Whip-poor-will and Common Nighthawk Surveys in Support of the Michigan Breeding Bird Atlas II – 2007 Final Report

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For:

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Cover Photo: Whip-poor-will on South Manitou Island, 2007. Susan McMahon

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EXECUTIVE SUMMARY

In 2004, the Michigan Natural Features Inventory proposed a three-year statewide survey of Nightjars (Family Caprimulgidae) to increase the data available for the Michigan Breeding Bird Atlas (MBBA) II project. This report presents the results of the final year of the surveys. Fifteen (15) randomly selected North American Breeding Bird Survey (BBS) routes were surveyed in 2007 from mid-May to the end of June. Ten point count stations were situated at approximately 1.6-km (1.0-mi) intervals along 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^2) MBBAII survey blocks.

During the 2007 survey, 35 Whip-poor-wills and three Common Nighthawks were observed during the route surveys. They were observed in 14 MBBA II survey blocks, primarily in the Upper Peninsula (UP). The highest observation rates for both species occurred during the second period in the UP. Five incidental bird species were recorded from 28 survey blocks. Killdeer was the most commonly observed incidental species (13 blocks). Comparisons of the number of responses observed during equal length time periods occurring before and after broadcasts indicated that response to calls by either species did not increase after broadcasts

During the three-year Nocturnal Bird Survey, a total of 187 Whip-poor-wills and 104 Common Nighthawks were observed on 137 MBBA II survey blocks. The highest number of probable breeding records was documented in the UP. The most common cover types for points with Whip-poor-wills were the Northern hardwood Association and for Common Nighthawks Herbaceous Open Land. These cover types are within the 0.25 km buffer zone around each point, but do not necessarily represent the habitat types used by each species. Where habitat type could be identified by surveyors, the majority of Caprimulgid occurrences were in clear-cut forests. Further research on habitat preferences of Whip-poor-wills and Common Nighthawks is needed to better understand their habitat needs in Michigan.

To summarize the 2005-2007 Nocturnal Bird Survey results, a total of 187 Whip-poor-wills and 104 Common Nighthawks were observed on 137 MBBAA II survey blocks. The highest number of probable breeding records was documented in the UP. The most common cover types for points with Whip-poor-wills were the Northern hardwood Association and for Common Nighthawks Herbaceous Open Land. These cover types are within the 0.25 km buffer zone around each point, but do not necessarily represent the habitat types used by each species. Where habitat type could be identified by surveyors, the majority of Caprimulgid occurrences were in clear-cut forests. Further research on habitat preferences of Whip-poor-wills and Common Nighthawks is needed to better understand their habitat needs in Michigan.

The survey protocol developed in this project was modified in 2006 to exclude points that contained a significant percentage of unsuitable habitats in order to maximize survey efforts. In the future, the percentage of unsuitable cover types that were excluded could be increased, as there were still many points surveyed that contained unsuitable habitat. Maximizing survey effort is extremely important when there is such a short time period in which to survey. By omitting broadcast calling from the protocol, surveyors could cover more points in an evening, which would also maximize survey effort.

INTRODUCTION

The Michigan Natural Features Inventory proposed to conduct a three-year statewide survey of Nightjars (Family 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 (MBBA) 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 the breeding distribution 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 . Five routes were randomly selected in each of the SLP, NLP, and UP zones (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 ≥70% of these points was considered an unsuitable route and discarded. As a result of this selection process, six routes were selected in the SLP, four in the NLP, and five in the UP to be surveyed in 2007.

Due to the limited amount of survey time each evening, 10 consecutive points approximately one mile apart were selected for censusing on each route, beginning with a randomly selected starting point (Table 1). When 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 and continued at the first point, if time allowed.

Routes were surveyed 14 May - 21 June, 2007 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

Surveyors collected measurements of wind speed, temperature, precipitation, and noise level at each point. Wind speed and temperature were measured using a Kestrel 3000 unit. Precipitation was ranked as none or light. We ranked ambient noise level on a scale of 1 to 4, with 1 equating to complete silence and 4 being constant loud noise making hearing calling birds impossible. When calling birds were located, their orientation was recorded using a compass and their distance from the vehicle estimated using 5 distance categories (<0.10 mi, 0.10-0.25 mi, 0.25-0.50 mi, 0.50-0.75 mi, and >1 mi). Survey 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 Common 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.

Calling Efficacy

We used the Sign Test to determine if the number of Whip-poor-will observations recorded before and after conspecific broadcasts was significantly different than what would be expected. There were not enough data for Common Nighthawks to conduct the analysis in 2007. Binomial distribution was assumed since only the presence or absence of a species before or after a broadcast was considered. The Sign Test is a nonparametric paired-sample test developed from the concept of the binomial test, and is essentially a binomial test with p hypothesized to be 0.50 (Zar 1996). We only used data from stations where Whip-poor-wills were heard before (+) or after (-) conspecific calls were played. Testing was conducted by survey period, since responsiveness may vary due to breeding phenology.

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 type composite variables: 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 mean proportion (ha/pt) of each cover type within ¼ km (250 m) of each survey point.

Summary of 2005-2007 Surveys

A summary of the Atlas Breeding Status from 2005-2007 survey data was compiled for the three-year study (see also Barton 2005, 2006). Final recommendations on survey protocol are based on three years of data collection.

RESULTS

Atlas Breeding Status – 2007 Surveys

We heard 35 Whip-poor-wills and 3 Common Nighthawks during surveys conducted at 141 points along 15 survey routes (Table 1). It was not possible to determine whether a calling bird located at the same point during different survey cycles was the same individual, however; observations by region are presented with duplicates both included and excluded for comparison (Table 2). The highest observation rates for Whip-poor-wills and Common Nighthawks occurred during the second cycle in the UP (Table 3). Overall observation rates for both species were higher in the UP.

