of survey time each evening, 10 consecutive points one mile apart per route were selected for censusing, beginning with a randomly selected starting point (Table 1). If a point was skipped during the survey because of accessibility or other issues, the survey resumed at the next suitable point and continued until a total of 10 were completed. If the route ended before 10 points were completed, surveyors returned to the beginning of the route if time allowed and continued at the first point.

**Table 1.** Census routes and points for the 2006 survey. NLP = Northern-lower Peninsula, SLP = Southern-lower Peninsula, UP = Upper Peninsula of Michigan.

Location	Route	County	Start Point
UP	49003	Gogebic	2
UP	49004	Houghton	10
UP	49005	Iron	14
UP	49006	Baraga	28
UP	49013	Menominee	15
UP	49014	Alger	20
UP	49015	Schoolcraft	7
UP	49016	Delta	21
NLP	49017	Manistee	25
NLP	49018	Mason, Lake	22
SLP	49019	Muskegon	15
SLP	49020	Berrien/Van Buren	14
SLP	49021	Van Buren	22
SLP	49022	Berrien	27
NLP	49027	Missaukee	1
NLP	49029	Grand Traverse, Kalkaska	24
SLP	49033	Muskegon/Newaygo	7
SLP	49035	Kalamazoo	10
NLP	49038	Mecosta	9
NLP	49042	Emmett	8
NLP	49043	Charlevoix	17
NLP	49046	Crawford	5
NLP	49048	Roscommon	25
SLP	49049	Clinton/Shiawassee	6
SLP	49056	Ingham, Livingston	6
SLP	49058	Hillsdale	8
NLP	49130	Grand Traverse	1
SLP	49907	Allegan	14

Routes were surveyed 15 May-21 June in two 3-wk cycles following the zones in a north-to-south direction. Censusing began at sunset and continued for no more than two hr after sunset. Surveys were not conducted during the following weather conditions:

- 1) wind speeds greater than 8 km/hr
- 2) ambient temperature below 7°C (44.6°F)
- 3) moderate to heavy precipitation, storms

Surveyors collected measurements of wind speed, temperature, precipitation, and noise levels at each point. When calling birds were located, their orientation and distance from the vehicle were recorded. Point locations were recorded using hand-held GPS (global positioning system) units.

### ***Atlas Breeding Status***

Breeding status was determined by survey block using methods outlined in the MBBA II Project Handbook (KNC 2004). The survey blocks are based on quarter-townships and consist of nine legal sections (KNC 2004). Data in this study were collected from stations spaced at 1.6-km intervals along established BBA survey routes, and summarized by MBBA II block. Whip-poor-wills and nighthawks that vocalized in response to broadcast calls or were heard vocalizing prior to broadcast calls were treated as singing males and assigned breeding criteria codes.

### ***Surrounding Land Cover Characterization***

Landscape-level habitat surrounding our survey points was characterized using a GIS. We used the MDNR IFMAP land coverage to classify cover types. Approximately 32 land cover classes are provided in the IFMAP coverage (Appendix B). Similar classes were combined into eight land cover types: 1) agricultural, 2) developed, 3) forest – pines, 4) forest – upland deciduous, 5) mixed forest, 6) other open areas, 7) upland shrub/low-density trees, and 8) wetlands. We determined the area and proportion of each cover type within ¼ km (250 m) of each survey point. We hope to use these data in future analyses to explore potential trends in landscape level habitat at locations where Whip-poor-will and Common Nighthawk were present.

## **RESULTS**

### ***Atlas Breeding Status***

We heard 101 Whip-poor-wills and 26 Common Nighthawks during surveys conducted at 498 points along 28 survey routes (Table 1); this compares to 81 Whip-poor-will and 70 Common Nighthawks observation during the 2005 survey (Barton 2005). It was not possible to determine whether a calling bird located at the same point during different survey cycles was the same individual, however; these data are presented in Table 2 for comparison. The highest observation rates for Whip-poor-wills occurred during the second cycle in the UP and for Common Nighthawks during the first cycle in the NLP (Table 3). Overall observation rates for Whip-poor-wills were higher in the UP; Common Nighthawks observation rates were higher in the NLP. This is in contrast to the 2005 study where Whip-poor-wills were observed at higher rates in the NLP (Barton 2005).

**Table 2.** a) Number of Whip-poor-wills and Common Nighthawks by region, b) number of Whip-poor-wills and Common Nighthawks with duplicate sightings during the second survey period omitted.

(a)				
Species	SLP	NLP	UP	Totals
Whip-poor-wills	16	9	76	101
Common Nighthawks	3	15	8	26

(b)				
Species	SLP	NLP	UP	Totals
Whip-poor-wills	15	9	60	84
Common Nighthawks	3	15	8	26



**Table 3.** Summary of Whip-poor-will and Common Nighthawk observations by region and survey period recorded during surveys conducted in Michigan in 2006. Survey Period 1 = 15 May – 1 June, Survey Period 2 = 5 June – 21 June.

