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Breeding Birds and Associated Upland Habitats of Sherburne National Wildlife Refuge

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BREEDING BIRDS AND ASSOCIATED UPLAND HABITATS OF SHERBURNE NATIONAL WILDLIFE REFUGE

by

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Chairperson

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Kent A. Sundseth

Sherburne National Wildlife Refuge supports a variety of upland habitats. These upland habitats may be divided into four main types: oak dominated woodlands, oak savanna, grassland and conifer plantations. Each of these habitats occupies a location along a vegetation gradient which begins with open grassland and ends with a stand of densely planted conifers. As the vegetation changes along the gradient so do the species of birds breeding there.

During the spring and summer months of 1994 -1996, a network of 73 survey points was established in the four main habitat types across the refuge. In 1995 and 1996 these points were sampled for breeding birds using a standardized point count method. Baseline data on the relative abundance and distribution of breeding birds in the upland habitats was established. In the summer of 1996 the vegetation surrounding most of the

survey points was sampled using a standardized relevé method. Information on vegetation structure and species composition was collected. Some patterns and associations between breeding birds and habitats were noted.

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Approved by Research Committee:

Alfred H. Grewe, Jr.

Alfred H. Grewe, Jr. Chairperson

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Chapter I

INTRODUCTION

Sherburne National Wildlife Refuge (NWR) is located in east central Minnesota in Sherburne County (Figure 1). The refuge is 12,410 ha in size and comprises a variety of habitat types. The pools, wetlands and upland areas of this refuge provide valuable habitat for many bird species. Aquisition of lands for Sherburne NWR began in 1965. Since that time no detailed survey of breeding bird communities in upland areas of the refuge has been completed. Breeding Bird Surveys have been conducted for six years along the refuge service roads, but little information exists concerning breeding bird communities in off road areas.

Sherburne NWR is a mosaic of habitats. The refuge is made up of pools, streams and wetlands but a large amount consists of upland areas. The upland areas may be divided into four main habitat types: oak dominated woodland, oak savanna, grassland and conifer plantations. Each of these habitat types occupies a location along a vegetation gradient which begins with open grasslands and ends with densely planted conifers.

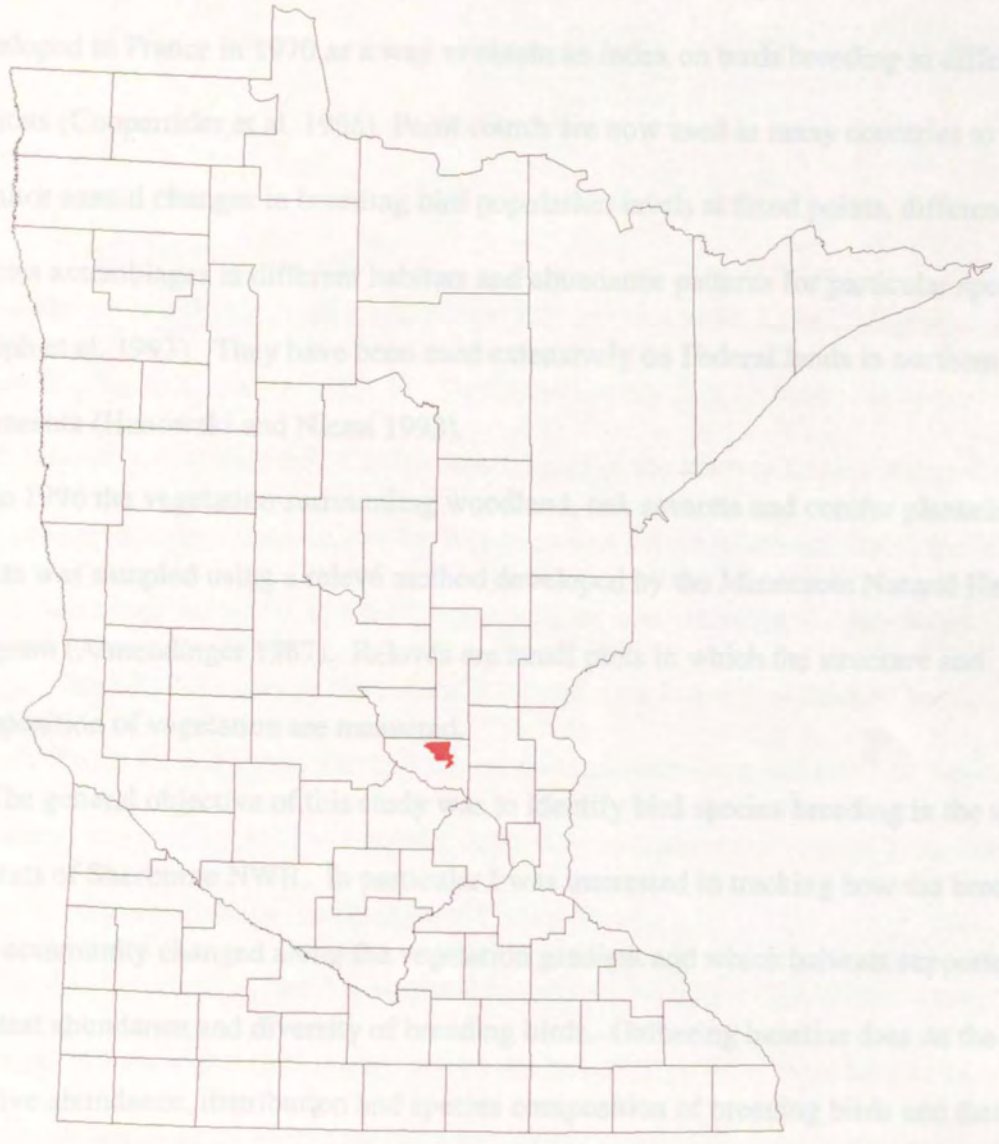


Figure 1. Location of Sherburne National Wildlife Refuge

In June of 1995 and 1996 point counts were used to sample breeding bird communities in the four main upland habitat types at Sherburne NWR. The point count method was developed in France in 1970 as a way to obtain an index on birds breeding in different habitats (Cooperrider et al. 1986). Point counts are now used in many countries to monitor annual changes in breeding bird population levels at fixed points, differences of species assemblages in different habitats and abundance patterns for particular species (Ralph et al. 1993). They have been used extensively on Federal lands in northern Minnesota (Hanowski and Niemi 1993).

In 1996 the vegetation surrounding woodland, oak savanna and conifer plantation points was sampled using a relevé method developed by the Minnesota Natural Heritage Program (Almendinger 1987). Relevés are small plots in which the structure and composition of vegetation are measured.

The general objective of this study was to identify bird species breeding in the upland habitats of Sherburne NWR. In particular I was interested in tracking how the breeding bird community changed along the vegetation gradient and which habitats supported the greatest abundance and diversity of breeding birds. Gathering baseline data on the relative abundance, distribution and species composition of breeding birds and their associated habitats provides information for future investigations and may assist in habitat management decisions.

Chapter II

STUDY AREA

Sherburne NWR is located approximately 25 km east of St. Cloud, Minnesota entirely within Sherburne County (Figure 1). Sherburne County Road 3 forms the approximate north boundary of the refuge. County Road 4 east of the town of Orrock forms the approximate southern boundary of the refuge except for the southwest tip of the refuge which runs along the banks of the St. Francis River south until the County Road 15 bridge. The east boundary of the refuge is located near and approximately parallel to County Roads 42 and 1 respective to the northern and southern halves. The west boundary runs northwest in an irregular fashion from the town of Orrock to the town of Santiago following refuge firebreaks and County Road 48.

The area surrounding Sherburne NWR is used primarily for agriculture. Corn, potatoes, soybeans and Christmas trees are the major crops with some land used as pasture for livestock as well. Use of center-pivot irrigation systems is increasingly common. Santiago and Orrock are the only towns which share common borders with the refuge.

Currently much of the surrounding area is being developed for residences. As this continues Sherburne NWR may become even more important as a haven for local wildlife.