We determined the breeding status for the two species on 14 MBBA II survey blocks (Table 4, Figures 2, 3). The highest number of probable breeding records was documented in the UP, Whip-poor-wills (10) and Common Nighthawks (3). Table A-1 (Appendix A) lists the nocturnal breeding data by survey block.

We observed breeding activity of five incidental species during the survey (Table 5). Killdeer (*Charadrius vociferus*) was the most commonly observed incidental species and recorded on 13 survey blocks, followed by American Woodcock (*Scolopax minor*) which was recorded from eight survey blocks. Barred Owl (*Strix varia*), Common Loon (*Gavia immer*) and Ruffed Grouse (*Bonasa umbellus*) were each observed in less than four blocks (Table 5). Incidental species data are summarized by survey block in Table A-2 (Appendix A).

Calling Efficacy

There was no significant difference in the number of Whip-poor-will responses occurring before and after conspecific broadcast in either the first (n=10, p=1.0) or second (n=9, p=1.0) survey periods. These results are similar to previous analyses (Barton 2004).

Surrounding Land Cover Characterization

The 2007 survey points were dominated by Forage crops/Non-tilled herbaceous (3.06 ha/pt) and Northern Hardwood Association (2.96 ha/pt) (Table 6). Both Common Nighthawk and Whip-poor-will points were dominated by Northern Hardwood Association (2.71 ha/pt, 9.12 ha/pt, respectively).

The dominant land cover types of all survey points using the composite variables were Forest-Upland Deciduous (5.26 ha/pt) (Table 7). Whip-poor-will points were dominated by Agricultural (4.76 ha/pt) and Common Nighthawk points were dominated by Forest-Upland Deciduous (10.80 ha/pt).

Summary of 2005-2007 Surveys

A total of 187 Whip-poor-wills and 104 Common Nighthawks were observed during 2005-2007 surveys at 998 points along 88 routes (Table A-3, Appendix A) (Barton 2005, 2006). Whip-poor-wills were most frequently observed during the second survey cycle in the UP; Common Nighthawks were observed at nearly the same frequency in both cycles but were more common in the NLP (Table 6). This coincides with the species' nesting period as Whip-poor-wills are known to breed later than Common Nighthawks

(Eastman 1991a and b). Breeding status was determined for the two species on 137 MBBA II survey blocks (Table 7, Figures 2, 3). The highest number of probable breeding records was documented in the UP with 51 Whip-poor-wills and 31 Common Nighthawks.

We observed breeding activity of nine incidental species during 2005-2007 surveys (Table 8, Table A-4, Appendix A). Killdeer (*Charadrius vociferus*) was the most commonly observed incidental species, being recorded from 14 survey blocks, followed by American Woodcock (*Scolopax minor*) which was observed on 19 survey blocks (Table 5). Incidental species data are summarized by survey block in Table A-4 (Appendix A).

DISCUSSION 2005-2007 SUMMARY

Most Whip-poor-will and Common Nighthawk occurrences recorded during this survey were associated with recently disturbed openings in undeveloped areas of the northern Lower and Upper Peninsulas. Surveys began at sunset and visibility was reduced as darkness advanced, so it was 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 seemed to be preferred by both species in 2005 (see Barton 2005). Whip-poor-wills were associated with red pine (*Pinus resinosa*) forests and open disturbed areas (gravel pits, early-successional fields, recently cut areas, and power line corridors) in New Hampshire, and were dependent on the juxtaposition of suitable forests for nesting and open lands for feeding (Wilson 2003, Hunt 2005). We observed higher proportions of open habitat surrounding points with Whip-poor-will and Common Nighthawk observations when compared to other survey points, which may indicate the need for recently disturbed areas near breeding sites. Further research on habitat preferences by both species in Michigan is warranted. While habitat analysis on a landscape level is important, nightjars are most likely restricting their activities to specific habitats (e.g. harvested pine forests, deciduous hardwoods) and these preferences can only be verified by on-the-ground research.

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

surveyed. In addition, using stratified random sampling reduced the chance of surveying unsuitable habitat. Our findings support those of Hunt (2006); Whip-poor-wills appear to be widely dispersed and may be limited to specific habitat types. Hunt (2006) 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 distributional survey. The objectives of distributional surveys are to verify existing records and to document new occurrences, and thus require more intensive survey effort than annual monitoring. The timing of surveys, however, may be adjusted as Whip-poor-will activity has been positively correlated with lunar cycles (Wilson and Watts 2006). Hunt (2006) recommends Whip-poor-will surveys be restricted to periods of high lunar illumination during peak periods of the breeding cycle. Our surveys targeted both Whip-poor-will and Common Nighthawks; therefore, further research on the effects of lunar cycles on Common Nighthawks are needed to determine whether survey periods should be adjusted in Michigan.

Long-term monitoring of Whip-poor-will and Common Nighthawk numbers and management practices at locations with high numbers of birds would provide information on both 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. Additional information on food preferences would also assist land managers in providing suitable habitat to maintain the needs of Michigan's nightjars.

The survey protocol developed in this project was modified in 2006 to exclude points that contained a significant percentage of unsuitable habitats in order to maximize survey efforts. In the future, the percentage of unsuitable cover types that was excluded could be increased, as there were still many points surveyed that contained unsuitable habitat. However, this process excludes urban and suburban areas that Common Nighthawks sometimes use for foraging, so specific surveys may be needed if monitoring of these sites is desired. Maximizing survey effort is extremely important when there is such a short time period in which to survey. Our analyses indicated that broadcasts did not increase the detection of these species, so by omitting broadcasts from the protocol, surveyors could maximize survey effort and cover more points in an evening.