Region <sup>a</sup>	Survey Period	No. Points	No. Whip-poor-wills		No. Nighthawks		Total	
			No. Obs. <sup>b</sup>	Mean <sup>c</sup>	No. Obs.	Mean	No. Obs.	Mean
SLP	1	77	4	0.05	3	0.04	7	0.09
	2	75	12	0.16	0	0.00	12	0.16
	Subtotal	152	16	0.11	3	0.02	19	0.13
NLP	1	88	1	0.01	11	0.13	12	0.14
	2	89	8	0.09	4	0.05	12	0.14
	Subtotal	177	9	0.05	15	0.09	24	0.14
UP	1	78	31	0.40	6	0.08	37	0.47
	2	91	45	0.50	2	0.02	47	0.52
	Subtotal	169	76	0.45	8	0.05	84	0.50
Overall	1	243	36	0.15	20	0.08	56	0.23
	2	255	65	0.26	6	0.02	71	0.28
	Total	498	101	0.20	26	0.05	127	0.26

<sup>a</sup>SLP = Southern Lower Peninsula, NLP = Northern Lower Peninsula, UP = Upper Peninsula.

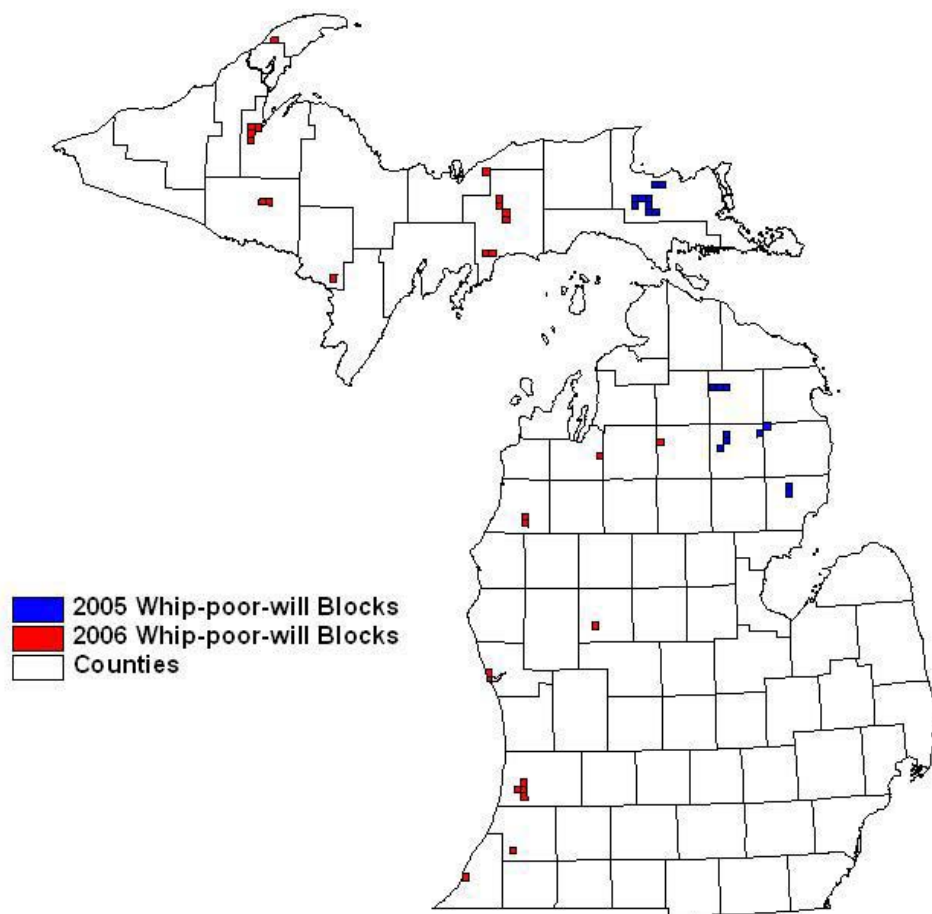
<sup>b</sup>Number of birds observed.

<sup>c</sup>Average number of birds per point surveyed.

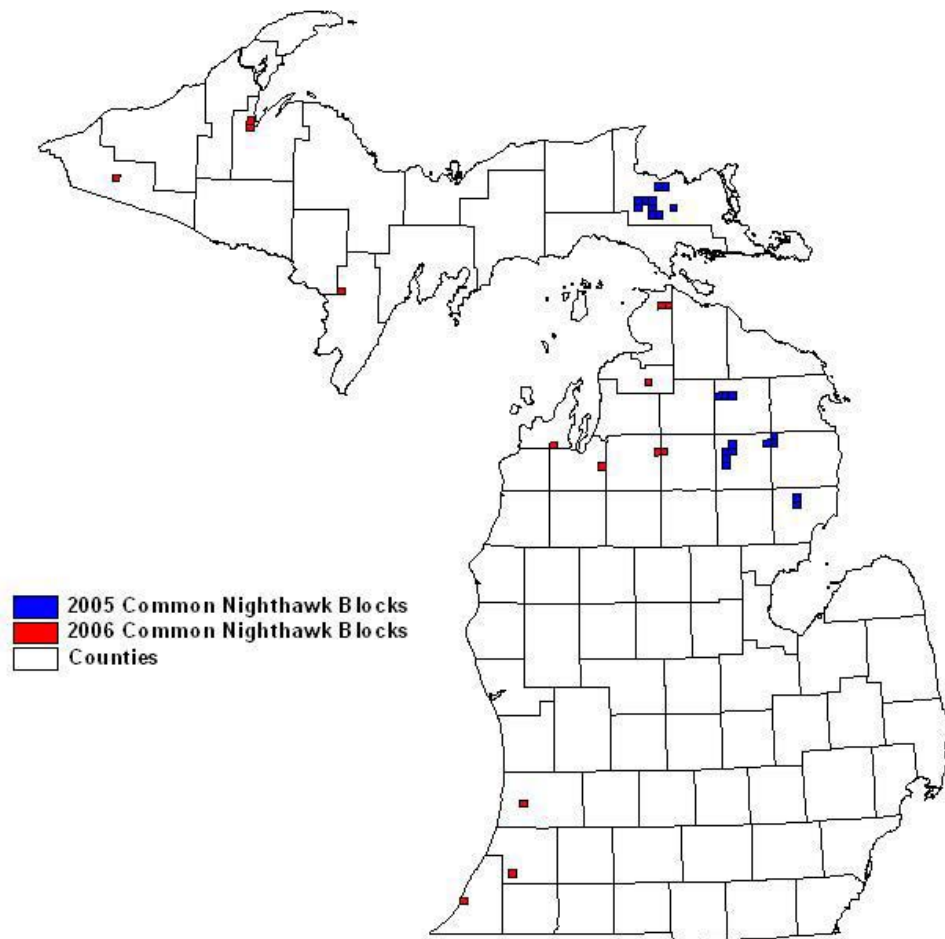
We determined the breeding status for the two species on 64 MBBA II survey blocks (Table 4, Figures 2, 3). The highest number of probable breeding Whip-poor-will records was documented in the UP (26) and for Common Nighthawks in the NLP (11). This is a nearly 50% reduction in the number of blocks with probable breeding by both species from surveys in 2005(Barton 2005). Table A-1 (Appendix A) lists the nocturnal breeding data by survey block.