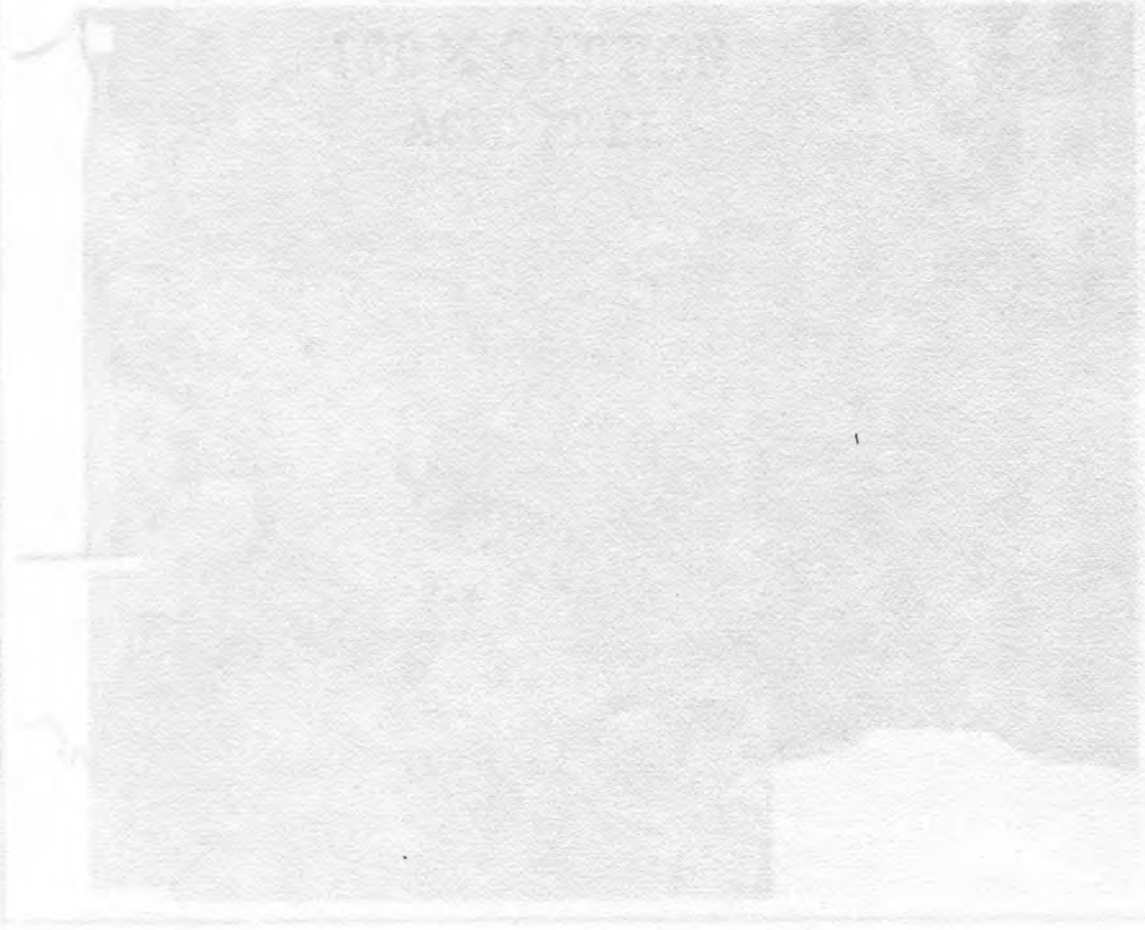
The St. Francis River is the primary source of water for Sherburne NWR. Water levels of the pools, ponds and wetlands of the refuge are controlled by man-made dikes and water control structures. South of the refuge, the St. Francis River flows into the Elk River which then flows into the Mississippi River.

Sherburne NWR is situated on the western lobe of the Anoka Sandplain. The Anoka Sandplain was formed during the most recent Wisconsin glacial period as the Grantsburg sub-lobe retreated (Cooper 1935). Streams from melting glaciers deposited sand and gravel over broad, level outwash plains. These sands covered most of the previous glacial deposits except for those which were high enough to avoid being covered (Wright 1972). A good example of this within Sherburne NWR is Blue Hill. In postglacial times prevailing winds caused the formation of dunes (Keen and Shane 1990). Dune topography is found in several areas within Sherburne NWR.

The refuge lies in the transition zone between the tallgrass prairie to the west, the big woods to the south, and the northern hardwood / conifer forests to the northeast. Prior to settlement the natural vegetation of the area was comprised mostly of oak savanna with extensive areas of wet prairie and smaller areas of oak woodland-brushland, dry prairie and aspen-oak land. Tamarack bogs and cattail marshes were also common (Marschner 1974).

Aquisition of land for the refuge began in 1965. Prior to this the land was used for agricultural purposes. Since its purchase the refuge has undergone continuous restoration efforts including the construction of water control structures, prescribed burns, reintroduction of native grasses and selective timber cutting.

This study area is comprised of the upland areas of Sherburne NWR. A series of survey points covering four of the major upland habitat types was constructed. There are five survey areas located across the refuge (Figures 2-6). Each survey point was assigned an alpha-numeric code. Oak dominated woodland points were labeled OW 1-30; oak savanna points were labeled OS 1-13; grassland points were labled GS 1-25 and conifer plantation points were labeled CP 1-5. These codes are labeled on the survey area maps.



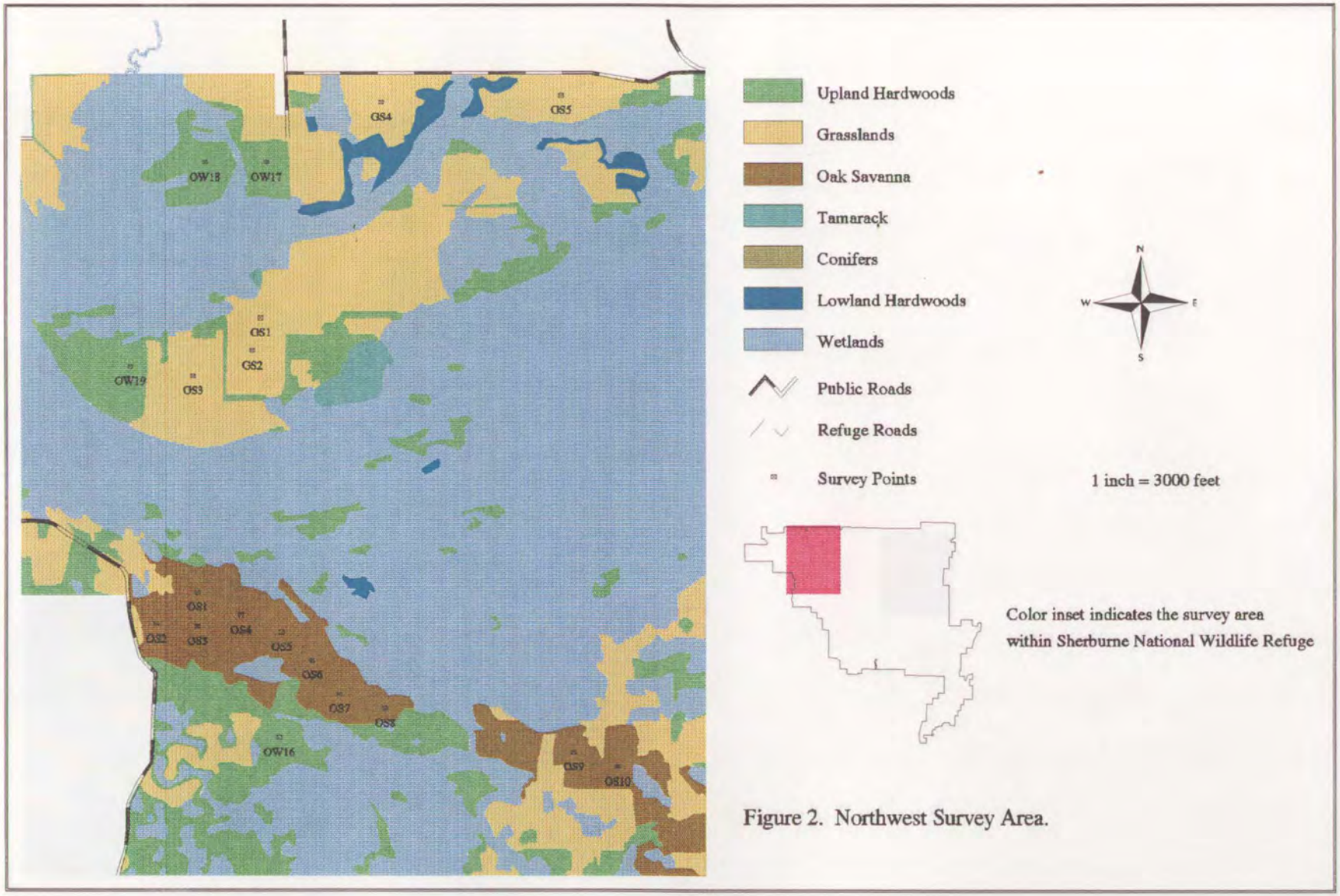


Figure 2. Northwest Survey Area.