ACKNOWLEDGEMENTS

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Table 1. Census routes and points for the 2007 nocturnal bird survey in Michigan. NLP = Northern-lower Peninsula, SLP = Southern-lower Peninsula, and UP = Upper Peninsula.

Location	Route	County	Start Point
SLP	49057	Lenawee	21
SLP	49055	Calhoun	19
SLP	49036	Kalamazoo	14
SLP	49034	Ionia/Kent	10
SLP	49070	Sanilac	6
SLP	49168	Oakland	15
NLP	49050	Midland	16
NLP	49045	Delta	7
NLP	49128	Wexford	14
NLP	49026	Charlevoix,/Antrim	19
UP	49002	Ontonagon	21
UP	49001	Ontonagon	15
UP	49007	Iron	21
UP	49009	Delta	14
UP	49025	Mackinac	17

Table 2. Summary of Whip-poor-will and Common Nighthawk observations by region during surveys in Michigan during 2007: a) total number of Whip-poor-wills and Common Nighthawks by region, and b) total number of Whip-poor-wills and Common Nighthawks by region with duplicate sightings during the second survey period omitted.

(a)

Species	SLP	NLP	UP	Totals
Whip-poor-wills	0	4	31	35
Common Nighthawks	0	0	3	3

(b)

Species	SLP	NLP	UP	Totals
Whip-poor-wills	0	2	18	20
Common Nighthawks	0	0	3	3

Table 3. Summary of Whip-poor-will and Common Nighthawk observations by region and survey period recorded during surveys conducted in Michigan in 2007. Survey Period 1 = 14 May – 1 June, Survey Period 2 = 4 June – 21 June.

Region[a]	Survey Period	No. Points	No. Whip-poor-wills		No. Nighthawks		Total	
			No. Obs.[b]	Mean[c]	No. Obs.	Mean	No. Obs.	Mean
SLP	1	33	0	-	0	-	0	-
	2	30	0	-	0	-	0	-
	Subtotal	63	0	-	0	-	0	-
NLP	1	30	2	.07	0	-	2	.07
	2	50	2	.04	0	-	2	.04
	Subtotal	80	4	.05	0	-	4	.05
UP	1	50	13	.26	1	.02	14	.28
	2	50	18	.36	2	.04	20	.40
	Subtotal	100	31	.31	3	.06	34	.34
Overall	1	113	4	.04	1	<.01	5	.04
	2	130	31	.24	2	.02	33	.25
	Total	243	35	.14	3	.01	38	.16

[a]SLP = Southern Lower Peninsula, NLP = Northern Lower Peninsula, and UP = Upper Peninsula.

[b]Number of birds observed.

[c]Average number of birds per point surveyed.

Table 4. Number of blocks with Whip-poor-will and Common Nighthawk observations by region from surveys conducted in Michigan in 2007.

Species	SLP	NLP	UP	Total
Whip-poor-wills	0	1	10	11
Common Nighthawk	0	0	3	3
Totals	0	1	13	14

Table 5. Number of blocks with incidental species observations by region from Whip-poor-will and Common Nighthawk surveys in Michigan in 2007.

Species	SLP	NLP	UP	Total
American Woodcock	2	3	3	8
Barred Owl	0	1	2	3
Common Loon	0	1	1	2
Killdeer	5	3	5	13
Ruffed Grouse	0	0	3	3
Total	7	8	14	29

Table 6. Land cover types observed within ¼ km radius of points for nocturnal birds surveyed in Michigan in 2007. Highest values are in bold.

Class	Habitat	All Survey Points (n=143) (ha/pt)	Whip-poor-will Points (n=13) (ha/pt)	Common Nighthawk Points (n=3) (ha/pt)
2113	Forage Crops / Non-tilled herbaceous	**3.06**	1.88	0.03
411	Northern Hardwood Association	2.96	**2.71**	**9.12**
310	Herbaceous Openland	1.90	2.54	2.16
413	Aspen Association	1.61	1.95	1.68
2112	Row Crops	1.45	0.00	0.00
122	Roads / Paved	1.39	2.14	1.20
43	Upland Mixed Forest	0.88	1.57	0.78
419	Mixed Upland Deciduous	0.77	0.18	0.00
421	Pines	0.70	2.06	2.10
412	Oak Association	0.68	0.11	0.00
611	Lowland Deciduous Forest	0.65	0.97	0.24
622	Lowland Shrub	0.58	0.35	0.09
11	Low Intensity Urban	0.55	0.12	0.36
50	Water	0.55	0.08	0.00
320	Upland Shrub / Low-density trees	0.49	0.84	0.69
612	Lowland Coniferous Forest	0.39	0.63	0.03
629	Mixed Non-Forest Wetland	0.22	0.15	0.00
123	High Intensity Urban	0.16	0.08	0.24
423	Other Upland Conifers	0.10	0.66	0.06
429	Mixed Upland Conifers	0.10	0.46	0.63
623	Emergent Wetland	0.08	0.01	0.12
222	Orchards / Vineyards / Nurseries	0.05	0.00	0.00
613	Lowland Mixed Forest	0.04	0.02	0.00
350	Parks / Golf Courses	0.04	0.00	0.00
621	Floating Aquatic	0.03	0.01	0.00
710	Sand / Soil	0.02	0.01	0.03
790	Other Bare / Sparsely Vegetated	0.02	0.00	0.00
2111	Non-vegetated Farmland	0.01	0.01	0.00
414	Other Upland Deciduous	0.01	0.00	0.00

Table 7. Composite variables of all 2007 survey points, Whip-poor-will, and Common Nighthawk points. Highest values are bolded.