**Table 4.** Number of blocks with Whip-poor-will and Common Nighthawk observations by region from surveys conducted in Michigan in 2006.

Species	SLP	NLP	UP	Total
Whip-poor-wills	9	8	26	43
Common Nighthawk	2	11	8	21
Totals	11	19	34	64



**Figure 2.** MBBA II survey blocks with Whip-poor-will observations during surveys conducted in Michigan during 2005-2006.



**Figure 3.** MBBA II survey blocks with Common Nighthawk observations during surveys conducted in Michigan during 2005-2006.

We observed breeding activity of six incidental species during the surveys, including the State Special Concern Species American Bittern (*Botaurus lentiginosus*). Barred Owl (*Strix varia*) and American Woodcock (*Scolopax minor*) were the most commonly observed incidental species, recorded from six and three survey blocks, respectively. Great Horned Owl (*Bubo virginianus*), Eastern Screech Owl (*Otus asio*), Killdeer (*Charadrius vociferus*), and Ruffed Grouse (*Bonasa umbellus*) were observed in only a single block each (Table 5). Incidental species data is summarized by survey block in Table A-2 (Appendix A). Five incidental species were recorded from 13 survey blocks during the 2005 surveys, with Barred Owls and American Woodcocks the most commonly observed species (Barton 2005).

**Table 5.** Number of blocks with incidental species observations by region from Whip-poor-will and Common Nighthawk surveys in Michigan in 2006.

Species	SLP	NLP	UP	Total
American Bittern	0	0	1	1
American Woodcock	1	1	4	6
Barred Owl	0	1	2	3
Eastern Screech-Owl	0	0	1	1
Great Horned Owl	0	1	0	1
Killdeer	0	1	0	1
Ruffed Grouse	0	1	0	1
Total	1	5	8	14

### ***Surrounding Land Cover Characterization***

The dominant land cover types of all survey points (using composite variables) were Agricultural (24.17%) and Deciduous Forests (23.36%) (Table 6). Points with Whip-poor-wills were dominated by Deciduous Forests (37.27%) (Table 7). Common Nighthawk points were associated with Deciduous Forests (22.84%) and Other Open Areas (19.71%) (Table 7). A similar proportion of Wetlands (approximately 14%) was observed in all three point categories. A statistical analysis of land cover types and nocturnal bird observations will be conducted in year three of this study.

**Table 6.** Land cover types observed within ¼ km radius of points surveyed in Michigan in 2006.

Class	Habitat	All Survey Points		Whip-poor-will Points		Common Nighthawk Points	
		ha	%	ha	%	ha	%
11	Low Intensity Urban	319.50	1.26	17.37	0.65	11.43	1.13
43	Upland Mixed Forest	1808.37	7.13	225.27	8.39	124.83	12.34
50	Water	281.43	1.11	0.99	0.04	0.54	0.05
122	Roads / Paved	1019.16	4.02	87.12	3.25	38.88	3.84
123	High Intensity Urban	87.66	0.35	5.58	0.21	4.32	0.43
211	Non-vegetated Farmland	22.59	0.09	0.27	0.01	0.00	0.00
212	Forage Crops / Non-tilled herbaceous	3812.31	15.04	36.27	1.35	67.68	6.69
222	Orchards / Vineyards / Nurseries	322.65	1.27	38.34	1.43	0.00	0.00
310	Herbaceous Openland	2550.24	10.06	324.45	12.09	154.62	15.29
320	Upland Shrub / Low-density trees	856.08	3.38	88.74	3.31	51.66	5.11
350	Parks / Golf Courses	90.09	0.36	0.00	0.00	0.00	0.00
411	Northern Hardwood Association	3092.40	12.20	542.88	20.23	118.53	11.72
412	Oak Association	1284.75	5.07	119.88	4.47	42.21	4.17
413	Aspen Association	1729.17	6.82	318.42	11.87	82.08	8.11
414	Other Upland Deciduous	16.20	0.06	0.36	0.01	0.00	0.00
419	Mixed Upland Deciduous	504.09	1.99	41.22	1.54	8.91	0.88
421	Pines	1400.13	5.52	240.21	8.95	110.16	10.89
423	Other Upland Conifers	201.24	0.79	36.45	1.36	21.96	2.17
429	Mixed Upland Conifers	130.50	0.51	24.57	0.92	5.13	0.51
611	Lowland Deciduous Forest	885.69	3.49	58.68	2.19	27.00	2.67
612	Lowland Coniferous Forest	1073.61	4.23	120.69	4.50	70.29	6.95
613	Lowland Mixed Forest	97.92	0.39	7.47	0.28	1.98	0.20
621	Floating Aquatic	43.92	0.17	2.43	0.09	0.99	0.10
622	Lowland Shrub	799.74	3.15	160.29	5.97	31.14	3.08
623	Emergent Wetland	154.35	0.61	8.73	0.33	3.51	0.35
629	Mixed Non-Forest Wetland	459.72	1.81	138.42	5.16	10.80	1.07
710	Sand / Soil	75.60	0.30	3.60	0.13	3.15	0.31
790	Other Bare / Sparsely Vegetated	34.83	0.14	6.75	0.25	0.09	0.01
2112	Row Crops	2199.60	8.68	28.17	1.05	19.62	1.94
	<b>Total</b>	<b>25353.54</b>	<b>100.00</b>	<b>2683.62</b>	<b>100.00</b>	<b>1011.51</b>	<b>100.00</b>