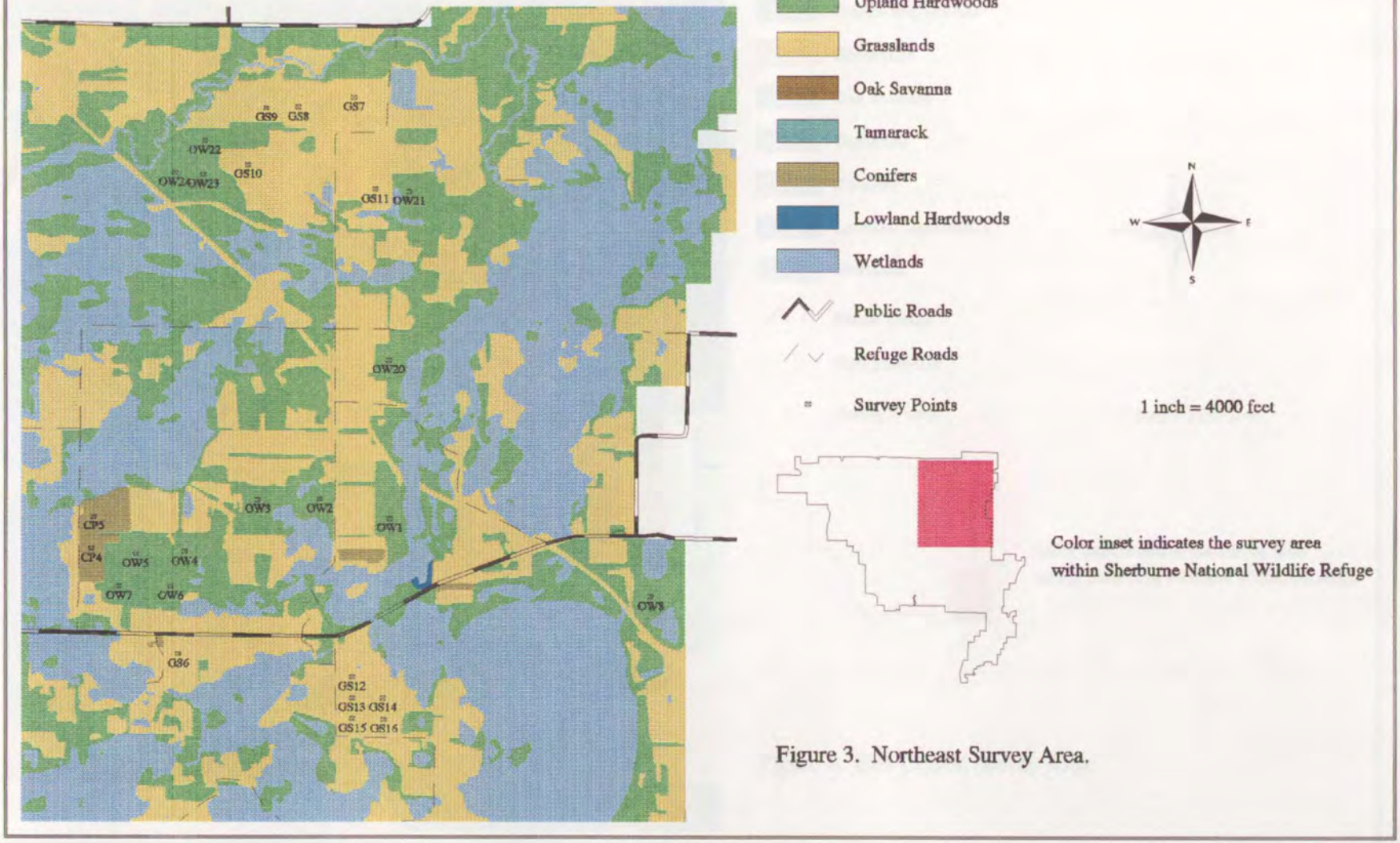


Figure 3. Northeast Survey Area.

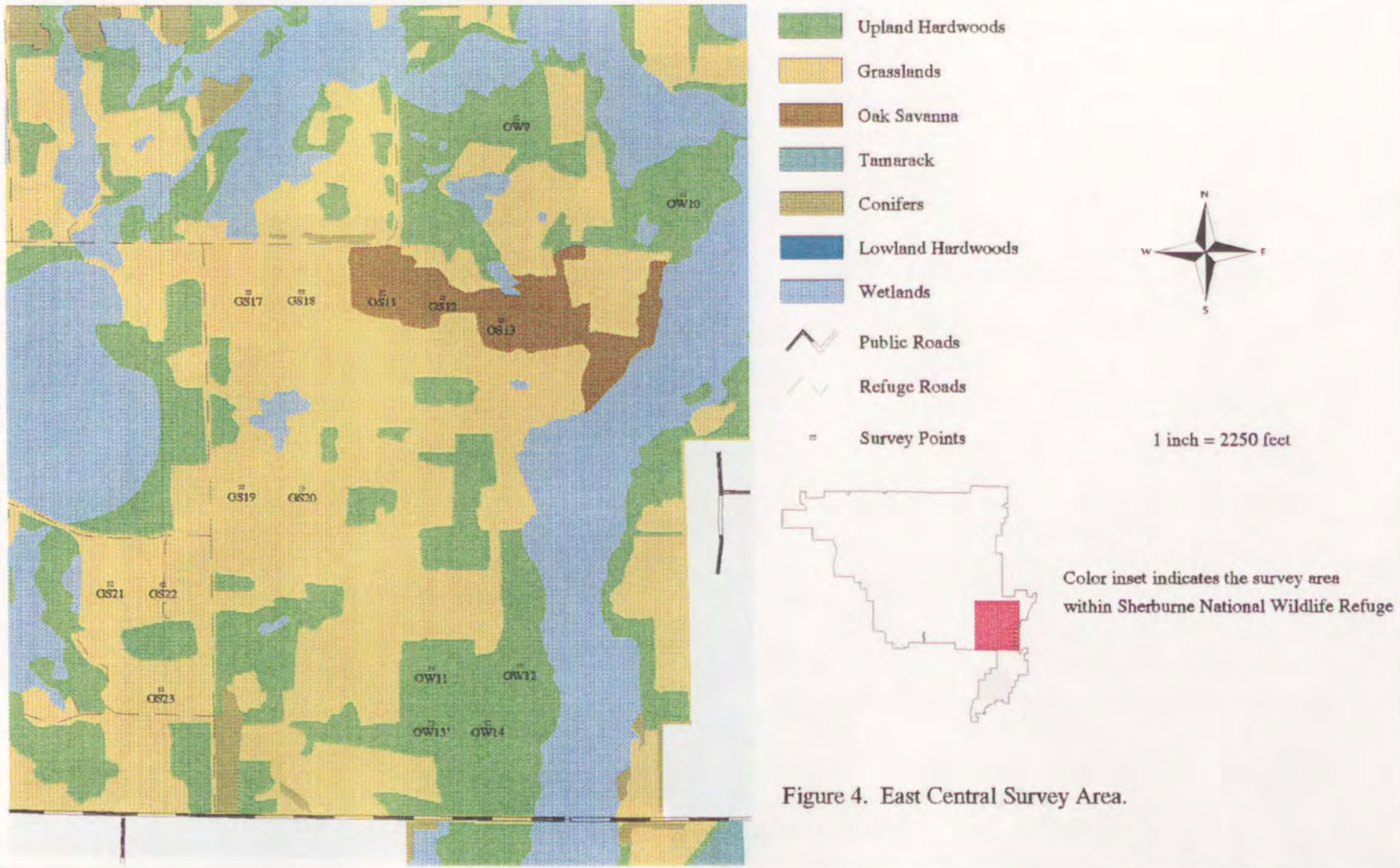


Figure 4. East Central Survey Area.

