Please note that location information has been removed from this document to protect sensitive species' populations.

Rare Wildlife and Habitat Surveys in Oak Savannas of the Anoka Sand Plain Subsection

Final Report
Project Number T-13-R-1
April 2008-March 2010

Prepared by
Liz Harper
Erica P. Hoaglund
Christopher E. Smith
Hannah Texler
Division of Ecological Resources
Minnesota Department of Natural Resources

September 2010

Table of Contents

List of Tables

List of Figures

List of Appendices

Introduction

The upland habitats in the Anoka Sand Plain Subsection, including those targeted by this project, are being developed at an alarming rate. The main portion of this subsection stretches across the northern portion of the Twin Cities metropolitan area, west to the St. Cloud area, and north to the North Branch area. Population growth in the Anoka Sand Plain is the second fastest of any subsection in the state, and more than 90% of the land is in private ownership (MNDNR 2006). Oak savanna is designated as a key habitat in the State Wildlife Action Plan (SWAP) (MNDNR 2006) for the Anoka Sand Plain Subsection, and the oak savannas remaining in this subsection are some of the highest quality examples of this habitat type remaining in the state. Most of the remaining savannas occur on public lands.

Surveys of rare animals in this subsection were completed by the Minnesota County Biological Survey (MCBS) in 1990. Due to the high number of counties surveyed during that field season, many portions of this subsection were not surveyed. Additionally, these surveys did not include invertebrate species. Thus, the MCBS data are 20 years old, incomplete, and do not include information on invertebrate Species in Greatest Conservation Need (SGCN) as defined by the SWAP. Goal II of SWAP is to improve knowledge about SGCN (MNDNR 2006 pgs.74-75). This survey addressed this goal by implementing Strategy IIA – surveying SGCN populations and habitats. To do this we addressed the priority conservation actions of surveying SGCN populations related to the key habitats (oak savanna), surveying wildlife taxa underrepresented by MCBS animal surveys, and collecting habitat information needed to support the conservation of oak savanna habitat. The results of this project addressed Goal I - stabilize and increase SGCN populations – by identifying oak savanna habitats within the Anoka Sand Plain that support SGCN and using the information to provide technical assistance to individuals and/or agencies responsible for the management of oak savanna and associated prairie and woodland habitats.

This survey helps to achieve Goals I and II of SWAP as outlined in the Anoka Sand Plain Subsection (MNDNR 2006 pgs. 74-75). As a result of this survey and distribution of the data gathered, there is an increased knowledge of the status and distribution of SGCN in the Anoka Sand Plain, and the health of the oak savanna ecosystem. The aim of this increased knowledge is to lead to more informed development and management decisions, and hence increased conservation of SGCN and oak savanna habitat. The data collected during this survey has been collected in a way that it may be used to develop a long-term monitoring study to track selected SGCN populations over time as management, climate change, and other factors exert influences over the sites.

This report summarizes the findings of this study including all species found, all SGCN found and all listed species found. We discuss results obtained in the nine managed areas targeted by this survey. The managed areas surveyed were located in four counties as follows: Sherburne County - Sherburne National Wildlife Refuge (NWR), Sand Dunes State Forest, Uncas Dunes Scientific and Natural Area (SNA), Rice Lake SNA, and Oak Savanna Park Reserve; Anoka County - Bunker Hills Regional Park and Cedar Creek Natural History Area and Helen Allison SNA; Isanti County - Cedar Creek Natural History Area; Chisago County - Wild River State Park. We also discuss management recommendations that emerged throughout the course of the work. In addition, we include the progress we have made towards implementing the next steps of this project that we identified in 2008 and 2009.

Methods

Review of Existing Information and Survey Site Selection

Current information available about rare species, habitats, and habitat management within each of the study areas was reviewed prior to site selection for the 2008 and 2009 field seasons. Sources reviewed for information included aerial photos, spatial data relating to current habitats and soil conditions, MCBS sites of biodiversity significance and mapped native plant communities, MCBS animal survey data, management plans submitted by partners, and the Natural Heritage Information System (NHIS) rare species information.

Sites of high quality oak savanna and associated prairie and wetland habitat within each study area were selected based on the existing information listed above, on the ground site visits, and conversations with site managers.

Survey Timing and Techniques

Occurrence surveys for SGCN were conducted between April and October in 2008 and 2009. Animal surveys focused on 18 target species which were selected for their dependence on oak savanna and prairie habitats (Table 1), but all species found were documented. Surveys for each species were conducted in the appropriate habitat within each study area and at the times when they were easiest to find (Table 2) within the nine managed areas (Fig. 1). Surveys involved a number of taxa-specific survey methods. Small mammals were surveyed using Sherman live traps, birds were surveyed using breeding-season point counts and target bird surveys, reptiles were surveyed using timed terrestrial searches, road surveys, turtle trapping and artificial cover objects, invertebrates were surveyed using terrestrial searches and sweep net sampling. Incidental observations for all target SGCN were also recorded on incidental datasheets (Appendix I), and observations were solicited from the public. Detailed vegetation surveys were conducted using the relevé methodology. Along with these detailed vegetation surveys, general habitat data was collected at most survey sites when surveying for animal occurrences. These data were collected in a standard manner by trained field staff and recorded on datasheets in generalized habitat type categories (Appendix I), such as “Emergent Marsh” or “Oak Savanna.”

Whenever possible and applicable, standard data was collected for every observed animal. These data included: weight in grams, size measurements in millimeters, sex, age, reproductive status, and location (see Appendix I for examples of all datasheets used). Here after this standard set of measurements will be referred to as “standard data.”

Small Mammal Surveys

Staff: Liz Harper, Erica P. Hoaglund, Christopher E. Smith, Tim Koppelman

Small mammal surveys were conducted between 5 Aug 2008 and 18 Sept 2008 and 4 Aug 2009 and 24 Sept 2009 within the nine survey areas (Fig. 2). Each grid was chosen based on habitat suitability for target animals and a review of existing information at each site. Each grid contained 4 rows of 10 traps each with traps spaced approximately 15 meters apart. Traps were Sherman live traps. All traps were baited with a mixture of oats and peanut butter. Traps were opened in the evening and checked early the next morning. Standard data on animals captured were recorded onto mammal trapping datasheets (Appendix I), and the animals were marked

with a non-toxic permanent marker on the ventral surface and immediately released. Traps were then closed for the heat of the day, and re-opened in the evening. Traps at each grid were set for three consecutive nights. Photographic vouchers were taken of any target animals captured. Along with capture information, site and micro-habitat data were collected at every trap grid. This habitat data was collected in the following manner: first, the nature of the habitat of the entire site was recorded on a mammal site habitat datasheet (Appendix I) characterizing the geologic characteristics of the area (terrain, soil, water, etc.) and the predominant growth forms of the grid. Second, micro-habitat data was collected at each trap within in the grid. At each trap observers recorded the top three microhabitat variables that composed at least 25% of the cover in a one square meter area centered on the trap. If a variable was given a 1 it signified that it represented the most abundant habitat variable in that square meter (Appendix I). If microhabitat variables composed <5% of the square meter, their presence was noted with a check mark. A map of the mammal grid and surrounding area was sketched onto the datasheet to allow for electronic mapping and future trapping replication.