**Table 7.** Composite variables of all survey points, Whip-poor-will, and Common Nighthawk points. Values representing approximately 20% or more of the total are bolded.

Classes	Land Cover Type	Total Points		Whip-poor-will Points		Common Nighthawk Points	
		ha	%	ha	%	ha	%
211+2112+212+222	Agricultural	<b>6334.56</b>	<b>24.17</b>	102.78	3.90	87.3	8.21
122+123+11+350	Developed	1516.41	5.79	110.07	4.18	54.63	5.14
421+423	Forest - Pines	1601.37	6.11	276.66	10.50	132.12	12.43
411+412+413+414	Forest -Upland Deciduous	<b>6122.52</b>	<b>23.36</b>	<b>981.54</b>	<b>37.27</b>	<b>242.82</b>	<b>22.84</b>
429+43+419	Mixed Forest	2442.96	9.32	291.06	11.05	138.87	13.06
310+211+790+710	Other Open Areas	3539.34	13.50	423.81	16.09	<b>209.52</b>	<b>19.71</b>
320	Upland Shrub / Low-density trees	856.08	3.27	88.74	3.37	51.66	4.86
611+612+613+50+621+622+623+629	Wetlands	3796.38	14.48	359.28	13.64	146.27	13.76
	<b>Total</b>	<b>21557.16</b>	<b>100.00</b>	<b>2633.94</b>	<b>100.00</b>	<b>1063.19</b>	<b>100.00</b>

## DISCUSSION

Region-wide Breeding Bird Survey data indicate a decline of Whip-poor-wills and Common Nighthawks since 1966, although it is important to note that the Breeding Bird Survey was not designed to monitor nocturnal species (Sauer et al. 2005). Causes of decline have been attributed to loss of habitat and loss of prey species due to pesticide use, and increased predation by raccoons, cats and other species associated with human encroachment (Hunt 2005).

The majority of Whip-poor-will and Common Nighthawk occurrences during this survey were in managed clear cut forests in undeveloped areas of the northern Lower and Upper Peninsulas. Surveys are conducted at sunset and visibility is reduced as darkness advances, so it is difficult to visually determine habitat types for the majority of the two-hour survey period. However, clear cut areas are easily identified with the aid of moonlight and spotlights, and this habitat type seems to be preferred by both species (see Barton 2005). Whip-poor-wills were associated with pitch pine (*Pinus resinosa*) forests, and open disturbed areas (gravel pits, early-successional fields, recently cut areas, and power line corridors) in New Hampshire, and are dependent on the juxtaposition of suitable forests for nesting and open lands for feeding (Wilson 2003, Hunt 2005). In comparison with the 2005 results, it appears that both species may be restricted to specific landscape level communities. Landscape level analysis of habitat types surrounding all observation points in Michigan will be conducted when the third year of field work is concluded.

The loss of nesting areas is of concern for both species, which are typically ground nesters. In addition to natural nesting sites, Common Nighthawks are also known to use gravel rooftops. Nighthawks select gravel rooftops that are 5-15 m in height and are wholly or partially rimmed by walls or parapets (Dexter

1961). Brigham (1989) attempted to determine the importance of rooftops as nesting sites, and found that Common Nighthawks overwhelmingly preferred natural habitats over artificial structures. Brigham (1989) proposed that the abundance of food near rooftops (due to high densities of insects drawn to city lights) may outweigh the potential avoidance of rooftops and thus attract the bird away from suitable natural habitat. Incidental reports suggest that Common Nighthawk observations are declining in some cities in Michigan, which is of concern because in highly populated areas natural habitats no longer exist. Rooftops may function as refugia in these areas. Causes of the reported decline in cities are unknown but should be examined.

Surveys for Caprimulgids identify areas where birds are calling, but do not necessarily identify breeding sites. For example, the average distance traveled by Common Nighthawks from roost sites to foraging areas was 2.7 km, with some individuals flying 12 km per night in a study by Brigham (1989). This presents a challenge to surveyors in identifying specific breeding site locations. Information on breeding habitat requirements for both species is critical in determining landscape requirements. As mentioned previously, both open lands and forests have been correlated with whip-poor-will occurrences, illustrating the importance of habitat matrices.