Classes	Land Cover Type	Total Points (n=143) mean (ha/pt)	Whip-poor-will Points (n=13) mean (ha/pt)	Common Nighthawk Points (n=3) mean (ha/pt)
411+412+413+414	Forest -Upland Deciduous	**5.26**	2.72	**10.80**
2111+2112+ 2113+222	Agricultural	4.57	**4.76**	0.03
421+423	Forest - Pines	0.80	2.55	2.16
710+790+310	Other Open Areas	1.94	1.89	2.19
122+123+11+350	Developed	2.14	2.33	1.80
611+612+613+50+621+622+623+629	Wetlands	2.54	2.22	0.48
429+43+419	Mixed Forest	1.74	2.22	1.41
320	Upland Shrub / Low-density trees	0.49	0.84	0.69

Table 8. Summary of Whip-poor-will and Common Nighthawk observations by region and survey period recorded during surveys conducted in Michigan in 2005-2007.

Region[a]	Survey Period	No. Points	No. Whip-poor-wills		No. Nighthawks		Total	
			No. Obs.[b]	Mean[c]	No. Obs.	Mean	No. Obs.	Mean
SLP	1	143	4	0.02	3	0.03	7	0.02
	2	141	12	0.06	0	0.00	12	0.04
	Subtotal	284	16	0.09	3	0.03	19	0.07
NLP	1	168	14	0.07	18	0.18	32	0.11
	2	181	41	0.22	35	0.34	76	0.26
	Subtotal	349	55	0.29	55	0.54	110	0.38
UP	1	173	45	0.24	28	0.27	73	0.25
	2	192	71	0.38	18	0.18	89	0.31
	Subtotal	365	116	0.62	46	0.45	162	0.56
Overall	1	484	63	0.34	49	0.48	112	0.39
	2	514	124	0.66	53	0.52	177	0.61
	Total	998	187	1.00	104	1.00	291	1.00

[a]SLP = Southern Lower Peninsula, NLP = Northern Lower Peninsula, UP = Upper Peninsula.

[b]Number of birds observed.

[c]Average number of birds per point surveyed.

Table 9. Summary of Whip-poor-will and Common Nighthawk observations by region during surveys in Michigan in 2005-2007: a) total number of Whip-poor-wills and Common Nighthawks by region from 2005-2007 surveys, and b) total number of Whip-poor-wills and Common Nighthawks by region with duplicate sightings by point omitted (Barton 2005, 2006, unpublished data).

(a)

Species	SLP	NLP	UP	Totals
Whip-poor-wills	16	55	116	187
Common Nighthawks	3	55	46	104

(b)

Species	SLP	NLP	UP	Totals
Whip-poor-wills	15	27	105	147
Common Nighthawks	3	37	37	77

Table 10. Number of blocks with Whip-poor-will and Common Nighthawk observations by region from surveys conducted in Michigan in 2005-2007.

Species	SLP	NLP	UP	Total
Whip-poor-wills	9	19	51	79
Common Nighthawk	2	25	31	58
Totals	11	44	82	137

Table 11. Number of blocks with incidental species observations by region from Whip-poor-will and Common Nighthawk surveys in Michigan in 2005-2007.