Bird Surveys

Surveyors: Clay Christensen, Val Cunningham, Jay Hamernick, Bonnie Sample, Yvette Monstad, Christopher E. Smith, Erica P. Hoaglund, and Liz Harper

Point Counts

Bird point counts were conducted up to three times at each survey point (Fig. 3) between 24 May 2008 and 28 June 2008 and 28 May 2009 and 30 June 2009. Point counts were conducted from 15 minutes before sunrise to approximately four hours after sunrise (around 0930 hrs). The point counts were ended a little earlier or later depending on bird activity and weather. Point counts were not conducted during periods of heavy rains, high winds, dense fog, or other weather that obviously negatively affected bird activity. Surveys were generally only conducted in winds less than 6 mph, but if birds seemed to be singing, the point count was completed.

In 2008, contractors were supplied with maps of priority survey areas including previous MCBS point count locations, and were told to keep survey points at least 150-200m from a habitat edge whenever possible. If a point had be located closer than 150m from a habitat edge, contractors were told to be very careful about differentiating between species within and outside of the habitat being surveyed. Survey points were at least 250m apart. In 2009, contractors returned to select survey points from 2008 as well as visiting a small number of new points in order to assure that all appropriate habitat areas were surveyed.

All data were recorded on point count datasheets provided to contractors (Appendix I). A datasheet was completed for every point count, whether birds were observed, or not. Contractors collected general habitat information, site locality information (GPS reading and site name), and recorded all birds heard or observed during the ten-minute survey. Survey period was split into two five-minute intervals. For each species, the number of singing males heard was recorded separately for birds located within a 50m radius of observer, and for those beyond 50m. If females, juveniles, or unknown birds were observed, contractors recorded this, and included the number observed within and beyond the 50m radius. Contractors were instructed not to count the same individual more than once (e.g., the same pair of sandhill cranes may be audible at two consecutive points, but there were only counted once).

Contractors recorded flyovers separately, and noted if bird was "using" the habitat (e.g., foraging swallows).

Targeted Bird Surveys

Loggerhead Shrike and Red-headed Woodpecker targeted searches were completed in appropriate habitats within all the nine survey areas between 10 June 2008 and 4 July 2008. Searches consisted of walking and driving through appropriate habitat within the study areas and recording observations of target birds on a provided targeted bird survey datasheet (Appendix I). The surveyor searched areas of appropriate habitat with binoculars looking for Loggerhead Shrike and Red-headed Woodpeckers. Other species observed were recorded as well. Surveys were conducted at any time of day during decent weather with a focus on survey times before 1030 hrs and after 1630 hrs. Surveys were not conducted in heavy rain, winds greater than 30 mph, dense fog, or when temperatures were above 90 degrees Fahrenheit. If a Loggerhead Shrike or Red-headed Woodpecker was observed, the surveyor was instructed to follow it for up to 15 min to attempt to locate a nest or nest cavity. A GPS unit was carried to mark the approximate location of the targeted bird observed, and record tracks of the areas searched. Red-headed Woodpecker and Loggerhead Shrike targeted surveys were not repeated in 2009 because so little data on these species were obtained through this survey method in 2008.

Red-headed Woodpeckers were also surveyed during this period with a collaborative effort that was formed because of this SWG project, but not funded by this project. Through our efforts to survey SGCNs on the Anoka Sand Plain, a partnership was formed with the Red-headed Woodpecker Recovery team (http://redheadrecovery.org/). The methods and results for this project can be found in Appendix II.

Whip-poor-will targeted searches were conducted at Bunker Hills Regional Park from 2125 hrs on 9 July 2008 to 0036 hrs 10 July 2008, Sand Dunes State Forest on June 24 2009 from 2100 hrs to 2239 hrs, Sherburne National Wildlife Refuge on 2 June 2009 from 2131 hrs to 2310 hrs and Cedar Creek Natural History Area and Helen Allison SNA on 29 June 2009 from 2121 hrs to 2217 hrs following the protocols established by the United States Nightjar Survey Network (http://www.ccb-wm.org/nightjars.htm). Each survey was started at least 30 minutes after sunset during survey periods suggested by the United States Nightjar Survey Network. The survey periods are selected to coincide with the nights of brightest moonlight and greatest Nightjar calling frequency. Surveys were conducted when the moon was above the horizon and not obscured by clouds. No whistles or audio-calls were used, and no lights were used to search for reflections of Nightjars eyes. Areas were surveyed based on suitable habitat and historical locations. Surveyors listened at each location for five minutes and recorded any Whip-poor-wills heard onto nightjar survey datasheets (Appendix I).

Public Reports:

Identification sheets for Loggerhead shrike and Red-headed woodpeckers were distributed to the public in order to solicit additional reports of these species (Appendix III).

Reptile Surveys
Staff: Liz Harper, Erica P. Hoaglund, Christopher E. Smith, Tim Koppelman

Reptile surveys were conducted between 20 May 2008 and 17 Sept 2008, and 28 April 2009 and 23 September 2009.

Turtle Surveys: Turtles were surveyed using hoop traps in Sherburne NWR, Sand Dunes State Forest, and Uncas Dunes SNA between 28 May and 19 June 2008 and in Sand Dunes State Forest, Sherburne NWR, Uncas Dunes SNA, and Wild River State Park (Fig. 4) between 24 June and 3 September 2009. The traps (types with leads and without leads) were set and then baited with a floating container of sardines. Traps were placed in habitat appropriate for Blanding's Turtles (*Emydoidea blandingii*) and checked daily. Any turtles captured were removed from the traps, and standard data were collected and recorded on herpetofauna (herp) search/trap datasheets (Appendix I). Datasheets were completed whether turtles were captured, or not. Digital photographs were taken to document captures.

If Blanding's Turtles were captured from within Sherburne NWR, Sand Dunes State Forest or Uncas Dunes SNA, each turtle was given a unique ID by notching their carapaces with a triangle file, and data were recorded on marked Blanding's Turtle datasheet (Appendix 1). The numbering was done at the request of and in conjunction with Sherburne NWR staff.