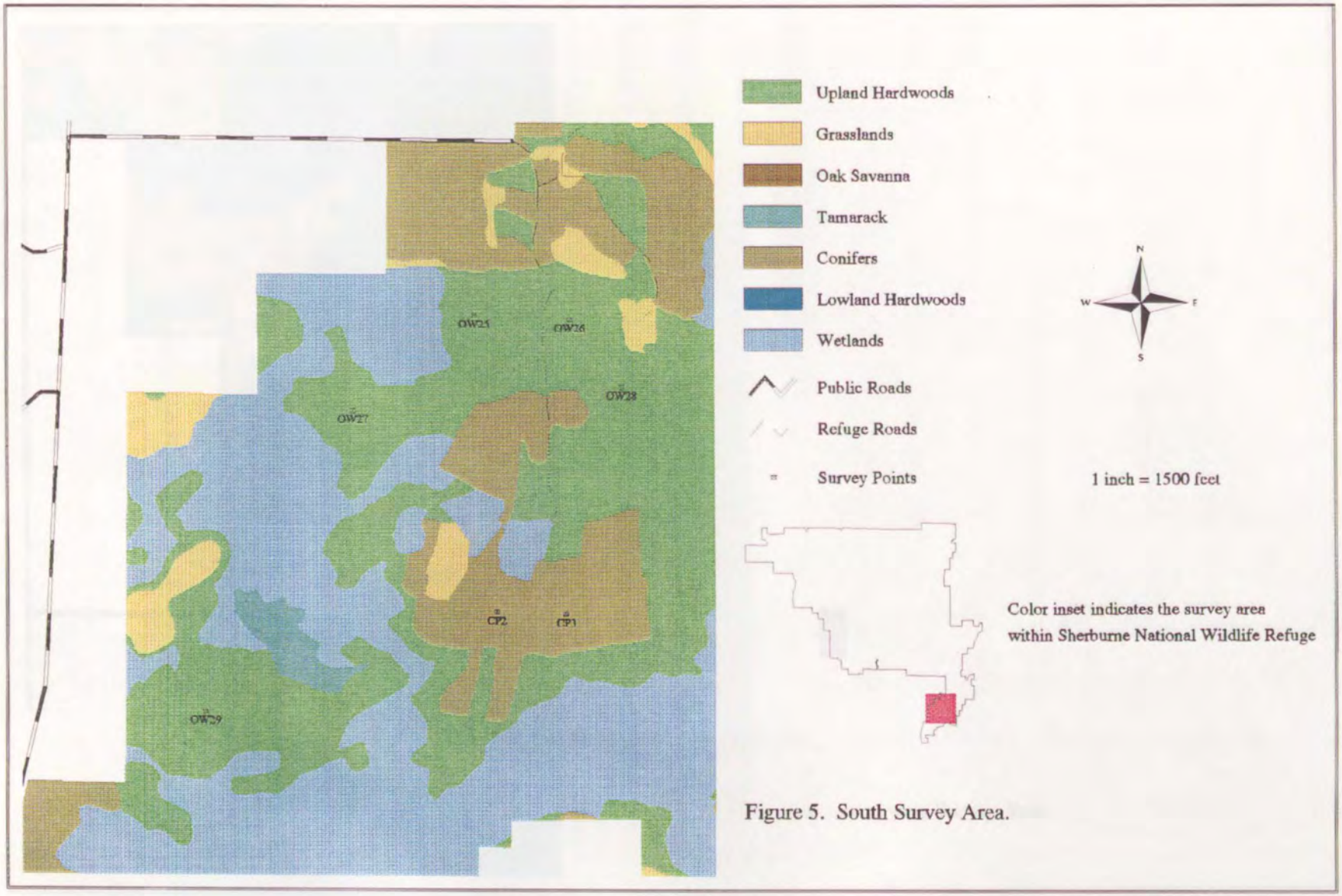


Figure 5. South Survey Area.

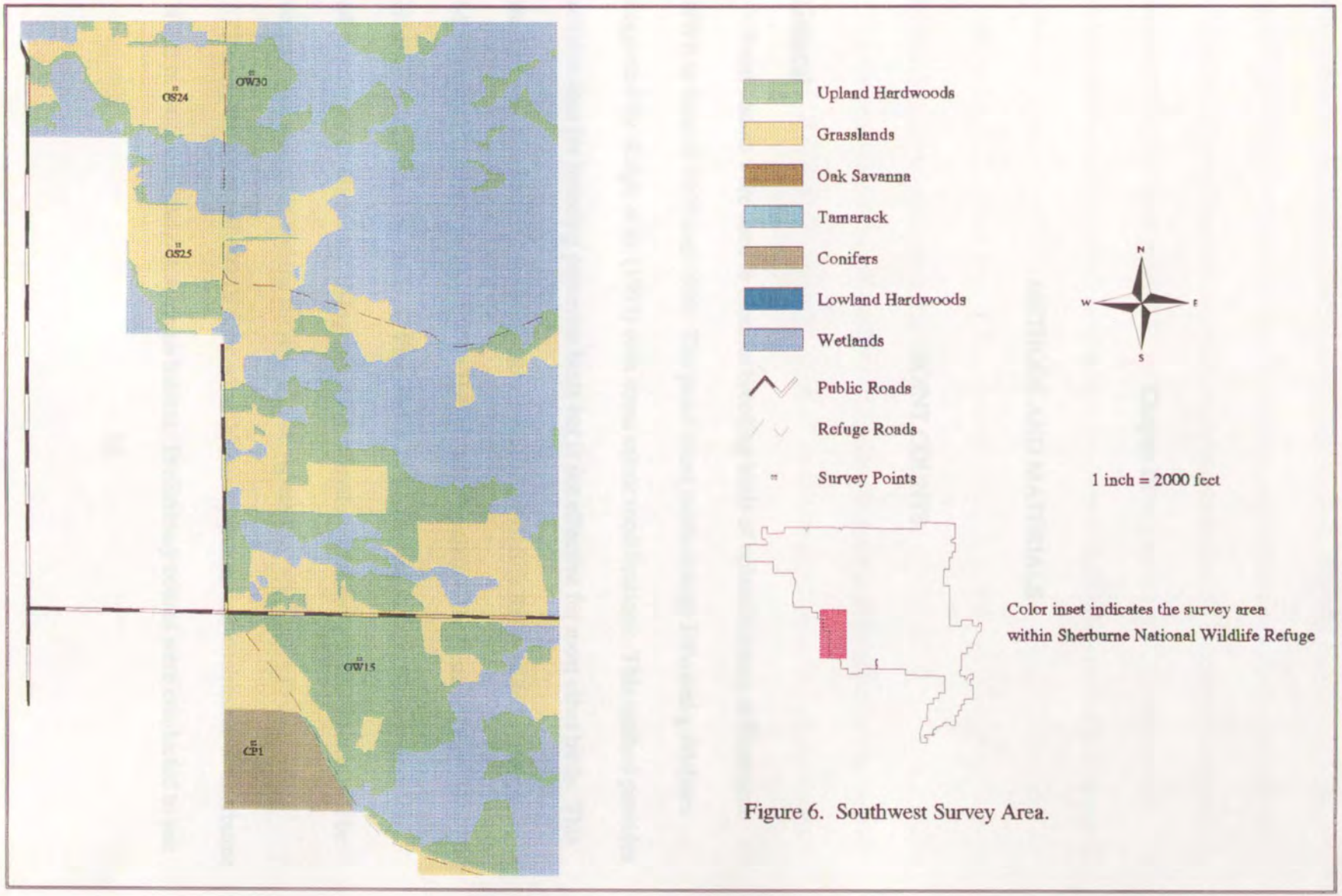


Figure 6. Southwest Survey Area.

Chapter III

METHODS AND MATERIALS

POINT COUNTS

General

Point counts were used to monitor breeding birds of upland habitats at Sherburne NWR in June of 1995 and 1996. The point count methodology followed guidelines suggested by Ralph et al. (1993) with some minor modifications. This method provides reliable data for breeding passerine birds but is not effective for most other birds. This method was standardized for Minnesota's National Wildlife Refuges and Wetland Management Districts in 1994 by the Habitat and Population Evaluation Team (HAPET). HAPET is organized by the U. S. Fish and Wildlife Service Refuge Biology and Migratory Birds divisions. Using this standardized method ensures that results will be comparable statewide and the surveys will be repeatable.

During the spring of 1994 a network of 33 survey points was established at Sherburne NWR in woodland and oak savanna habitat. Preliminary counts were conducted to test

the method for potential problems and sharpen observer identification skills. In the spring of 1995 the network of survey points was expanded to include 68 points in three of the four major upland habitats. Before counts began in 1995 there were 30 points established in woodland habitat, 25 points in grassland habitat and 13 points in oak savanna habitat. In the spring of 1996 five points were established in conifer plantation habitat.

Layout of survey point network

Survey points were established in a systematic manner in an effort to represent all major upland habitats in this study. Most of the survey points were located in off road areas accessible only by foot. Points were placed no less than 125 m from the edge of the habitat in which they were located. Points were spaced a minimum of 250 m apart in all habitats. Since birds are unlikely to be heard or seen beyond 125 m this ensures that individual birds will not be recorded at more than one point.