The results of this study underscore the need for long-term studies in order to understand the habitat needs, distribution, and abundance of Whip-poor-wills and Common Nighthawks in Michigan. The addition of an extra field crew in 2006 enabled greater coverage, nearly doubling the number of routes. In addition, using stratified random sampling reduced the chance of surveying unsuitable habitat. Further refinements to survey methodology may be recommended after additional data analysis, as both species appear to be widely dispersed and may be limited to specific habitat types (personal obs., Hunt 2005). Hunt (2005) suggests that if surveys are conducted during the peak breeding period, only one cycle of surveys is required to adequately locate calling birds. This method of surveying may be adequate for annual monitoring of known occurrences, but is not recommended for this survey. The timing of surveys may be adjusted as Whip-poor-will activity has been positively correlated with lunar cycles (Wilson and Watts 2006). Hunt (2005) recommends Whip-poor-will surveys be restricted to periods of high lunar illumination during peak periods of the breeding cycle. Our surveys target both Whip-poor-will and Common Nighthawks; further research on the effects on lunar cycles on Common Nighthawks will be required to determine whether survey periods should be restricted for this project.

The results of the 2005-2006 studies have significantly contributed to our current knowledge of Whip-poor-will and Common Nighthawk occurrences in Michigan. We are in the process of determining preferred habitat types and defining current ranges in Michigan. This information is critical in determining appropriate management practices for both species, especially since most occurrences are in managed State and National Forests. We are also in the process of refining the survey protocol, which will enable future surveyors to conduct studies in the most efficient and effective manner.

Long-term monitoring of Whip-poor-will and Common Nighthawk numbers and management practices at routes with high numbers of birds would provide information both on population trends and the effects of management on their distributions. This is particularly important when considering temporal effects on open land habitats. As woody vegetation encroaches into open areas, it is likely that Whip-poor-wills and Common Nighthawks will shift to more suitable habitat.

## **ACKNOWLEDGEMENTS**

This project was funded by the Michigan Department of Natural Resources Wildlife Division through the State Wildlife Grants Program. Paula Shock, Pamela Bean, Lisa McAurther, and Lauren Soloman assisted with surveys. Administrative support was provided by Lyn Scrimger, Sue Ridge, and Connie Brinson. Helen Enander provided GIS technical advice. Michael Monfils assisted with study design and analysis.

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## APPENDIX A

**Table A-1.** Whip-poor-will and Common Nighthawk observation data by MBBA II survey block from surveys conducted in Michigan in 2006.

**Table A-2.** Incidental species observation data by MBBA II survey block from Whip-poor-will and Common Nighthawk surveys conducted in Michigan in 2006



**Table A-1.** Whip-poor-will and Common Nighthawk observation data by MBBA II survey block from surveys conducted in Michigan in 2006.

Species <sup>a</sup>	Observation Id <sup>b</sup>	No. Obs.	Date	Observer(s) <sup>c</sup>	Code <sup>d</sup>	Town	Range	Section	Block	Priority <sup>e</sup>	Twp. Name	County
WPWI	4900440	1	5/30/2006	BB,PS,LS	X	56N	32W	32	2	N	Calumet	Houghton
WPWI	4900526	2	6/1/2006	BB,PS,LS	X	45N	33W	27	4	N	Hematite	Iron
WPWI	4900530	1	6/1/2006	BB,PS,LS	X	45N	33W	33	3	N	Hematite	Iron
WPWI	4900648	2	5/31/2006	BB,PS,LS	X	49N	37W	5	2	N	Baraga	Baraga
WPWI	4901325	1	5/29/2006	PB,LM	X	39N	28W	7	2	N	Waucedah	Dickinson
WPWI	4901430	2	6/1/2006	PB,LM	X	47N	17W	15	1	N	Munising	Alger
WPWI	4901507	1	5/31/2006	PB,LM	X	45N	16W	14	1	N	Hiawatha	Schoolcraft
WPWI	4901509	2	5/31/2006	PB,LM	X	45N	16W	7	4	N	Hiawatha	Schoolcraft
WPWI	4901511	1	5/31/2006	PB,LM	X	45N	16W	25	4	N	Hiawatha	Schoolcraft
WPWI	4901513	3	5/31/2006	PB,LM	X	45N	16W	36	4	N	Hiawatha	Schoolcraft
WPWI	4901515	4	5/31/2006	PB,LM	X	45N	16W	36	4	N	Hiawatha	Schoolcraft
WPWI	4901517	1	5/31/2006	PB,LM	X	44N	15W	6	2	N	Manistique	Schoolcraft
WPWI	4901519	2	5/31/2006	PB,LM	X	44N	15W	7	2	N	Manistique	Schoolcraft
WPWI	4901521	2	5/31/2006	PB,LM	X	44N	15W	18	2	N	Manistique	Schoolcraft
WPWI	4901523	3	5/31/2006	PB,LM	X	44N	15W	19	3	Y	Manistique	Schoolcraft
WPWI	4901525	1	5/31/2006	PB,LM	X	44N	15W	29	3	Y	Manistique	Schoolcraft
WPWI	4901631	1	5/30/2006	PB,LM	X	44N	17W	15	1	N	Inwood	Schoolcraft
WPWI	4901643	1	5/30/2006	PB,LM	X	44N	16W	16	2	Y	Thompson	Schoolcraft
WPWI	4901937	1	5/18/2006	PB,LM	X	10N	17W	21	3	Y	Muskegon	Muskegon
WPWI	4902020	1	5/16/2006	PS,LS	X	04S	16W	15	1	Y	Keeler	Van Buren
WPWI	4902219	1	5/15/2006	PS,LS	X	06S	19W	4	2	Y	Lake	Berrien
WPWI	4902926	1	5/25/2006	PB,LM	X	26N	09W	3	1	N/A	Union	Grand Traverse
WPWI	4990720	1	5/18/2006	PS,LS	X	02N	15W	23	1	Y	Clyde	Allegan
WPWI	490052602	2	6/20/2006	PS,LS	X	45N	33W	27	4	N	Hematite	Iron
WPWI	490063602	2	6/19/2006	PS,LS	X	50N	34W	10	1	Y	Baraga	Baraga
WPWI	490063802	4	6/19/2006	PS,LS	X	50N	37W	16	2	N	Baraga	Baraga
WPWI	490064002	2	6/19/2006	PS,LS	X	50N	37W	17	2	N	Baraga	Baraga
WPWI	490064202	1	6/19/2006	PS,LS	X	50N	37W	20	3	N	Baraga	Baraga
WPWI	490064402	1	6/19/2006	PS,LS	X	50N	37W	29	3	N	Baraga	Baraga
WPWI	490064802	3	6/19/2006	PS,LS	X	49N	37W	5	2	N	Baraga	Baraga