Along with trapping, Blanding's Turtles were targeted by visually scanning areas of suitable habitat (emergent marshes, lakes, rivers, wetlands) with binoculars. All species observed during surveys were recorded on datasheets.

Terrestrial Searches: Timed terrestrial searches were completed within all nine survey areas (Fig. 5). Searches were completed on foot by walking a target area with staff spread out evenly scanning the ground. All species of herpetofauna (herps) observed were recorded on herp search/trap datasheets (Appendix I), and standard data were collected. A datasheet was completed for each terrestrial search whether or not species were observed. Digital photographs were taken to document observations.

Road Searches: Road searches were completed where appropriate. Road searches consisted of timed driving of roads within or bordering survey areas and searching for animals crossing the road. When an animal was encountered, standard data were collected and recorded on a datasheet. All animals were released well away from the road in the same direction they had been traveling. Any dead-on-the-road (DOR) animals observed were also recorded and standard data was recorded as available. Dead animals were then moved well off the road to prevent re-counting. Digital photographs were taken to document all observations.

Artificial Cover Objects: Artificial cover objects where placed out in Sherburne NWR and Cedar Creek Natural History Area in suitable habitat for target species in May of 2008 (Fig. 5). All were tin cover boards approximately 3 ft x 3 ft square. Each cover board was checked as often as possible throughout both the 2008 and 2009 field seasons and any animals found underneath were recorded on a drift fence/cover object datasheet (Appendix 1).

Drift Fence: Drift fences were used to survey herpetofauna during the 2009 field season. One drift fence was installed in Sherburne NWR and one in Cedar Creek Natural History Area (Fig. 4).

The drift fence at Sherburne NWR was installed on 8 April 2009 and the drift fence at Cedar Creek Natural History Area was installed on 21 April 2009. Both drift fence arrays consisted of a 12 meter (36 foot) fence made of metal screening with a tall anchor stake every three meters along its length secured to the fencing with zip-ties, 5 five-gallon bucket pit-fall traps, and three funnel traps also made out of screening. To install a drift fence a trench was dug the length of the fence to a depth of approximately 3-4 inches, the fence was then placed in the trench, the support stakes pounded into the ground, and the dirt replaced along the bottom of the trench to prevent animals from slipping under the fence. A pitfall trap (consisting of one five-gallon bucket sunk into the ground flush with the surface of the soil) was then placed at the terminal ends of the fence and then one every three meters on alternating sides of the fence. A small amount of water and a sponge were then added to each pitfall to prevent the overheating, dessciation or drowning of captured animals. Funnel traps where then placed at opposing sides of the fence to the three bucket traps along the middle of the fence and lawn spikes were used to secure the funnels to the soil along the fence. Shade covers where then installed over each trap location by stretching black weed control fabric in a tent over the traps and staking it to the ground. Traps were "closed" by placing lids on the five-gallon buckets and removing funnels.

Both fences were opened and checked 2 to 3 times daily (early morning, noon and evening) whenever reptile or mammal survey activities were taking place near the fence. Standard data was collected on all captured animals and recorded on a drift fence/cover object datasheet (Appendix I). All live animals were released some distance away from the drift fence to prevent immediate re-capture, and any animals that died in the traps were collected and will be added to museum collections for educational purposes. Digital photographs were taken to document all captures.

Public Reports: Reptile identification sheets with photographs and written descriptions of target species were distributed at several sites within the survey areas to solicit observations from the public and agency staff (Appendix III). Public records were collected for target species sightings and confirmed sightings were added to the data.

Terrestrial Invertebrate Surveys

Surveyor and Staff: Dean Hansen, Liz Harper, Erica P. Hoaglund, Christopher E. Smith

Invertebrate surveys were conducted using terrestrial searches and sweep net sampling at all 9 survey areas between 2 June 2008 and 17 September 2008 and between 20 May 2009 and 10 September 2009 (Fig. 6). Inverts were targeted on a species basis through the use of visual searches, host plant searches and net sweeps. Species were targeted during the time periods where they were most likely to be observed (Table 2). Visual searches of suitable habitat were conducted and any individuals observed were noted and a GPS waypoint was taken of the location. Voucher specimens were also taken to confirm species identity when necessary. Digital photographs were taken of species when possible. Net sweeps in sets of 25 or 50 were also conducted when large areas of suitable host or food plants for a target species were found. All invertebrate species located during surveys were not identified and recorded due to the high number of non-target species observed and the time constraints of the invertebrate contract work.

Cincindela patruela patruela and *Metaphidippus arizonensis* were located and photo documented at several locations while staff were surveying for other taxa. Data were collected on incidental datasheets (Appendix I).

Vegetation Surveys
Staff: Hannah Texler

Relevès were conducted at 15 locations across all study sites (Fig. 7) to assess general vegetation parameters in the oak savanna and oak woodland habitat. Relevès were completed following the protocol from the Minnesota Department of Natural Resources "A Handbook for Collecting Vegetation Plot Data in Minnesota: The Relevé Method" using the datasheet developed to be used with this protocol (MN DNR 2007) (Appendix I). Plots were placed in or near animal sampling areas in coordination with the animal survey schedule wherever possible. Data collected in relevé plots included identification of all plant species and estimates for each species in height and cover classes. Each plant community was also assigned a standard "A" through "D" rank. These ranks are indicative of community quality and range from an "A" for a high-quality, relatively undisturbed community, down to a "D" for a highly disturbed community. These ranking systems apply to the area of the relevé plot only, and are not meant to rank the whole community of each managed area. Rare plant species were also documented when encountered.

GIS Analysis of Landscape Context of Vegetation

Staff: Erica P. Hoaglund, Hannah Texler, Liz Harper

GIS analysis of landscape context of vegetation was completed after the 2009 field season in order to examine the connectivity and patch size of open habitat within the managed areas surveyed and the surrounding landscape. ArcMap 9.3 ArcView software was used along with 2008 FSA Color Aerial Infrared Imagery and 2008 FSA Color Aerial Photography layers to digitize open habitat patches within target managed areas and in the landscape surrounding them. When digitizing open habitat patches areas of row crops were excluded as they do not represent viable habitat. Barriers to connectivity were defined as being a movement or dispersal barrier to a significant number of the SGCN that would use the habitat. Total acreage of open habitat per managed area was then calculated and percent open habitat to total area of each managed area was also calculated.