When a prospective area of habitat was located, black and white aerial photographs of the refuge were consulted to aid in determining if the area was suitable. If an area appeared suitable it was then examined to see if it met the size requirements. A grid composed of squares spaced 250 m from center to center at the proper scale for the aerial photographs was constructed. This grid was then placed over the photographs to determine the maximum number of survey points that could be placed in a particular area. The locations of the prospective points were then plotted on reproductions of the aerial photographs.

Once the point locations had been marked on the aerial photographs, they were located on foot. The exact location of woodland, oak savanna and conifer plantation survey points was determined by pacing off the proper distance following a compass bearing. The points were marked with a five foot section of iron reinforcement bar which was then painted orange. The trees immediately surrounding the point were marked with colored flagging to aid in locating the points in low light conditions. Grassland points were established by following a compass bearing and measuring the distance using a 100 m tape. Iron reinforcement bar was not used to mark grassland points so the bar would not provide a perch and possibly alter the composition of bird species using the area. They were instead marked with the small colored flags used by utility companies to mark underground cables.

Equipment and time needed

The equipment needed to conduct point counts once the points have been established is minimal. Essentials I used were a pair of Nikon 7 x 50 binoculars, a digital stopwatch, aerial photographs of the study area, two different colored pencils, a compass and field data forms. Nonessential but helpful items include water resistant footwear, quality insect repellent and lens cleaning tissue.

The time needed to conduct a series of point counts was generally less than four hours. Travel time between points was variable, ranging from five to twenty five minutes dependent on terrain, distance between the points and whether or not a vehicle was

involved. I could complete between two and eight points in a morning dependent on weather and travel time.

Season and time of day

Point counts in the study area are conducted in the first three weeks of June. This is when territorial males are most vocal and breeding activity is high. The spring of 1995 came later than usual and some migrants were still present in the study area on June 1st so the starting date for point counts was moved to June 5th. Point counts in woodland, oak savanna and grassland habitats were completed on June 22nd 1995. The conifer plantation point counts were conducted on June 19th 1996.

Point counts are conducted in the early morning hours when males are most vocal. Counts began approximately 15 minutes after sunrise and were completed before 1000 hours each morning. However, there was a noticeable reduction in activity after 0900 so counts were typically terminated about that time. Time was recorded at the beginning of each count.

Points were sampled only once during the breeding season. Time is used most effectively by sampling additional points rather than sampling a smaller number of points repeatedly (Ralph et al. 1993).

Weather

Weather is an important factor when conducting point counts and must be monitored closely (Robbins 1981). Counts were not conducted during rain, excessive fog,

unseasonable cold or when winds exceeded 12 miles per hour. High wind presented more problems in the study area than the other environmental factors. Approximate wind speed and cloud cover were recorded at the beginning of each count.

Data collection

Points were sampled for a ten minute period. All birds detected by sight or sound within 100 m of the point were recorded using a standardized four letter species code. Two colored pencils were used to distinguish between birds detected in the first five minutes and the last five minutes of the count. Approximate distance and location were recorded on a field form showing 50 and 100 m radius circles. Birds were recorded at the distance which they were first observed. Birds detected outside 100 m were not recorded. Birds were not recorded twice.

Points were approached as quietly as possible. If a bird was flushed within 100 meters of a point and could be identified it was recorded as occurring at the point. Birds flying over the point without perching were recorded in a miscellaneous category and were not included as occurring at the point. Counts began immediately upon reaching the point.

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RELEVES

General

Releves were conducted at each of the woodland, oak savanna and conifer plantation points in June and July of 1996. Releves were not conducted at grassland points. Many of the grassland areas were involved in restoration projects and the vegetation had been plowed under in the spring of 1996. The releve method used followed guidelines set by the Minnesota Natural Heritage Program (Almendinger 1987).

Releves are intended to provide a summary of a particular stand of vegetation. The size of the plot varies with the type of community being sampled. Vegetation is first separated into life-form groups such as broadleaf deciduous, herbaceous or graminoid. These groups are then placed into height strata characteristic of that stand. Wooded areas typically include three strata of woody vegetation: trees, shrubs and seedlings. Separate strata are recorded for herbs and graminoids. For each stratum the percent coverage of each life form is recorded as well as the coverage of individual species. Therefore, vegetation is recorded first by life-form group, then by height stratum and finally by species. This makes it possible to record a species more than once if it occurs in different strata.

Each releve plot was approximately 400 square meters in area. Plots were 20 m by 20 m with the point marker located in the center of the releve plot. Distances were paced off and the corners of the plot were marked with colored flagging which was removed upon completion of the releve.

Chapter IV

RESULTS AND DISCUSSION

BIRD COMMUNITIES

A total of 54 species and 686 individuals were recorded on 73 point counts in June of 1995 and 1996. The six most numerous birds on these counts overall were the Red-eyed Vireo*, Field Sparrow, Least Flycatcher, Vesper Sparrow, Eastern Wood Peewee and Grasshopper Sparrow in descending order.

The total number of species recorded was highest in oak savanna and woodland habitats. Both had 29 recorded species (Table 1). There were 21 species recorded in grassland habitats and eight species recorded in conifer plantation habitats (Table 1). The mean number of species per point was highest in oak savanna followed by woodland, grassland and conifer plantation habitat (Table 1). Woodland and grassland habitats had larger sample sizes than oak savanna and conifer plantation habitats. However, without extrapolation these numbers are still indicative of species richness when comparing these four habitats. Calculating the mean and standard error of individual birds and species per point provides an index on the relative abundance and distribution of breeding birds across the vegetation gradient.

*Scientific names of all species mentioned in text appear in Appendix A.

Table 1. Average number of species and individuals per point by habitat type.

	# of points	Species	Species/Pt.	Individuals	Individ./Pt.
Woodland	30	29	6.2	301	10.03
Savanna	13	29	7.5	148	11.40
Grassland	25	21	5.0	206	8.36
Conifer	5	8	1.6	31	6.00
Overall	73	54	5.8	686	9.40

There were no species of birds found in all four habitat types. There were 29 species of birds which were found in only one habitat. These include six species found only in oak savanna, ten species found only in woodlands and 13 species found only in grasslands (Table 2). There were no species found only in conifer plantations.

The six most abundant species found in woodland habitats were the Red-eyed Vireo, Least Flycatcher, Eastern Wood Peewee, Ovenbird, Scarlet Tanager and Great Crested Flycatcher (Table 3). Only one of these six most abundant species, the Least Flycatcher, was found exclusively in woodlands.

The six most abundant species in oak savanna habitat were the Field Sparrow, Chestnut-sided Warbler, Scarlet Tanager, Indigo Bunting, Blue Jay and Mourning Dove (Table 3). Of these six species only the Mourning Dove was found exclusively in oak savanna.

Table 3. Mean and standard error of birds observed per point in oak dominated woodlands and oak savanna habitats.

	Oak Dominated Woodland		Oak Savanna	
Species	Mean	Standard Error	Mean	Standard Error
Cooper's Hawk	0.10	0.10		
Ruby-Throated Hummingbird	0.03	0.03		
Mourning Dove			0.54	0.18
Downy Woodpecker	0.07	0.05	0.08	0.08
Hairy Woodpecker	0.07	0.05		
Eastern Kingbird			0.46	0.22
Eastern Peewee	1.17	0.91	0.46	0.18
Great-Crested Flycatcher	0.50	0.12	0.31	0.18
Least Flycatcher	1.57	0.31		
American Crow	0.03	0.03	0.08	0.08
Blue Jay	0.33	0.12	0.62	0.24
Black-capped Chickadee	0.17	0.08	0.15	0.15
House Wren	0.13	0.09	0.15	0.11
Blue-Grey Gnatcatcher	0.10	0.06	0.08	0.08
Grey Catbird	0.10	0.10	0.46	0.18
Brown Thrasher			0.08	0.08
Wood Thrush	0.07	0.05		
Veery	0.07	0.05		
American Robin	0.03	0.03	0.08	0.08
Red-Eyed Vireo	2.17	0.17	0.23	0.12
Yellow-Throated Vireo	0.37	0.11		
Common Yellowthroat	0.17	0.08	0.46	0.24
Chestnut-Sided Warbler	0.47	0.14	1.23	0.26
Yellow Warbler	0.13	0.08	0.15	0.11
American Redstart	0.43	0.16		
Ovenbird	0.73	0.14		
Mourning Warbler	0.07	0.07		
Northern Oriole			0.46	0.31
Red-Winged Blackbird			0.30	0.21
Common Grackle	0.03	0.03	0.15	0.15
Brown-Headed Cowbird			0.08	0.08
Scarlet Tanager	0.63	0.16	1.00	0.25
Indigo Bunting	0.23	0.09	0.85	0.30
Field Sparrow	0.03	0.03	2.30	0.33
Vesper Sparrow			0.08	0.08
Chipping Sparrow			0.15	0.11
American Goldfinch			0.15	0.15
Rose-Breasted Grosbeak			0.08	0.08
Rufous-Sided Towhee			0.15	0.11

Table 4. Mean and standard error of birds observed per point in grassland and conifer plantation habitats.