Species	SLP	NLP	UP	Total
American Woodcock	3	8	8	19
American Bittern	0	0	1	1
Barred Owl	0	6	2	8
Eastern Screech Owl	0	0	1	1
Great Horned Owl	1	1	0	2
Common Loon	0	2	1	3
Killdeer	5	4	5	14
Sand Hill Crane	0	1	0	1
Ruffed Grouse	0	1	3	4
Total	9	23	21	53
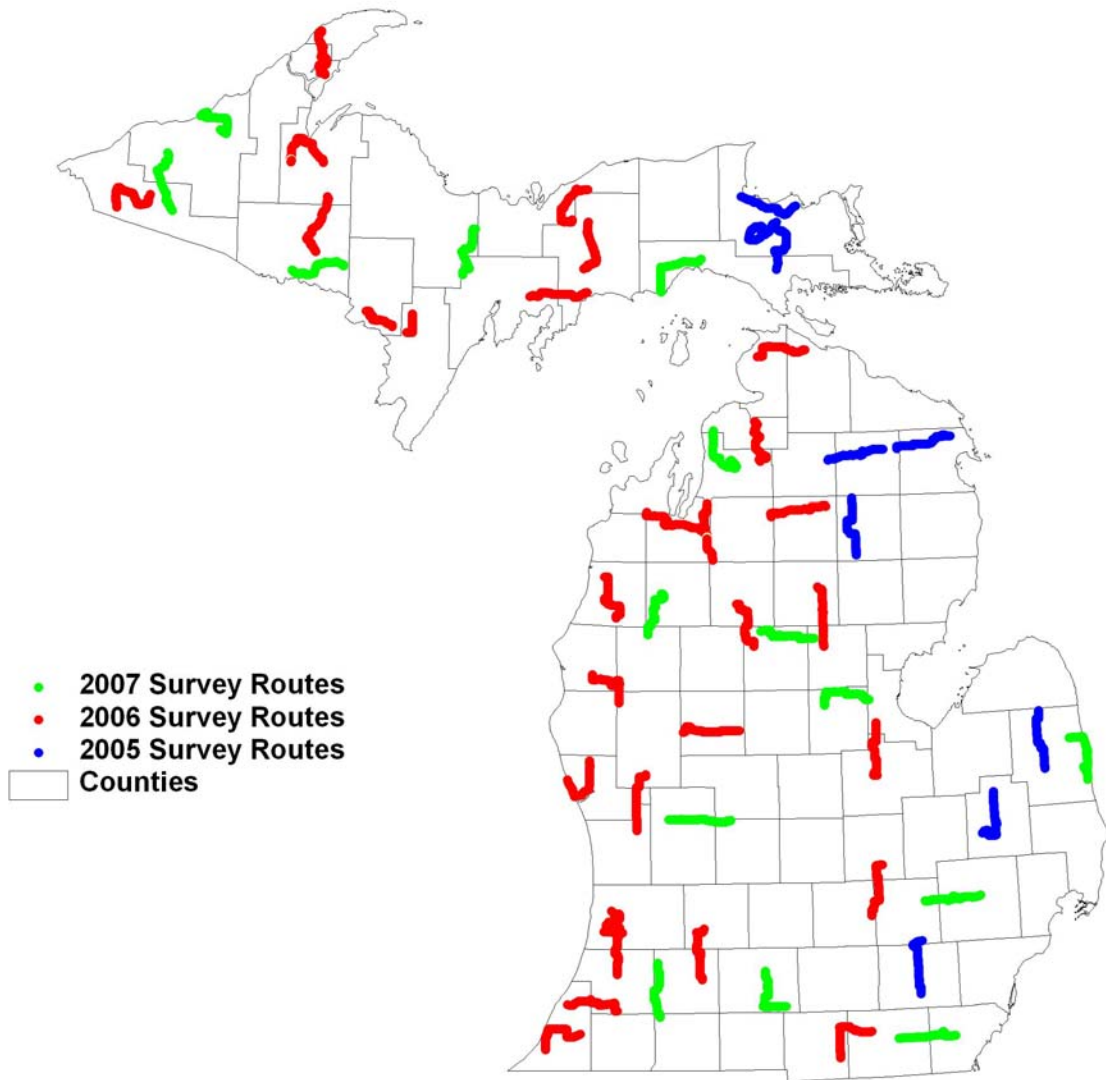
Figure 1. 2005-2007 Nocturnal Bird Survey routes in Michigan.
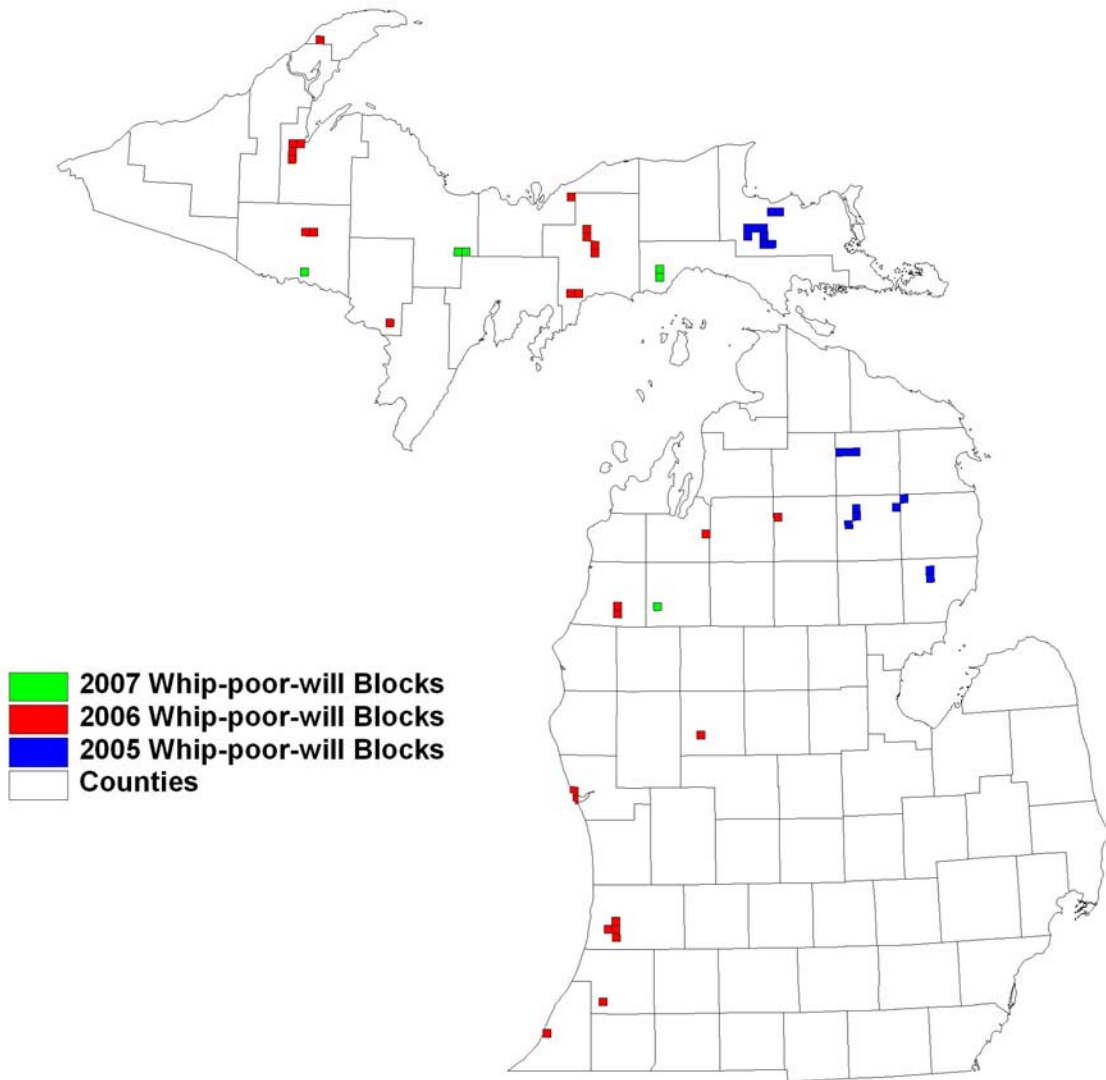