Information Management

Staff: Erica P. Hoaglund, Christopher E. Smith, Liz Harper, Hannah Texler

All mammal, bird, reptile, and invertebrate data from the 2008 and 2009 field seasons were entered into Excel spreadsheets which were submitted to the observation database*. Relevé data were entered into the relevé database. All photos taken by staff or submitted by contractors or the public were catalogued and entered into a photo tracking spreadsheet which included at minimum: photo numbers, subject of the photo, photographer, and location photo was taken. Along with photos, all other forms of documentation for target SGCN (e.g. emails from the public) were catalogued and organized for documentation of tracked species. All occurrences of NHIS tracked animal and plant species encountered during the 2008 and 2009 field season were complied, submitted and entered into Biotics**.

---

*The data collected for the Anoka Sand Plain project are being used to test the Observation Database, a new data management system being developed for use by the Minnesota Department of Natural Resources (MNDNR), Division of Ecological Resources. This new database will not only facilitate entry of data into Biotics, but it also provides a centralized, secure location for the storage, sharing, management and use of all MNDNR Ecological Resources data regardless of state listing or SGCN status.

**The Biotics system is maintained by the Division of Ecological and Water Resources for the storage and dispersal of the data for use in land and project planning. In Biotics, the fundamental mapping unit is the source feature. Element occurrences may comprise one or more source features, which represent the spatial location of exactly where on the ground the observation occurred. Standard specifications for each tracked species or group of species are created based on the ecological characteristics of the species or community. These specifications dictate whether a new observation in the vicinity of an existing observation will become part of an existing element occurrence or a new element occurrence will be created.

Developing next steps for work in the Anoka Sand Plain

Staff: Liz Harper, Erica P. Hoaglund, Hannah Texler

During the course of the 2008 and 2009 surveys of SGCN in the Anoka Sand Plain (hereafter referred to as ASPI) it became very apparent that more work would be necessary in order to better understand the rarest species on the Anoka Sand Plain, and provide management recommendations for the habitat of these species. Staff met to discuss preliminary results, and outlined goals for an additional proposal to continue this project.

Results and Discussion

Fourteen of the 18 targeted SGCN were observed during the Anoka Sand Plain field surveys (Table 3). In total, 38 SGCN were observed, along with 132 non-SGCN.

Small Mammal Surveys

Throughout the two field seasons of this project, 5,733 trap nights were spent surveying for the target mammal species: plains pocket mice (*Perognathus flavescens)* and western harvest mice (*Reithrodontomys megalotis*). This effort was spaced across 49 grids of Sherman live traps within the nine managed areas (Fig. 2). The plains pocket mouse was the only SGCN mammal observed during the survey. However, an additional 11 other mammal species were recorded during survey efforts (Table 4).

During the course of the survey 33 individual pocket mice were trapped using Sherman live traps and one was captured in a pitfall trap. These 34 individuals were spread across four of the nine managed units (Tables 3 and 4) and found in 11 of the 49 grids set (Fig. 2). Of the 34 individuals, 18 were determined to be female, and 16 to be male. Plains pocket mice were trapped the most frequently in habitat classified as “oak savanna,” with the second most commonly recorded habitat being “grassland.” They were also trapped in habitat classified as “edge.” Edge habitat is defined for this study as an area of transition between one distinct habitat type and another (e.g. oak woodland to oak savanna). Plains pocket mice were trapped the most frequently on flat habitat (as opposed to on slopes). Of all the traps that contained a plains pocket mouse 71% had bare soil as the dominant microhabitat cover type. The second most abundant cover type was low herbaceous plants, the third most abundant cover type was leaf or grass litter and dead vegetation, and the fourth most abundant cover type was low graminoid plants.

Despite apparently suitable habitat being very abundant in some areas that were trapped for small mammals, plains pocket mice were only located at 22% of trap locations (11 out of 49), not including the one individual that was trapped by a pitfall in the drift fence array at Sherburne

NWR. It is as yet undetermined what specifically characterizes some of these locations that appear to demonstrate greater use than apparently similar nearby areas. Plains pocket mice appear to favor sparsely vegetated habitat with loose sandy soil (MN DNR 2010), as seen by high percentage of traps with pocket mice in them that had "bare soil" listed as the chief habitat component of the area. It is possible that local populations of mice had been extirpated from the apparently suitable areas that were trapped and did not yield any individuals.

We also failed to find plains pocket mice in a historical location within Sand Dunes State Forest, presumably due to habitat loss since the previous sighting. This historical sighting was just west of Ann Lake. The mouse was observed there in 1949 at which time the observer noted a 3 year old pine plantation surrounding the observation. Since 1949 the pine plantation has matured and reduced the suitable habitat for pocket mice. The population has most likely been extirpated from that locality.

Populations of plains pocket mice are often widely isolated and separated by areas of unsuitable habitat. This makes genetic flow between populations unlikely, therefore individual populations must be protected because of their genetic diversity. Long-term monitoring of both vegetation and small mammal composition should be conducted, as changes in these characteristics indicate a decline in suitable habitat for the species. Habitat protection from human disturbance is also essential. Impacts of human development, including the introduction of cats and dogs and soil compaction from foot and vehicular traffic, can eliminate populations of plains pocket mice. Finally, it is important to protect habitat from successional trends, as an increase in the number and size of trees and thick ground vegetation will eventually eliminate this species. When prescribed burning or discing are used as management tools on sites where the species has been documented, the area to be managed should be subdivided into management units to avoid disturbing all potential habitat in any one year (MNDNR 2010).

The fact that no western harvest mice were found during surveys is likely a result of the study areas were located on the northern edge of this species' range in Minnesota. This species was included as a target SGCN, because the surveys were taking place in suitable habitat for this species, and there is at least one township record for this species in Sherburne County (Hazard 1982).

Bird surveys

Bird species were surveyed using point counts, targeted survey techniques, and by collecting incidental observations. During the study, 231 bird point counts were completed (131 in 2008 and 100 in 2009), 427 minutes were spent completing targeted Whip-poor-will surveys, and approximately 1,964 minutes were spent completing targeted Loggerhead Shrike and Red-headed Woodpecker searches. These survey efforts resulted in the observations of five of our six target bird SGCN, 39 additional SGCN and 131 non-SGCN birds (Tables 3 and 5). Of the targeted bird SGCN, only the Loggerhead Shrike was not observed at all during the study. The Field Sparrow was the most abundantly observed target species with 162 observations across all nine managed areas. The other four of the target species were observed in relative abundance as follows: Brown Thrasher with 55 observations across eight survey areas, Red-headed Woodpecker with 39 observations across four managed areas, Whip-poor-will with 31 observations across five managed areas, and the Eastern Meadowlark with 8 observations across two of the nine managed areas. Although these counts are excellent sources of relative

abundance, they do not necessarily represent unique individuals as some were most likely recorded on multiple site visits.