**Table A-1 Continued.**

Species <sup>a</sup>	Observation Id <sup>b</sup>	No. Obs.	Date	Observer(s) <sup>c</sup>	Code <sup>d</sup>	Town	Range	Section	Block	Priority <sup>e</sup>	Twp. Name	County
WPWI	490132302	1	6/18/2006	PB,LM	X	39N	28W	8	2	N	Waucesha	Dickinson
WPWI	490132502	4	6/18/2006	PB,LM	X	39N	28W	7	2	N	Waucesha	Dickinson
WPWI	490143002	1	6/21/2006	PB,LM	X	47N	17W	15	1	N	Munising	Alger
WPWI	490143202	1	6/21/2006	PB,LM	X	47N	17W	11	1	N	Munising	Alger
WPWI	490150902	4	6/20/2006	PB,LM	X	45N	16W	7	4	N	Hiawatha	Schoolcraft
WPWI	490151102	5	6/20/2006	PB,LM	X	45N	16W	25	4	N	Hiawatha	Schoolcraft
WPWI	490151302	4	6/20/2006	PB,LM	X	45N	16W	36	4	N	Hiawatha	Schoolcraft
WPWI	490151502	1	6/20/2006	PB,LM	X	45N	16W	36	4	N	Hiawatha	Schoolcraft
WPWI	490151902	1	6/20/2006	PB,LM	X	44N	15W	7	2	N	Manistique	Schoolcraft
WPWI	490152102	1	6/20/2006	PB,LM	X	44N	15W	18	2	N	Manistique	Schoolcraft
WPWI	490152302	1	6/20/2006	PB,LM	X	44N	15W	19	3	Y	Manistique	Schoolcraft
WPWI	490163102	2	6/19/2006	PB,LM	X	44N	17W	15	1	N	Inwood	Schoolcraft
WPWI	490163502	1	6/19/2006	PB,LM	X	44N	17W	14	1	N	Inwood	Schoolcraft
WPWI	490163702	3	6/19/2006	PB,LM	X	44N	17W	13	1	N	Inwood	Schoolcraft
WPWI	490173302	3	6/14/2006	PB,LM	X	22N	14W	30	3	Y	Dickson	Manistee
WPWI	490174502	2	6/14/2006	PB,LM	X	21N	14W	6	2	N/A	Norman	Manistee
WPWI	490194502	1	6/8/2006	PB,LM	X	10N	17W	6	2	Y	Laketon	Muskegon
WPWI	490210702	1	6/7/2006	PS,LS	X	02N	15W	33	3	Y	Clyde	Allegan
WPWI	490211502	2	6/7/2006	PS,LS	X	01N	15W	1	1	Y	Lee	Allegan
WPWI	490211702	2	6/7/2006	PS,LS	X	01N	15W	12	1	Y	Lee	Allegan
WPWI	490292802	1	6/15/2006	PS,LS	X	26N	09W	11	1	N/A	Union	Grand Traverse
WPWI	490382902	1	6/12/2006	PB,LM	X	14N	09W	21	3	N/A	Austin	Mecosta
WPWI	490461102	1	6/16/2006	PS,LS	X	27N	04W	5	2	Y	Frederic	Crawford
WPWI	499071602	2	6/8/2006	PS,LS	X	02N	15W	11	1	Y	Clyde	Allegan
WPWI	499071802	2	6/8/2006	PS,LS	X	02N	15W	4	1	Y	Clyde	Allegan
WPWI	499072002	2	6/8/2006	PS,LS	X	02N	15W	23	4	Y	Clyde	Allegan
CONI	4900308	1	5/29/2006	PS,LS	X	46N	43W	5	2	N	Marenisco	Gogebic
CONI	4900440	1	5/30/2006	BB,PS,LS	X	56N	32W	32	2	N	Calumet	Houghton
CONI	4900638	1	5/31/2006	PS,LS	X	50N	37W	16	2	N	Baraga	Baraga
CONI	4900648	1	5/31/2006	BB,PS,LS	X	49N	34W	8	2	N	Baraga	Baraga