Figure 2. MBBA II survey blocks with Whip-poor-will observations during surveys conducted in Michigan during 2005-2007.
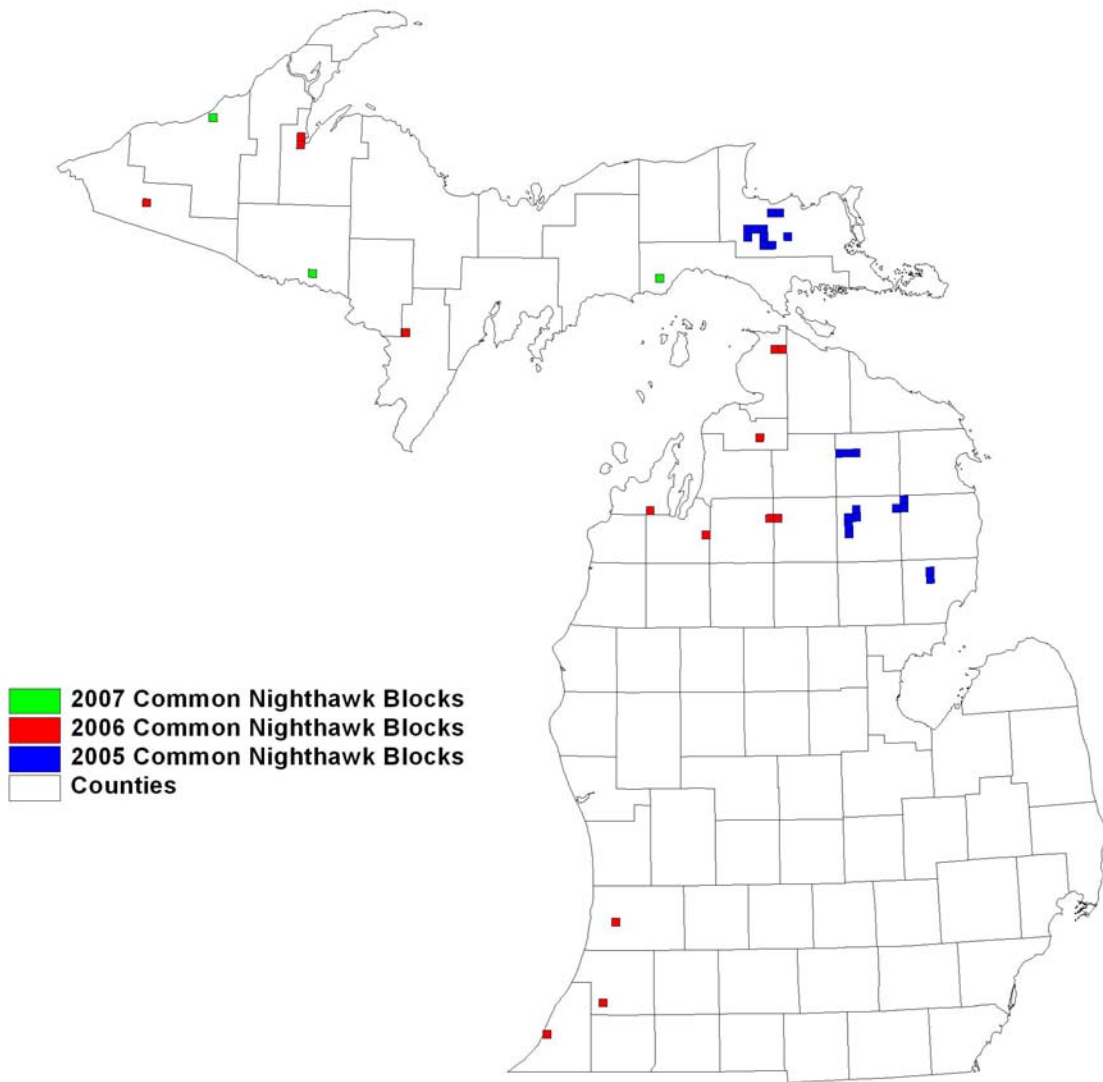
Figure 3. MBBA II survey blocks with Common Nighthawk observations during surveys conducted in Michigan during 2005-2007.
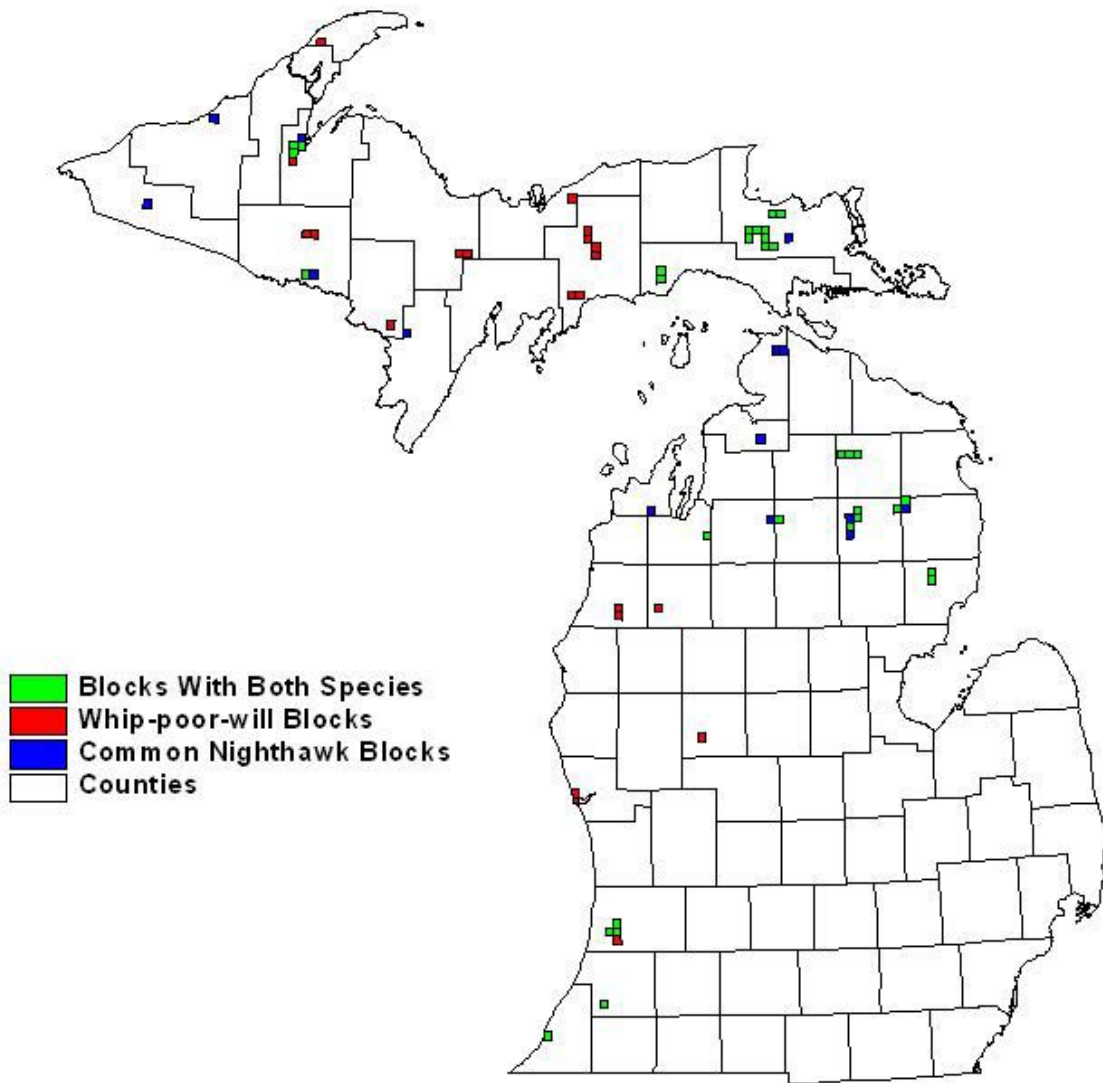
Figure 4. MBBA II survey blocks with both Whip-poor-will and Common Nighthawk observations during surveys conducted in Michigan in 2005-2007.