The lack of observations of Loggerhead Shrikes during this project is disturbing, as there are historical records of this species in some of our survey areas, and apparently suitable habitat existed in nearly all of the managed areas surveyed. Habitat loss is partly responsible for this species' decline in Minnesota, as Loggerhead Shrikes require relatively large areas of grassland habitat with scattered shrubs or small trees for nesting.

Management efforts for this species should focus on increasing and maintaining suitable grasslands and shelterbelts, brush along fence lines, and scattered trees and shrubs for nest and perch sites. Some loggerhead shrike habitat has become overgrown with trees, particularly red cedar. While red cedar is often an important nest tree for loggerhead shrikes, dry grassland slopes can become so covered by the dense growth of this tree that it becomes unsuitable shrike habitat. Management efforts to control the encroachment of red cedar would benefit this species. Further research should focus on identifying where midwestern Loggerhead Shrikes overwinter and whether habitat protection or management activities in those areas could help reduce population declines (MNDNR 2010).

Reptile Surveys

During the course of the Anoka Sand Plain herp surveys 4,319 acres of habitat across the nine managed areas were searched for target SGCN (Fig. 5). Many areas searched were revisited multiple times within a year and across the two years of the survey. A total of 21,780 minutes were spent in herp search activities. Fifty-six trap nights were spent targeting Blanding's Turtles in four of the managed areas. The results of this effort were the observations of all three of the target SGCN reptiles, three additional SGCN reptiles, and 16 non-SGCN reptiles and amphibians (Tables 3 and 6). In total, 22 snake, lizard, frog, toad, and salamander species were recorded during the project (Table 6). No species were found in all managed areas searched, and Rice Lake SNA was the only managed area to yield no SGCN.

Of the target SGCN reptiles, gophersnakes were found to be the most abundant and widespread with 152 individuals located within the bounds of eight of managed areas (Tables 3 and 6). They were found most often in habitat classified as "edge" and second most commonly in habitat classified as "oak savanna." Gophersnakes were recorded most frequently at an air temp between 21 and 25 degrees Celsius and second most frequently at an air temp between 16 and 20 degrees Celsius. The time of day they were most frequently recorded was between 1500 and 1700 hrs, with the second most frequent being 0900 to 1100 hrs.

Blanding's Turtles were the second most abundantly recorded target SGCN reptile with 56 individuals located within four managed areas (Tables 3 and 6). They were most often recorded in habitats classified as "emergent marsh." No other habitat type was nearly as frequently listed. While this observation is interesting, it should be noted that emergent marsh habitats were targeted for trapping. However, of those Blanding's turtles that were not trapped, emergent marsh was still the most commonly recorded habitat type. Blanding's Turtles were most frequently observed at an air temperature between 21 and 25 degrees Celsius, with no other range of air temperatures being recorded as frequently. This observation proved true of both trapped and observed (non-trapped) individuals. These turtles were most frequently recorded as being observed between 0900 hrs and 1100 hrs.

The third most abundantly recorded target SGCN reptile was the Western Hognose Snake, with 25 individuals observed within four managed areas. Western Hognose Snakes were recorded most frequently in habitat classified as “edge” and second most frequently in habitat classified as “grassland.” They were most often found at an air temperature between 16 and 20 degrees Celsius, with a close second for number of observations being between 11 and 15 degrees Celsius. These snakes were overwhelmingly observed between 0900 hrs and 1100 hrs.

Of the non-target SGCN reptiles, Common Snapping Turtles were the most frequently observed, with 12 individuals observed across 4 managed areas (Tables 3 and 6). They were most frequently found in “edge” habitat, at an air temperature of 21 to 25 degrees Celsius, and between 1200 and 1400 hrs.

Eastern Hognose Snakes were the next most frequently observed non- target SGCN reptile with 10 individuals located in two managed areas. Although this is a more limited sample, they were found most frequently in habitat classified as “deciduous forest,” at air temperatures of between 21 and 30 degrees Celsius, and between 1200 and 1700 hrs.

The least recorded non-target SGCN reptile was the Smooth Greensnake. It was observed only six times across four managed areas. What little we can say from this limited sample is that it was most often found in “edge” habitat, between 21 and 30 degrees Celsius, and between 1500 and 1700 hrs.

Throughout the course of this project reptiles represent the only taxa for which all target SGCN were successfully located. This high degree of success has allowed us to observe some very interesting trends, natural history notes, and behaviors.

The first observation is that of abundance and the distribution of that abundance for the various target species. It was noted by field staff that several of the species appear to be concentrated in abundance in comparatively small geographical locations, while other species appear to be more spread out across the landscape. Western Hognose Snakes, in particular, seem to fall under the “concentrated” category. Great abundances (comparatively) of individuals of this species were found within a limited time period very close to one another in areas of habitat less than an acre in size. These small patches seemed to be characterized by being transition zones between habitat types (usually oak savanna to oak woodland or prairie to oak savanna) and by having abundant open soil (see management recommendations and conservation concerns sections for a more in-depth discussion of the importance of open soil).

Gophersnakes, however, appeared to be found generally wherever habitat was suitable and generally not in great abundance at any given location. This may be because Gophersnakes represent a more active predator with larger home ranges and greater resource needs (Rodrigues-Robbles 2003). It is likely that these two snake species use the habitat very differently.

Blanding’s turtles were a target SGCN that represented a mix of the behaviors discussed above. Blanding’s turtles were found both singly across a vast landscape, and in close proximity sharing the same wetland. This is most likely because of the life history of the species and its well know tendency to travel vast distances to nest and subsequently move very little (Congdon et al. 1993).

Another, rather more troubling observation about Blanding's turtles was an apparent lack of recruitment in surveyed areas. During the course of the study only one individual under five years of age was found alive. This is even more troubling considering that as soon as this pattern was noted, field staff made every effort to specifically target juvenile Blanding's turtles with no success. Although the behavior of these young turtles is relatively well understood (Pappas et al. 2009) none were located. This is further troubling when coupled with the anecdotal observations of a large number of predated turtle nests observed throughout the project. It is possible that meso-predators are having an impact on this turtle species.

The final troubling observation that pertained most significantly to amphibian and reptile species was road mortality. During the course of field work it was observed that direct mortality caused by vehicle collisions was substantial whenever roads bordered suitable habitat, and especially prevalent when roads bisected habitat (Figs. 8 and 9). Many of the rare reptile species targeted by this survey have a low reproductive rate, meaning they often give birth to lower numbers of young (many of whom do not survive to reproduce) and take a very long time to reach sexual maturity (Congdon et al. 1993). These factors make the frequent deaths on roads devastating to populations.