**Table A-1** Continued.

Species <sup>a</sup>	Observation Id <sup>b</sup>	No. Obs.	Date	Observer(s) <sup>c</sup>	Code <sup>d</sup>	Town	Range	Section	Block	Priority <sup>e</sup>	Twp. Name	County
CONI	4901317	1	5/29/2006	PB,LM	X	39N	27W	33	3	N	Meyer	Menominee
CONI	4901325	1	5/29/2006	PB,LM	X	39N	28W	7	2	N	Waucedah	Dickinson
CONI	4902928	2	5/25/2006	PS,JS	X	26N	09W	11	1	N/A	Union	Grand Traverse
CONI	4902932	2	5/25/2006	PS,JS	X	26N	09W	14	1	N/A	Union	Grand Traverse
CONI	4904214	1	5/22/2006	PS,JS	X	38N	04W	25	4	N/A	Carp Lake	Emmet
CONI	4904218	2	5/22/2006	PS,JS	X	38N	04W	11	4	N/A	Carp Lake	Emmet
CONI	4904220	1	5/22/2006	PS,JS	X	38N	04W	28	3	N/A	Carp Lake	Emmet
CONI	4904319	2	5/23/2006	PS,JS	X	32N	05W	8	2	Y	Boyne Valley	Charlevoix
CONI	4913001	1	5/24/2006	PB,LM	X	28N	12W	31	3	Y	Solon	Leelanau
CONI	4990716	1	5/18/2006	PS,JS	X	02N	15W	11	1	Y	Clyde	Allegan
CONI	4990720	2	5/18/2006	PS,JS	X	02N	15W	14	1	Y	Clyde	Allegan
CONI	490063002	1	6/19/2006	PS,JS	X	51N	033W	32	3	N	Baraga	Baraga
CONI	490063602	1	6/19/2006	PS,JS	X	50N	034W	10	1	Y	Baraga	Baraga
CONI	490460702	1	6/16/2006	PB,LM	X	27N	05W	1	1	N/A	Bear Lake	Kalkaska
CONI	490460902	2	6/16/2006	PB,LM	X	27N	04W	6	2	Y	Frederic	Crawford
CONI	490461102	1	6/16/2006	PB,LM	X	27N	04W	5	2	Y	Frederic	Crawford

<sup>a</sup>Species: CONI - Common Nighthawk; WPWI = Whip-poor-will

<sup>b</sup>Observation ID = Species+Route+Station (suffix "02" = second visit)

<sup>c</sup>Observers: BB = Barb Barton, PB = Pamela Bean, LM = Lisa McArthur, PS = Paula Shock, LS = Lauren Solomon

<sup>d</sup>Breeding criteria codes: # = species observed in suitable nesting habitat during its breeding season; X = singing male present in suitable

nesting habitat during its breeding season.

<sup>e</sup>Priority survey block: Y = yes and N = no.

**Table A-2.** Incidental species observation data by MBBA II survey block from Whip-poor-will and Common Nighthawk surveys conducted in Michigan in 2006.

Species <sup>a</sup>	Observation Id <sup>b</sup>	No.		Date	Observer(s) <sup>c</sup>	Code <sup>d</sup>	Town	Range	Section	Block	Priority <sup>e</sup>	Twp. Name	County
		Obs.	Obs.										
AMBI	AMBI4900440	1	5/30/2006	BB,PS,LS	X	56N	32W	32	2	N	Calumet	Houghton	
AMWO	AMWO4900440	2	5/30/2006	BB,PS,LS	X	56N	32W	32	2	N	Calumet	Houghton	
AMWO	AMWO490483702	1	6/16/2006	PB,LM	X	22N	01W	18	2	N/A	Richfield	Roscommon	
AMWO	AMWO4900638	1	5/31/2006	BB,PS,LS	X	50N	37W	16	2	N	Baraga	Baraga	
AMWO	AMWO4900524	1	6/1/2006	BB,PS,LS	X	45N	32W	7	2	Y	Crystal Falls	Iron	
AMWO	AMWO4900526	1	6/1/2006	BB,PS,LS	X	45N	33W	27	4	N	Hematite	Iron	
AMWO	AMWO490210102	1	6/7/2006	PS,LS	X	02N	16W	36	4	Y	Ganges	Allegan	
BADO	BADO49003002	2	5/29/2006	BB,PS,LS	X	47N	43W	33	3	N	Marenisco	Gogebic	
BADO	BADO4900320	2	5/29/2006	BB,PS,LS	X	46N	44W	4	2	N	Marenisco	Gogebic	
BADO	BADO490484502	1	6/16/2006	PB,LM	X	23N	02W	25	4	N/A	Higgins	Roscommon	
EASO	EASO49005202	1	6/1/2006	BB,PS,LS	X	45N	32W	6	2	Y	Crystal Falls	Iron	
GHOW	GHOW490383102	1	6/12/2006	PB,LM	X	14N	09W	21	3	N/A	Austin	Mecosta	
KILL	KILL490483502	1	6/16/2006	PB,LM	X	22N	01W	19	3	Y	Richfield	Roscommon	
RUGR	RUGR490172502	1	6/14/2006	PB,LM	X	22N	15W	22	4	Y	Brown	Manistec	

<sup>a</sup>Species: AMBI = American Bittern, AMWO = American Woodcock, BADO = Barred Owl, EASO = Eastern Screech Owl, GHOW = Great Horned Owl, KILL = Killdeer, RUGR = Roughed Grouse.

<sup>b</sup>Owl observation ID = Species+Route+Station (suffix 02 = second visit).

<sup>c</sup>Observers: BB = Barb Barton; PB = Pamela Bean, LM = Lisa McArthur, PS = Paula Shock, LS = Lauren Solomon.