	Grassland		Conifer Plantation	
Species	Mean	Standard Error	Mean	Standard Error
Upland Sandpiper	0.04	0.04		
Red-Tail Hawk	0.04	0.04		
Northrern Flicker	0.04	0.04		
Eastern Kingbird	0.24	0.10		
American Crow			0.60	0.40
Blue Jay			0.40	0.25
Black-Capped Chickadee			0.20	0.20
Sedge Wren	0.04	0.04		
Brown Thrasher	0.04	0.04		
Eastern Bluebird	0.08	0.06		
Ovenbird			0.40	0.25
Common Yellowthroat	0.04	0.04		
Yellow Warbler	0.12	0.07		
Red-Winged Blackbird			1.00	0.45
Eastern Meadowlark	1.24	0.19		
Western Meadowlark	0.08	0.06		
Bobolink	0.20	0.16		
Song Sparrow	0.60	0.14	0.20	0.20
Chipping Sparrow	0.20	0.17	3.20	0.68
Clay-Colored Sparrow	0.35	o.17		
Savanna Sparrow	0.16	0.07		
Field Sparrow	0.92	0.02		
Vesper Sparrow	1.76	0.30		
Grasshopper Sparrow	1.36	0.28		
Swamp Sparrow	0.04	0.04		
Lark Sparrow	0.64	0.19		
Rufous-Sided Towhee			0.20	0.20

The six most abundant species recorded in grassland habitats were the Vesper Sparrow, Grasshopper Sparrow, Eastern Meadowlark, Field Sparrow, Lark Sparrow and Song Sparrow (Table 4). Three of these species, the Grasshopper Sparrow, Eastern Meadowlark and Lark Sparrow were found only in grassland habitat.

There were only eight species of birds recorded in conifer plantation habitats and these occurred at low densities (Table 4). The Chipping Sparrow was the most abundant in this habitat followed by the Red-winged Blackbird and American Crow, which are not believed to nest in the conifer plantations.

HABITATS

Oak Dominated Woodlands

Oak dominated woodlands are an extensive upland habitat at the refuge and had the highest number of survey points. Thirty survey points were established and sampled in 17 oak dominated woodlands across the refuge. Due to the area's historical use as agricultural land, the woodland habitats are fragmented and vary in size from 7.3 - 56.7 ha. Ten of the 17 woodlands were small enough to support only one survey point and none had more than four.

Results from the releves conducted in 1996 showed there is considerable variability in the structure of oak dominated woodlands at Sherburne NWR. These differences can be attributed to such factors as soil types, fire frequency, topography and past disturbances such as grazing and cutting. The differences in structure cause the oak dominated

woodlands to be separated into two types. The first and most common type is described as oak woodland-brushland and the second as oak forest (Minnesota Natural Heritage Program 1993).

Oak woodland-brushland habitats comprised 19 of the 30 survey points located in oak dominated woodlands. These sites were located on sandy or otherwise well drained soils which are found over most of the refuge. Oak woodland-brushland habitats also dominated much of the old dune formations found in the East Central and South Survey Areas (Figures 4 and 5).

Oak woodland-brushland habitats at differ from oak forest habitats by having a more open canopy and a more extensive shrub layer. They are also more likely to have grassland forbs present in the herbaceous layer. These features can be attributed to frequent, low intensity ground fires and the dry soils on which they grow. In the absence of fire those sites not found on droughty soils or dune landforms would eventually succeed into a habitat more closely resembling oak forest. Areas that are currently oak woodland-brushland may have been oak savanna prior to settlement but have undergone an artificial succession in the absence of fire (Wovcha et al. 1995). Oak woodland-brushland habitats occupy a broad section of the vegetation gradient between oak forest and oak savanna.

Results from releves conducted at survey points in oak woodland-brushland habitats reveal canopy coverages between 35 - 80%. Half fell between 65 -75% canopy coverage. Bur Oak and Northern Pin Oak dominated the canopy with Quaking Aspen found in the canopy at 20% of the oak woodland-brushland survey points. The faster growing

Northern Pin Oak was more dominant than Bur Oak at 60% of the oak woodland-brushland points. Canopy trees ranged from 12 - 18 m high with most falling in the 13 - 16 m range. Northern Pin Oaks were taller on average than Bur Oaks.

Subcanopy trees were limited in oak woodland habitats. Subcanopy coverages fell between 5 - 40%. Young Bur Oaks dominated the subcanopy followed by Northern Pin Oak, Black Cherry, Choke Cherry and Quaking Aspen. These trees were 3 - 9 m tall.

The shrub layer yielded the greatest variability and diversity of vegetation in oak woodland-brushland habitats. Shrub coverages ranged from 10% to thickets of over 90% coverage. Shrubs were thickest where large openings existed in the canopy or where fires had not burned in more than three years. High shrub densities are also indicative of past disturbances. Large, nearly impassable thickets of Prickly Ash and Hazelnut occur in areas which were likely grazed or logged in the past as evidenced by old fencelines and stumps (Figure 7). Thickets of Blackberry and Raspberry occurred in some woodlands following fires but fires reduced densities of other shrub species in oak woodland-brushland habitats.

Shrub height in oak woodland-brushland habitats was also variable. Measurements varied from under one half meter for low growing shrubs to over two meters in areas where fires had not burned recently or did not burn hot enough to kill the shrubs.

Herbaceous vegetation was often reduced in oak woodland-brushland habitats. This was often due to shading produced by heavy densities of shrubs. In areas where small openings occurred some grassland forbs such as Hairy Puccoon, Goldenrods and Common Milkweed were present. Graminoid species present in the herbaceous layer

included Pennsylvania Sedge and Kentucky Bluegrass. Herbaceous coverages not including graminoids varied from 35 - 75% and averaged 49%. Common herbaceous plants included Hog Peanut, Poison Ivy, Bedstraw and Pointed-leaved Tick Trefoil. Climbing species such as Virginia Creeper and Wild Grape were common. Disturbed areas were characterized by mats of Pennsylvania Sedge.

Oak forest habitats were less common than oak woodland-brushland habitats at Sherburne NWR. They comprised 11 of the 30 oak dominated woodland survey points. Oak forest habitats were located on heavier, more gravel laden soils associated with geographic features such as Blue Hill in the Northeast Survey Area and the St. Francis River in the Northwest and East Central Survey Areas (Figures 2-4).

Oak forest habitats differ from oak woodland-brushland habitats by having a denser canopy with taller, more evenly spaced trees with larger diameters (Figure 8). This produces a more shaded, moist condition than is found in oak woodland-brushland areas. Fires are less prevalent in oak forest habitats and are prevented in some of the areas. Some areas which currently resemble oak forest may have been oak savanna or oak woodland-brushland prior to settlement when fires were eliminated (Wovcha et al. 1995). Oak forest habitats represent the most heavily wooded section of the natural vegetation gradient.

Results from relevés show the canopy of oak forest areas is dominated by Northern Pin Oaks or Northern Pin Oak x Red Oak hybrids. Other important canopy trees included Bigtooth Aspen, Quaking Aspen, Bur Oak and an occasional Red Maple. Bur Oaks with wide crowns and large limbs low to the ground support the idea that these areas may have

Figure 7. Open canopy and thick shrub layer of disturbed oak woodland-brushland in Northeast Survey Area.

Figure 8. Reduced shrub layer and larger trees of oak forest in Northeast Survey Area.

once resembled savanna rather than forest. Canopy coverages ranged from 70 - 90%. The average height of canopy trees was betweem 15 -18 m. The subcanopy was sparse in most oak forest areas. Common subcanopy trees included Black Cherry, American Elm, Quaking Aspen and Paper Birch. The more moist sites supported Green Ash, Red Maple and Basswood in the subcanopy.

Shrub coverages were variable in oak forest areas ranging from 20 - 80%. Shrubs often occurred in patches, but dense thickets were less common than in oak woodland-brushland areas. Small trees become a more prevalent part of the shrub layer in oak forest areas. Common species of the shrub layer in oak forest areas included Hazelnut, Gray Dogwood, Blueberry, Common Elder and Juneberry. Height ranged from less than one half meter to two meters. Disturbed areas were evidenced by patches of Prickly Ash and Tartarian Honeysuckle.