Terrestrial Invertebrate Surveys

During the course of the invertebrate surveys, approximately 1196 acres were searched within the nine managed areas (Fig. 6). Many acres searched were revisited multiple times within a year and across the two years of the survey. This effort yielded observations of three of the seven insect and spider target SGCN (Tables 3 and 7). *Cicindela patruela patruela* (Northern barrens tiger beetle), *Hesperia leonardus* (Leonard's skipper), and *Metaphidippus arizonensis* (a jumping spider) were the three target insect SGCN observed. An additional 17 invertebrate species were recorded (Table 7). (Although many other invertebrate species were observed throughout the course of the survey, the contractor and staff were instructed to focus on target SGCN and other species of interest).

The northern barrens tiger beetle was observed 29 times across five of the nine managed areas. The Leonard's skipper was observed 227 times across four managed areas, and the jumping spider was observed 64 times across seven managed areas (Tables 3 and 7). The northern barrens tiger beetle was recorded most frequently in August overall, as was the Leonard's skipper. The jumping spider was recorded most often in June.

The general results of the invertebrate surveys seem to be abundance or absence. When target species were found, they were generally found in relatively high numbers in the expected areas. Tiger beetles were found on sandy blow-outs, or on sandy trails. Leonard's skippers were generally found nectaring on blazing stars (*Liatris* spp.). The jumping spider was generally found in or near nests in large-flowered penstemon (*Penstemon grandiflorus*) and round-headed bush clover (*Lespedeza capitata*) seed heads. However some species appear extirpated from historical ranges. Despite the presence of suitable sand blow-out habitat somewhat near to historical ranges, *Cicindela lepida* was never observed. Despite the presence of hairy grama (*Bouteloua hirsuta*), the host plant for the Uncas Skipper, it was never observed. Despite suitable nest plants, *Tutelina formicaria* (a jumping spider) was never observed.

The seeming absence of the Uncas Skipper is very concerning, as the areas surveyed for this project include all but one of the known historical locations for this species in Minnesota.

The seeming absence of *Tutelina formicria* is also concerning, as Cedar Creek Natural History Area and Helen Allison SNA are the only two known historical locations for this species in Minnesota.

The absence of the Karner Blue Butterfly (*Lycaeides melissa samuelis*) was disappointing, but not surprising, as this species is suspected to be limited to Winona County Minnesota. Although historical records are known from our survey area in Cedar Creek Natural History Area, this species was extirpated from that site many years ago.

It does not take much to eliminate a local population of invertebrates and it may take them decades to re-colonize a disturbed habitat, or they may never return at all if there is no suitable habitat adjacent to the disturbed area. Many of the historical sites for these species no longer contain suitable habitat, as the areas have been developed or converted to plantations.

Two other hazards to the persistence of these rare invertebrate species that were noted during this project were fire and seed collection. It appears that large continuous patches of habitat are burned frequently at many of the managed areas visited, often with no nearby refugia provided to allow invertebrates to persist. This alone could easily be the cause of local extirpations. Seed collecting for restoration purposes can also affect the species which require host plant seed heads for some stage of their life, such as both target jumping spiders. It was noted by the contractor surveying the Anoka Sand Plain that often whole Penstemon seed heads were chopped off well below the actual seed head during seed collecting activities. This not only may cause direct mortality to any spiders or spiderlings currently in the seed head being collected, but also further limits an already limiting resource for these species, virtually guaranteeing population decline.

It is also possible that pesticide use for controlling insects that affect planted pines as well as agricultural and homeowner pesticide use has led to the decline of many invertebrate species in some of these areas.

Vegetation Surveys

Relevès were completed at every managed area, 16 locations in total (Fig. 7). One plot was classified “AB” in quality, six were classified “B,” an additional six classified “BC,” two classified “C,” and 1 “CD” (Table 8). Additionally, three new element occurrences for rare plant species were observed during the course of vegetation surveys: small-leaved pussytoes (*Antennaria parvifolia*) in Uncas Dunes SNA, beach heather (*Hudsonia tomentosa*) in Uncas Dunes SNA, Bunker Hills Regional Park and Oak Savanna Park Reserve, and sea-beach needlegrass (*Aristida tuberculosa*) at Bunker Hills Regional Park.

Bunker Hills Regional Park

The oak savanna in the Bunker Hills Park occurs on the only remaining natural portion of an extensive dune field composed of many small dunes, with a maximum elevation of about 1000 feet. The park is now surrounded by housing developments, and a fairly large part of the park is developed into a golf course and other high-use park activity areas.

Vegetation at the time of the Public Land Survey in the 1850s was oak savanna. Line notes generally read “scattering oak, scattering timber” and “thicket, brush, underbrush”. The bearing trees were all bur oak and northern pin oak. Marschner (1974) mapped the area as oak

openings and barrens. Today there are about 280 acres of open savanna grading to prairie in the park. The vegetation quality is variable, but a number of the dunes support high quality, diverse, intact oak savanna plant communities with a number of blowouts. The oak savanna relevé in the park was ranked B quality. Native species diversity was high. Disturbance factors included the presence of Canada bluegrass and European buckthorn.

New occurrences of sea-beach needle grass and beach heather were found as part of this survey. Other rare plants that occur in the upland portions of the oak savanna in this park are rhombic-petaled evening primrose *(Oenothera rhombipetala),* long-bearded hawkweed *(Hieracium longifolium),* and purple sand grass *(Triplasis purpurea).* All of these rare species occur in areas of open sand with few other plant species growing nearby.

The most important management recommendations are to limit recreational activity in the portions of the park that still support oak savanna, prairie, and rare plant and animal occurrences. In addition, some brush clearing, control of European buckthorn, and prescribed burning would be beneficial.

Cedar Creek Ecosystem Science Reserve

The vegetation at the time of the Public Land Survey in the 1850s was similar to that described above for Helen Allison Savanna.