Appendix A

Table A-1. Whip-poor-will and Common Nighthawk observation data by MBBA II survey block from surveys conducted in Michigan in 2007.

Table A-2. Incidental species observation data by MBBA II survey block from Whip-poor-will and Common Nighthawk surveys conducted in Michigan in 2007.

Table A-1. Whip-poor-will and Common Nighthawk observation data by MBBA II survey block from surveys conducted in Michigan in 2007.

Species[a]	Observation Id[b]	No. Obs.	Date	Observer(s)[c]	Code[d]	Town	Range	Section	Block	Priority[e]	Twp. Name	County
CONI	490012101	1	05/30/2007	PB,MN	X	52N	39W	35	4	N	Ontonagon	Ontonagon
CONI	490072902	1	06/20/2007	PB,MN	X	42N	33W	12	1	Y	Mastodon	Iron
CONI	490253702	1	06/21/2007	PB,MN	X	42N	11W	4	2	N	Newton	Mackinac
WPWI	490073502	2	06/20/2007	PB,MN	X	42N	33W	16	1	Y	Mastondon	Iron
WPWI	490073701	2	05/31/2007	PB,MN	X	42N	33W	17	1	Y	Mastondon	Iron
WPWI	490073702	2	06/20/2007	PB,MN	X	42N	33W	17	1	Y	Mastondon	Iron
WPWI	490073901	1	05/31/2007	PB,MN	X	42N	33W	17	1	Y	Mastondon	Iron
WPWI	490092202	1	06/17/2007	PB,MN	X	44N	23W	20	3	Y	Turin	Marquette
WPWI	490092401	2	05/28/2007	PB,MN	X	44N	23W	19	3	Y	Turin	Marquette
WPWI	490092402	3	06/17/2007	PB,MN	X	44N	23W	19	3	Y	Turin	Marquette
WPWI	490092601	1	05/28/2007	PB,MN	X	44N	23W	30	3	Y	Turin	Marquette
WPWI	490092801	1	05/28/2007	PB,MN	X	44N	24W	25	4	N	Turin	Marquette
WPWI	490093002	3	06/17/2007	PB,MN	X	44N	23W	31	3	Y	Turin	Marquette
WPWI	490253301	1	06/01/2007	PB,MN	X	43N	11W	28	3	N	Newton	Mackinac
WPWI	490253302	1	06/21/2007	PB,MN	X	43N	11W	28	3	N	Newton	Mackinac
WPWI	490253501	3	06/01/2007	PB,MN	X	43N	11W	33	3	N	Newton	Mackinac
WPWI	490253502	2	06/21/2007	PB,MN	X	43N	11W	33	3	N	Newton	Mackinac
WPWI	490253701	2	06/01/2007	PB,MN	X	42N	11W	4	2	N	Newton	Mackinac
WPWI	490253702	4	06/21/2007	PB,MN	X	42N	11W	4	2	N	Newton	Mackinac
WPWI	491283001	1	05/22/2007	PB,MN	X	22N	12W	27	4	N	Slagle	Wexford
WPWI	491283201	1	05/22/2007	PB,MN	X	22N	12W	27	4	N	Slagle	Wexford
WPWI	491283202	2	06/14/2007	PB,MN	X	22N	12W	27	4	N	Slagle	Wexford