As the shrub layer became more reduced in oak forest areas it allowed more light to reach the ground. This results in a more diverse and vigorous herbaceous layer. Coverages are higher, ranging from 30 - 90% and Pennsylvania Sedge becomes less prevalent than in oak woodland-brushland areas. Common forbs include Wild Geranium, Sweet Cicely, Hog Peanut, Canada Mayflower, Wild Sarsaparilla and Starflower. Disturbed areas were evidenced by extensive patches of Interupted and Bracken Ferns.

Oak Savanna

Sherburne NWR lies in the transition zone between the tallgrass prairies to the west and the hardwood forests to the east. It is in this transition zone that oak savanna occurs.

Prior to settlement, much of the area which is now Sherburne NWR is thought to have been oak savanna (Marschner 1974).

Due to its transitional nature, oak savanna is difficult to define. In 1959 Curtis described oak savanna or oak openings as a communites of oaks with less than 50% canopy and a ground layer dominated by grasses and prairie forbs. Others set a higher canopy coverage but agree the groundlayer should be dominated by grasses and prairie forbs (Packard 1993). All researchers agree that fire is essential to the maintenance of the oak savannas open nature.

Currently, the areas fitting the definition of oak savanna at Sherburne NWR are limited. A total of 13 survey points were established in three oak savanna habitats ranging from 8.1 - 34.4 ha in size. Ten of these points are located in the Northwest Survey Area and three are located in the East Central Survey Area (Figures 2 and 4).

Releves in oak savanna habitats convey a great deal of variability. Some of the areas surrounding survey points were of an open, parklike nature (Figure 9). Others were of a more closed, grovelike nature that begins to resemble oak woodland-brushland (Figure 10). Oak savanna occupies a section of the vegetation gradient between oak woodlands and open grassland.

Oak savanna habitats at have canopy coverages ranging from 5 - 55%. The average canopy coverage was 30%. The dominant tree species of the canopy are Bur Oak and Northern Pin Oak. Canopy trees in oak savanna areas averaged shorter than those in oak dominated woodland areas. Height ranged from 7 - 12 m with Northern Pin Oaks being the tallest. A true subcanopy was not present in oak savanna habitat.

Figure 9. Open canopy oak savanna in Northwest Survey Area.

Figure 10. Closed canopy oak savanna in Northwest Survey Area.

Shrubs are an important element of oak savanna habitats. Shrub coverages and species composition varied dependent on fire history, soil moisture and topography. Shrub coverages ranged between 5 - 70% with an average of 44%. Sprouts of Bur and Northern Pin Oak were the most common species present in the shrub layer at oak savanna survey points. Localized thickets of Hazelnut are common. Other important shrub species included Choke Cherry, Leadplant and Smooth Sumac. Small, wet depressions found in oak savanna areas were mostly choked with small Quaking Aspen.

The groundlayer of oak savanna habitats is dominated by grasses and grassland forbs. These are the true dominants of an oak savanna. Grasses occupy most of the groundlayer with coverages ranging from 35 - 85%. Important species include Porcupine Grass, Big Bluestem, Little Bluestem, Indian Grass and June Grass. Disturbed oak savanna areas were characterized by extensive patches of Quack Grass and Kentucky Bluegrass.

Grassland forbs are important components of the groundlayer in oak savanna habitats. Releves show coverages of 20 - 60%. Common plants included Hairy Puccoon, Large-flowered Beardtongue, Purple Prairie-clover, Prairie Larkspur, Round-headed Bush-clover and Western Ragweed. The large oak savanna in the Northwest Survey Area supported a healthy population of Wild Lupine. As canopy coverages increased species more common to woodland areas such as Hog Peanut and Poison Ivy increased in frequency. Disturbed areas were characterized by extensive patches of Western Ragweed.

The ground layer in oak savanna areas at Sherburne NWR is often interspersed with patches of bare, sandy soil. Some of these patches are due to the digging efforts of Plains Pocket Gophers, but true wind scoured blowouts typical of dune areas are rare.

Grassland

Grasslands are the most common upland habitat at Sherburne NWR. Twenty five survey points were established in nine grassland areas. Field size ranged from 7 - 27.5 ha. The grassland habitats at Sherburne NWR are old agricultural fields that were planted with a mixture of cool season grasses in the early 1970's. The soils in these areas is sandy and sterile. Patches of bare ground and mosses are common as are Plains Pocket Gopher mounds. These areas are dominated by Smooth Brome, Kentucky Bluegrass, Quack Grass and Switchgrass. Common forbs include Yarrow, Horseweed, Mullein, Sweet Everlasting, Hoary Alyssum and Goldenrod.

Sherburne NWR personnel are in the process of planting these old field areas with native grasses. At some of the grassland survey points sampled in 1995 the restoration process is well underway (Figure 11). The native species planted include Big Bluestem, Little Bluestem and Switchgrass. Grassland forb growth in these areas is limited.

Most of the grassland habitats at the refuge are bordered by woodlands. Although these areas are burned on a regular basis, the fires are not always hot enough to eliminate the encroachment of woody growth. Small trees occur frequently in grassland areas (Figure 12). The most common tree species include Red Cedar, Box Elder and Quaking Aspen.

Figure 11. Large grassland seeded with native grasses in East Central Survey Area.

Figure 12. Small grassland with trees present in Southwest Survey Area.

Conifer Plantation

Conifer plantations represent the most disturbed habitats at Sherburne NWR. The dry, sandy soils of the refuge provide good growing conditions for pine and spruce and Christmas tree production is common across the Anoka Sandplain. Large stands of pine and spruce were not historically present in the area.

Five survey points were established in conifer plantation habitats in 1996. Two of these were in Norway Pine plantations, two were in White Spruce plantations and one was in a white spruce plantation with Norway Pine planted on one end.

There is considerable difference in the structure of Norway Pine and White Spruce stands. Norway Pines were 17 - 20 m tall and White Spruce were 15 - 18 m tall. Norway Pine stands had canopy coverages of 75 - 85% and the understory was open due to the selfpruning nature of the limbs (Figure 13). White Spruce plantations had canopy coverages of 85-95% and a dense understory of dead lower limbs (Figure 14).

The shrub and groundlayers in conifer plantations are nearly nonexistent. The more open nature of Norway Pine plantations allowed the growth of small Raspberry and Hazelnut shrubs. The only forbs present were Dandelion and an occasional Western Ragweed. White Spruce plantations were so dense that no other vegetation was present except some patches of moss on the groundlayer.

Figure 13. Norway Pine plantation in Southwest Survey Area.

Figure 14. White Spruce plantation in Northeast Survey Area.

BIRD HABITAT ASSOCIATIONS

It is difficult to draw definite conclusions on the habitat needs of particular species of birds from one season of point count data. Other methods such as spot mapping are better suited to the collection of this type of information. However, after gathering information on the relative abundance of birds through point counts and habitat data through releves I believe there are some patterns and associations worth noting.

The Red-eyed Vireo was the most abundant bird in oak dominated woodlands. It was recorded at all but one of the oak dominated woodland survey points. It was recorded at only two of the oak savanna survey points. Relevé information shows it was not recorded in areas with less than a 35% canopy coverage.

A pair of Mourning Warblers was recorded at survey point OW 6 on the south side of Blue Hill in the Northeast Survey Area (Figure 3). Mourning Warblers have been recorded in Sherburne County before, but are not common (Wovcha et al. 1995). They were associated with the clearcut area found there.

The Chestnut-sided Warbler was the second most abundant bird in oak savanna habitats and was common in oak dominated woodlands. This species was found only in areas that supported extensive thickets of Hazelnut.

Scarlet Tanagers were the third most abundant bird in oak savanna habitats and the fifth most abundant in oak dominated woodlands. They were recorded at all but three of the oak savanna survey points and at oak dominated woodland survey points which had less than an 80% canopy coverage. Scarlet Tanagers are known to be associated with the

edges of oak groves and woodlands in the study area (Hartwig 1996). A similar pattern is followed by the Indigo Bunting.

A single Upland Sandpiper was recorded during point counts at Sherburne NWR. It was found at survey point GS 21 in the East Central Survey Area. This survey point lies within the largest expanse of grassland on the refuge. The adults were later observed with flightless young.

Five Bobolinks were recorded during point counts at the refuge. Four of these five singing males were recorded at survey point GS 5 in the Northwest Survey Area. This is a wet grassland found just north of St. Francis Pool. That it is a wet area provides an explanation for the high density of Bobolinks in one field.

Lark Sparrows were the fifth most abundant bird in grassland habitats. They occurred in dry fields with vegetation that was less dense than others. Most of these fields also contained small trees.