Today, the portions of the Cedar Creek Ecosystem Science Reserve included in this study are a mix of oak savanna and oak woodland. The upland areas surrounded by wetlands tend to be oak woodland, probably because they burned less often on the presettlement landscape due to the presence of the wetlands. The relevé done in oak woodland was ranked AB, very high quality. This oak woodland had been included in a spring prescribed burn the year of the survey, and its structure and species diversity were excellent for this community type. The vast majority of oak woodlands on today's Anoka Sand Plain are highly disturbed. Most have been grazed in the past, have heavy infestations of non-native shrubs such as European buckthorn and Tartarian honeysuckle, have not been burned in recent years, and exhibit ground layers with few native species and a number of non-natives. The oak savanna relevé was B-rank, with good structure and moderate species diversity, and open-grown oaks with burn scars. Rare plants recorded in savanna areas of Cedar Creek include beach heather, sea-beach needle grass, rhombic-petaled evening primrose, long-bearded hawkweed, and white wild indigo (*Baptisia lactaea)*. A number of the areas at Cedar Creek that are mapped as savanna or prairie were cropland in the past, but with prairie either naturally revegetating once crops were removed, or planted; this has resulted in a number of areas being lower in plant species diversity than native prairie and savanna areas.

Management needs include continued prescribed burning (with thought given to refugia for animals) and invasive non-native shrub removal.

Helen Allison SNA

The vegetation at the time of the Public Land Survey in the 1850s was recorded as oak openings and forest, timber, and interpreted by Marschner (1974) overall as oak openings and barrens. Bearing trees in the site were all northern pin oak.

This SNA, together with the Cedar Creek Ecosystem Science Reserve to the north, is located on an extensive several-miles-wide dune field composed of low dunes with a maximum

elevation of about 930 feet. The vegetation consists of oak savanna in the eastern portion, and a mix of planted prairie on old cropland and oak woodland in the western portion. The oak savanna in the releves was ranked B in quality. Disturbance factors included relatively high cover of Canada bluegrass. Native species diversity was moderately high. Rare plant species in the upland portions of the oak savanna included rhombic-petaled evening primrose, sea-beach needle grass, and beach heather. The regular prescribed burning in this site has maintained an open aspect and several of the dunes have open shifting sand that provides good habitat for rare plant species.

Oak Savanna Park Reserve

The vegetation at the time of the Public Land Survey in the 1850s was oak savanna, recorded as "scattering oak, scattering timber". Bearing trees in the vicinity of the park were all bur oaks and northern pin oaks.

The park includes part of the western portion of a dune complex that has an elevation of about 1000 feet. This particular dune formation is about one mile in diameter, and is surrounded by flat topography to the west and south, and is adjacent to the Elk River on the east and north. Most of the dune slopes in the park are west or south-facing slopes, which would have likely supported oak savanna grading to prairie that burned frequently on the pre-European settlement landscape. Today, the vegetation pattern includes a mix of very open areas with groves of tall eastern red cedar, areas overgrown to dense oak woodland, and occasional large blowouts with little vegetative cover. This pattern, along with the prevalence of a number of invasive non-native species such as European buckthorn and smooth brome, indicates a past history of grazing. The oak savanna relevé was given a rank of BC; disturbance factors included a large amount of Kentucky bluegrass and smooth brome in the groundlayer and frequent tall eastern red cedar. The native species diversity was moderate. The oak woodland relevé was given a rank of C; disturbance factors included European buckthorn, Scotch pine, Kentucky bluegrass, and a dense canopy cover that allowed little light to penetrate to the ground.

A new element occurrence record for beach heather was recorded in this site as a part of this project. Other rare plants that occur in this site include small-leaved pussytoes, sea-beach needlegrass, and old field toadflax *(Linaria canadensis).* All of these species occur in open areas with little canopy cover and exposed sand with little other vegetation.

Management recommendations include intensive clearing of eastern red cedar and hardwood canopy trees in the oak woodland to return it to a more open savanna-like structure, removal of European buckthorn and planted pines, and a more intensive prescribed burning program with caution taken to leave refugia for animals. In addition, prairie restoration projects in the park have created dense areas of prairie that leave little open sand. Some efforts have been made to stabilize some of the blowouts in the park with vegetation planting; rare species of plants and animals would be best served by ensuring some of these open blowouts remain largely unvegetated.

Rice Lake Savanna SNA

The SNA is a small part of an extensive dune field that supported oak savanna in pre-settlement years. Bearing trees were bur oak. Vegetation was described as scattering oak, scattering timber, and timber. Marschner mapped the area as oak openings and barrens.

Today most of the SNA is mapped as oak savanna, with a small portion mapped as oak woodland. Many areas are overgrown with woody vegetation, both native hardwood species and planted conifers, and has more of a woodland aspect with small open areas of savanna. A fairly large portion is sedge meadow grading to wet prairie, with aspen common. The plant community in the site shows signs of past disturbance, affected by past grazing, the planting of conifers, and the lack of fire. Relevés were ranked CD for oak savanna, and BC for oak woodland. No rare plant species have been documented in this SNA.

Management needs include removal of conifers, thinning of oaks, and prescribed fire.

Sand Dunes State Forest

The Sand Dunes State Forest occurs on part of the largest expanse of high dunes in Minnesota. The vegetation in what is now the state forest at the time of the Public Land Survey was described as scattering oak, scattering timber, and it was mapped by Marschner (1974) as oak openings and barrens. The bearing trees in the current state forest were bur oak and northern pin oak.

Today large portions of the dune areas of the state forest are mapped by MCBS as oak woodland or oak savanna. Most of these areas have been heavily impacted by the planting of pines, other conifers, and amur maple, and by the exclusion of fire. There are a number of south to west-facing slopes that have remained open as pines were not able to survive. The relevé in oak savanna was BC rank, and the relevé in oak woodland was C rank. Vegetation was relatively low in native species diversity. Rare plants occurring in oak savanna in Sand Dunes State Forest include skeleton weed *(Shinnersoseris rostrata),* small-leaved pussytoes, sea-beach needle grass, beach heather, creeping juniper *(Juniperus horizontalis)*, long-bearded hawkweed, and old-field toadflax. All occur in areas of relatively open sand in places that have not become overgrown by pines and hardwood trees.

Management needs are many, including the removal of pines; control of non-native invasive shrubs, including European buckthorn, Tartarian honeysuckle, and amur maple; and prescribed burning. (For more information see MNDNR 2009.)

Sherburne National Wildlife Refuge

Most of the Sherburne NWR is relatively flat, with only a few small, low dunes. The presettlement vegetation was mapped as oak openings and barrens. Wetlands were and are common throughout, which may have slowed fires somewhat, but the flat topography would have encouraged fire.

There are only a few areas of MCBS mapped oak savanna and woodland on the Refuge. Large portions of the savanna and prairie on the Refuge have been planted on old croplands. The oak savanna and woodland relevé s were both B in quality. The species diversity was relatively high, and both areas had been prescribed-burned in recent years. Rare plants in upland oak savanna on the Refuge include long-bearded hawkweed, skeleton weed, small-leaved pussy toes*,* beach heather*,* and sea-beach needle grass*,* all in areas of open sand.