[a]Species: CONI - Common Nighthawk; WPWI = Whip-poor-will

[b]Observation ID = Species+Route+Station (suffix "02" = second visit)

[c]Observers: PB = Pamela Bean, MN = Melissa Nicholsen

[d]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.

[e]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 2007.

Species[a]	Observation Id[b]	No. Obs.	Date	Observer(s)[c]	Code[d]	Town	Range	Section	Block	Priority[e]	Twp. Name	County
AMWO	BADO4900121	1	05/30/2007	PB, MN	X	52N	39W	35	4	N	Ontonagon	Ontonagon
AMWO	AMWO4900926	1	05/23/2007	PB, MN	X	44N	23W	30	3	Y	Turin	Marquette
AMWO	AMWD4902527	1	05/31/2007	PB, MN	X	43N	11W	23	4	N	Newton	Mackinac
AMWO	COLO4902619	1	05/20/2007	PB, MN	X	31N	08W	16	2	Y	Central Lake	Antrim
AMWO	AMWO4903422	1	05/16/2007	BB, PB, MN	X	08N	09W	4	2	Y	Grattan	Kent
AMWO	AMWO4903626	3	05/17/2007	PB, MN	X	03S	12W	19	3	Y	Texas	Kalamazoo
AMWO	AMWO4907012	1	05/20/2007	PB, MN	X	12N	16E	4	2	Y	Forester	Sanilac
AMWO	RUGR4912816	1	06/15/2007	PB, MN	X	21N	12W	22	4	Y	South Branch	Wexford
BADO	AMWO4900127	1	05/30/2007	PB, MN	X	52N	39W	27	4	N	Ontonagon	Ontonagon
BADO	COLO4900735	1	05/30/2007	PB, MN	X	42N	33W	16	2	N	Mastodon	Iron
BADO	RUGR4905413	1	06/14/2007	PB, MN	X	20N	03W	28	3	N	Franklin	Clare
COLO	BADO4900117	1	05/28/2007	PB, MN	X	52N	38W	33	3	N	Ontonagon	Ontonagon
COLO	BADO4902631	1	06/01/2007	PB, MN	X	30N	08W	1	1	Y	Forest Home	Antrim
KILL	KILL490572501	1	05/14/2007	PB, MN	X	06S	06E	30	3	Y	Dundee	Monroe
KILL	KILL491681901	1	05/15/2007	PB, MN	X	03N	08E	17	2	Y	White Lake	Oakland
KILL	KILL490093201	1	05/28/2007	PB, MN	X	43N	23W	6	2	Y	Maple Ridge	Delta
KILL	KILL490092601	1	05/28/2007	PB, MN	X	44N	23W	30	3	Y	Turin	Marquette
KILL	KILL490092401	1	05/28/2007	PB, MN	X	44N	23W	19	3	Y	Turin	Marquette
KILL	KILL490092201	1	05/28/2007	PB, MN	X	44N	23W	20	3	Y	Turin	Marquette
KILL	KILL490092001	1	05/28/2007	PB, MN	X	44N	23W	21	3	Y	Turin	Marquette
KILL	KILL490502401	1	05/21/2007	PB, MN	X	16N	01E	16	2	N	Hope	Midland
KILL	KILL490502201	1	05/21/2007	PB, MN	X	16N	01W	12	1	Y	Edenville	Midland
KILL	KILL490502001	1	05/21/2007	PB, MN	X	16N	01W	11	1	Y	Edenville	Midland
KILL	KILL490702401	1	05/20/2007	PB, MN	X	11N	16E	2	1	Y	Sanilac	Sanilac
KILL	KILL490700601	1	05/20/2007	PB, MN	X	12N	16E	6	2	Y	Forester	Sanilac
KILL	KILL490340101	1	05/16/2007	PB, MN	X	08N	08W	6	2	Y	Otisco	Ionia
RUGR	RUGR490011902	1	06/16/2007	PB, MN	X	52N	38W	29	3	N	Ontonagon	Ontonagon
RUGR	RUGR490012702	1	06/19/2007	PB, MN	X	52N	39W	27	4	N	Ontonagon	Ontonagon
RUGR	RUGR490012902	1	06/19/2007	PB, MN	X	52N	39W	33	3	N	Ontonagon	Ontonagon

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 Open land

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 Open land (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   <u>Sand/Soil</u> (31)

Land cover is formed primarily of sand or bare soil.

720   <u>Exposed Rock</u> (32)

Land cover is formed of solid rock.

730   <u>Mud Flats</u> (33)

If periodically flooded.

790   <u>Other Bare/Sparsely Vegetated</u> (35)