Chapter V

SUMMARY AND CONCLUSIONS

Sherburne NWR supports a variety of upland habitats. During the summers of 1994 - 96 a network of 73 survey points was established in upland areas of the refuge to sample breeding birds and vegetation. Breeding birds were sampled using a point count method. Vegetation was sampled using a releve method.

The upland habitats of Sherburne NWR consist of four main types that can be followed along a vegetation gradient. This gradient begins with open grassland areas. These grasslands are former agricultural fields that have been planted with a number of grass species. Oak savanna habitats occupy the next main section of the vegetation gradient. Oak savanna is characterized by scattered oaks with a groundlayer dominated by grasses and grassland forbs. Oak savanna gradually grades into oak woodland-brushland. Oak woodland-brushland habitat has canopy coverages of up to 80% and a dense shrub layer that often shades out the groundlayer. Oak forest follows oak woodland-brushland across the vegetation gradient. Oak forest has canopy coverages of up to 90% and a reduced shrub layer that allows an increased growth of woodland forbs.

Conifer plantations support the most dense vegetation on the gradient. This community is not native to the area and contains the least amount of vegetational diversity. As the vegetation changes along this gradient so does the composition of bird species breeding there.

Point counts conducted in the upland areas of Sherburne NWR recorded a total of 54 species and 686 individuals. Oak dominated woodland survey points had a total of 29 species and 301 individuals. There was an average of 6.2 species per point and 10.0 individuals per point. Oak savanna survey point had a total of 29 species and 149 individuals. There was an average of 7.5 species per point and 11.5 individuals per point. Grassland survey points had a total of 21 species and 206 individuals. There was an average of 5.0 species per point and 8.3 individuals per point. Conifer plantations had a limited sample size but had a total of 8 species and 31 individuals. There was an average of 2.1 species per point and 3.9 individuals per point.

Sherburne NWR supports some fine examples of upland communities in their natural condition. Periodic fires are essential to the maintenance and improvement of oak woodland, oak savanna and grassland habitats of the refuge. As the area surrounding the refuge continues to be developed, the importance of the refuge as a haven for wildlife and a place for the public to enjoy it will increase.

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APPENDIX A

Scientific Names of Animals and Plants Cited in the Text

Scientific Names of Animals and Plants Cited in Text

Common name	Scientific name
Animals	
American Crow	Corvus brachyrhynchos
American Goldfinch	Carduelis tristis
American Redstart	Setophaga ruticilla
American Robin	Turdus migratorius
Black-capped Chickadee	Parus atricapillus
Blue-gray Gnatcatcher	Polioptila caerulea
Blue Jay	Cyanocitta Cristata
Bobolink	Dolichonyx oryzivorus
Brown-headed Cowbird	Molothrus ater
Brown Thrasher	Toxostoma rufum
Chestnut-sided Warbler	Dendroica pensylvanica
Chipping Sparrow	Spizella passerina
Clay-colored Sparrow	Spizella pallida
Common Flicker	Colaptes auratus
Common Grackle	Quiscalus quiscula
Common Yellowthroat	Geothlypis trichas
Cooper's Hawk	Accipiter cooperii
Downy Woodpecker	Picoides pubescens
Eastern Bluebird	Sialia sialis
Eastern Kingbird	Tryannus tryannus
Eastern Meadowlark	Sturnella magna
Eastern Peewee	Contopus virens
Field Sparrow	Spizella pusilla
Grasshopper Sparrow	Ammodramus savannarum
Gray Catbird	Dumatella carolinensis
Great Crested Flycatcher	Myiarchus crinitus
Hairy Woodpecker	Picoides villosus
House Wren	Troglodytes aedon
Indigo Bunting	Passerina cyanea
Lark Sparrow	Chondestes grammacus
Least Flycatcher	Empidonax minimus
Mourning Dove	Zenaida macroura
Mourning Warbler	Oporornis philadelphia
Northern Oriole	Ictarus galbula
Ovenbird	Seiurus aurocapillus
Pocket Gopher	Geomys bursarius

Red-eyed Vireo	Vireo olivaceous

Appendix A. cont'd

Common name	Scientific name
Red-tailed Hawk	Buteo jamaicensis
Red-winged Blackbird	Agelaius phoeniceus
Rose-breasted Grosbeak	Phuecticus ludovicianus
Ruby-throated Hummingbird	Archilocus colubris
Rufous-sided Towhee	Pipilo erythropthalmus
Savannah Sparrow	Passerculus sandwichensis
Scarlet Tanager	Piranga olivacea
Sedge Wren	Cistothorus platensis
Song Sparrow	Melospiza melodia
Swamp Sparrow	Melospiza georgiana
Upland Sandpiper	Bartramia longicauda
Veery	Catharus fuscescens
Vesper Sparrow	Pooecetes graminus
Western Meadowlark	Sturnella neglecta
White-breasted Nuthatch	Sitta carolinensis
Wood Thrush	Hylocichla mustelina
Yellow-throated Vireo	Vireo flavifrons
Yellow Warbler	Dendroica petechia
Plants	
American Elm	Ulmus americana L.
Basswood	Tilia americana L.
Bedstraw	Galium spp.
Big Bluestem	Andropogan gerardii Vitman
Bigtooth Aspen	Populus grandidentata Michx.
Black Cherry	Prunus serotina Ehrh.
Blueberry	Vaccinium angustifolium Ait.
Box Elder	Acer negundo L.
Bracken Fern	Pteridium aquilinum L.
Bur Oak	Quercus macrocarpa Michx.
Choke Cherry	Prunus virginiana L.
Christmas Trees	Picea glauca Moench
	Picea pungens Engelm.
	Pinus resinosa Ait.
	Pinus strobus L.
	Pinus sylvestris L.
Common Blackberry	Rubus allegheniensis Porter
Common Milkweed	Asclepias syriaca L.

Appendix A. cont'd

Common name	Scientific name
Corn	Zea mays L.
Dandelion	Taraxacum officinale Weber
Goldenrod	Solidago spp.
Gray Dogwood	Cornus foemina Mill.
Green Ash	Fraxinus pennsylvanica Vahl
Hazelnut	Corylus americana Walt.
Hairy Puccoon	Lithospermum caroliniense Walt.
Hoary Alyssum	Berteroa incana L.
Hog Peanut	Amphicarpa bracteata L.
Horseweed	Conyza canadensis
Indian Grass	Sorghastrum nutans L.
Interrupted Fern	Osmunda claytoniana L.
Juneberry	Amelanchier spp.
June Grass	Koelaria macrantha L.
Kentucky Bluegrass	Poa pratensis L.
Large-flowered Beardtongue	Penstemon grandiflorus Nutt.
Leadplant	Amorpha canescens Pursh
Little Bluestem	Schizachyrium scoparius Michx.
Mullein	Verbascum thapsus L.
Northern Pin Oak	Quercus ellipsoidalis Michx.
Oak	Quercus spp.
Pennsylvania Sedge	Carex pensylvanica Lam.
Pine	Pinus spp.
Pointed-leaved Tick Trefoil	Desmodium glutinosum Muhl.
Poison Ivy	Rhus radicans L.
Porcupine Grass	Stipa spartea Trin.
Potato	Solanum tuberosum L.
Prairie Larkspur	Delphinium virescens Nutt.
Prickly Ash	Xanthoxylem americana Mill.
Purple Prairie Clover	Petalostemon purpureum Vent.
Quack Grass	Agropyron repens L.
Quaking Aspen	Populus tremuloides Michx.
Red-berried Elder	Sambucus pubens Michx.
Red Cedar	Juniperus virginiana L.
Red Maple	Acer rubrum L.
Red Raspberry	Rubus strigosus Michx.
Round-headed Bush Clover	Lespedeza capitata Michx.
Smooth Brome	Bromus inermis Leyss.
Smooth Sumac	Rhus glabra L

Appendix A. cont'd

Common name	Scientific name
Soybean	Glycine max L.
Spruce	Picea spp.
Starflower	Trientalis borealis Raf.
Sweet Cicely	Osmorhiza claytonii Michx.
Sweet Everlasting	Gnaphalium obtusifolium L.
Switch Grass	Panicum virgatum L.
Tartarian Honeysuckle	Lonicera tartarica L.
Virginia Creeper	Pathrnocissus inserta Kerner
Western Ragweed	Ambrosia coronopifolia T.& G.
Wild Geranium	Geranium maculatum L.
Wild Grape	Vitis spp.
Wild Lupine	Lupinus perennis L.
Wild Sarsaparilla	Aralia nudicaulis L.
Yarrow	Achillea millefolium L.