<sup>d</sup>Breeding criteria codes: # = species observed in suitable nesting habitat during its breeding season; X = singing male present in suitable nesting habitat during its breeding season.

<sup>e</sup>Priority survey block: Y = yes and N = no.

**APPENDIX B**

**Habitat Descriptions**

## Habitat Descriptions

### Description of Classes Used in the Michigan Statewide Map

This is an explanation of the values present in the Michigan statewide raster map, with the associated rules used to arrive at the class labels. Arabic numbers in bold type are those included in the map. Classification scheme should be viewed as a series of sequential if-then statements. Order counts. For example, consider a forest stand where 50% of the canopy is Aspen, 20% Maple, and 30% Pine. Because Aspen precedes Upland Mix in the decision rules, the forest types out as Aspen (413) rather than Mixed Deciduous (419). Class numbers were chosen in part to be similar to existing MIRIS Land Cover labels and their decision rule sequence does not necessarily match the numeric order (for example class 110 follows class 122 in the decision rules). Number in parentheses following classification name is the grid value in the raster map.

#### I Urban

Land areas greater than 10% man-made structures including paved and gravel roads and parking lots.

**121** Airports (3)

Impervious land within airport grounds, including runways.

**122** Road/Parking Lot (4)

Roads or parking lots.

**123** High Intensity Urban (2)

Land area greater than 25% solid impervious cover made from man-made materials, other than airports, roads, or parking lots.

**11** Low Intensity Urban (1)

Land area is greater than 10% and less than 25% man-made structures including paved and gravel roads and parking lots.

#### II Agricultural

Land intensely managed for vegetation production excluding forestry.

**2111** Non-vegetated Farmland (5)

Land area tilled for crop production with less than 25% currently vegetated.

**2112** Row crops (6)

Vegetation consists of annual crops planted in rows (e.g. corn, soybeans).

**2113/212** Forage Crops/ Non-tilled herbaceous agriculture (7)

Vegetation used for fodder production (e.g. alfalfa, hay). Also includes land used for pasture, or non-tilled herbaceous agriculture.

**222** Orchards/Vineyards/Nursery (9)

Woody trees not grown for Christmas trees.

#### UPLAND

Land not periodically flooded nor on hydric soils.

#### III Upland Openland

Less than 25% of land area is covered by tree canopy, and greater than 25% of land area is vegetated.

**350** Parks/Golf Courses (13)

Maintained for recreational purposes.

**320/330** Upland Shrub/Low Density Trees (12)

The combination of woody shrubs and tree canopy (woody cover) covers more than 25% of the land area.

- 310** Herbaceous Openland (10)  
Less than 25% of land area consists of woody cover.
- IV Upland Forest  
Proportion of trees exceeds 25% of land area.
- A. Upland Deciduous Forest  
Proportion of deciduous trees exceeds 60% of the canopy.
- 411** Northern Hardwood Association (14)  
Combination of Maples, Beech, Basswood, White Ash, Cherry, Yellow Birch exceeds 60% of the canopy.
- 412** Oak Association (15)  
Proportion of Oaks exceeds 60% of the canopy.
- 413** Aspen Association (16)  
Proportion of Aspen exceeds 40% of the canopy.
- 414** Other Upland Deciduous (17)  
Proportion of any other single species exceeds 60% of the canopy.
- 419** Mixed Upland Deciduous (18)  
Proportion of deciduous trees exceeds 60% of the canopy.
- B. Upland Coniferous Forest
- 421/422** Pines (19)  
Proportion of pines exceeds 60% of the canopy.
- 423** Other Upland Conifers (20)  
Proportion of non-pine upland conifers exceeds 60% of the canopy.
- 429** Mixed Upland Conifers (21)  
Proportion of coniferous trees exceeds 60% of the canopy.
- 43** Upland Mixed Forest (22)  
Mixed forest not falling into any other category. Proportion of conifers to deciduous ranges from 40%:60% to 60%:40%.
- V. Water
- 50** Water (23)  
Proportion of open water exceeds 75% of land area.
- LOWLAND  
Land is periodically flooded and/or on hydric soils.
- VI. Lowland Forest  
Proportion of trees exceeds 25% of land area.
- 611** Lowland Deciduous Forest (24)  
Proportion of deciduous trees exceeds 60% of the canopy.
- 612** Lowland Coniferous Forest (25)  
Proportion of coniferous trees exceeds 60% of the canopy.
- 613** Lowland Mixed Forest (26)  
Mixed forest not falling into any other category. Proportion of conifers to deciduous ranges from 40%:60% to 60%:40%.
- VII. Non-forested Wetlands  
Proportion of trees is less than or equal to 25% of land area.
- 621** Floating Aquatic (27)  
Proportion of floating aquatic vegetation exceeds 60% of non-water cover.
- 622** Lowland Shrub (28)  
Proportion of lowland shrub exceeds 60% of non-water cover.

**623** Emergent Wetland (29)

Proportion of emergent vegetation exceeds 60% of non-water cover.

**629** Mixed Non-forest Wetland (30)

Non-forested wetlands not falling into any other category.

VIII Bare/Sparsely Vegetated

Land is less than 25% vegetated.

**710** Sand/Soil (31)

Land cover is formed primarily of sand or bare soil.

**720** Exposed Rock (32)

Land cover is formed of solid rock.

**730** Mud Flats (33)

If periodically flooded.

**790** Other Bare/Sparsely Vegetated (35)