Uncas Dunes SNA

Uncas Dunes SNA and Sand Dunes State Forest are part of the largest expanse of high dunes in Minnesota. The vegetation in what is now the SNA at the time of the Public Land Survey was

described as scattering oak, scattering timber, and it was mapped by Marschner (1974) as oak openings and barrens. The bearing trees in the current SNA were bur oak and northern pin oak.

Most of the MCBS mapped vegetation in the SNA is oak savanna, with smaller areas of oak woodland where fire has been less frequent. Relevés in oak savanna in the SNA were B quality in the south unit, and BC quality in the north unit. The primary disturbance factor is the prevalence of areas that were formerly shaded by planted pines before the pines were removed, that now support areas low in native species diversity and high in annual weedy species such as goosefoot and horseweed. It is expected that these areas will recover a more diverse composition of native species as succession continues post-logging. New records of beach heather and small-leaved pussy toes were found as part of this survey. Other rare plants in the SNA include old-field toadflax and creeping juniper

Wild River State Park

The landforms in the part of the park included in this study include a wide old river terrace with sand and gravel soils in the northeastern portion that supported aspen-oak vegetation at the time of the Public Land Survey, and the Pine City Moraine in the southwestern portion that supported deciduous forest at the time of the Public Land Survey. There were likely small areas that had a brushy or savanna-like structure, especially on the river terrace in drier climate periods, but on the whole the area was forested in the 1850s.

Today most of the MCBS-mapped native plant communities are mesic oak forest on the moraine and oak woodland on the terrace. There are several small dry sand-gravel oak savanna areas near the junction of the moraine and the terrace. A relevé was placed in one of these savanna openings that has been recently cleared and burned to restore the savanna vegetation. The quality rank was BC. Native species diversity was relatively low. Canada bluegrass had high cover in the relevé, probably as a result of many years of shade. Rare plant species that occur in savanna openings in the park include kittentails *(Besseya bullii),* sea-beach needle grass*,* long-bearded hawkweed*,* rhombic-petaled evening primrose*,* and old field toadflax*.* There are also extensive areas in the park that have been planted to prairie vegetation; these are the areas where most of the SGCN targeted for this study were found.

Continued clearing and prescribed burning to enlarge these oak savanna openings would be beneficial to restoring oak savanna habitat. Burning of the oak woodland would also help to improve the quality of this fire-dependent plant community.

Information Management

The animal data collected by this survey yielded a total of 668 new element observations in the Biotics system of tracked species, and added 4,131 records to the new observation database which include all animal species found on the project. These data are available for land managers and will allow them greater insight into SGCN on their lands.

Over 2000 photographs were collected and catalogued during this project. These photos have already been utilized for SGCN education, as many of the photos are utilized in the Rare Species Guide (http://www.dnr.state.mn.us/rsg/index.html).

GIS Analysis of Landscape Context of Vegetation

Patches representing open habitat (suitable habitat for most of our target SGCN) within the matrix of each managed area surveyed were mapped for all nine managed areas (Fig. 10), and their size was calculated. The total mapped acreage of the open habitat was then compared to the total acreage of each managed area. The results are as follows:

Bunker Hills Regional Park:
665 acres of open habitat, 35% of its total area (17 SGCN)

Cedar Creek Natural History Area:
1347.58 acres of open habitat, 23% of its total area (25 SGCN)

Helen Allison SNA:
52.20 acres of open habitat, **58%** of its total area (11 SGCN)

Oak Savanna Park Reserve:
34.73 acres of open habitat, 25% of its total area (10 SGCN)

Rice Lake SNA:
23.90 acres of open habitat, 30% of its total area (9 SGCN)

Sand Dunes State Forest:
918.01 acres of open habitat, **8%** of its total area (25 SGCN)

Sherburne National Wildlife Refuge:
6,616.67 acres of open habitat, 22% of its total area (32 SGCN)

Uncas Dunes SNA:
145.32 acres of open habitat, 22% of its total area* (21 SGCN)
*Note: management at Uncas Dunes has already begun as a result of this project, and the percent open area has already increased greatly.

Wild River State Park:
787.51 acres of open habitat, 11% of its total area (19 SGCN)

The managed area that had the highest percentage of open habitat was Helen Allison SNA, and the area with the lowest percentage of open habitat was Sand Dunes State Forest. The percent of the total managed area in open habitat does not seem to be a good predictor for the number of SGCN species found. It seems likely that quality of the open habitat and connectivity of intact habitat in the landscape plays a large role in SGCN presence.

Habitat mapping showed that for the most part, each managed area is surrounded by private land offering little additional oak savanna, prairie, or grassland habitat. The exception is the contiguous nature of Sand Dunes State Forest, Uncas Dunes SNA, and Sherburne NWR. This highlights the critical need to understand, preserve, and restore these managed areas, to restore habitat adjacent to them, and to connect them where possible with protected and restored corridors.

The final observation of interest was the lack of connectivity of the patches themselves within each area. Open habitat is surrounded by a matrix of other habitats such as wetlands, developments, pine plantations, or woodlands. Every habitat type, be it rare or common, is part of a matrix that builds a landscape, and often those that grade from one habitat to another are critical areas for wildlife. Thus it is important to manage not just a target habitat but to preserve

the quality of the surrounding matrix as well. Connectivity through gradation of one habitat to another is important and should be managed for.

Developing next steps for work the Anoka Sand Plain

During this project, it became very apparent that more work needed to be completed on the Anoka Sand Plain. We submitted an amendment to the grant to allow us to identify and develop next steps for work on the Anoka Sand Plain, and the results of this effort can be found in the State Wildlife Grant (SWG) funded project: "Microhabitat Components of Key Habitat Types in the Anoka Sand Plain that Influence Habitat Selection among Species in Greatest Conservation Need" (Appendix IV).

One of the information gaps identified during ASPI field work was the lack of information available on Western Hognose Snakes (a SGCN species that appears from ASP I to be particularly rare). A literature review was completed to gather available information on this species, and the lack of relevant useful data on Western Hognose Snakes in this region was better understood. Specific gaps in knowledge in the literature included detailed studies of phenology, habits, habitat use and selection, and life history were identified. Challenges to collecting data on this species were also noted.

Time was spent investigating how scientists have historically answered questions such as these for other species, and remote tracking was discovered to be the accepted manner of conducting natural history studies. The challenge to using remote tracking on Western Hognose Snakes, however, has been this species small size and the large size of conventional radio transmitter technology. Once this challenge was identified, alternative study techniques were investigated. Harmonic radar technology was discovered as being a promising way to track very small animal species. An extensive literature search was conducted on the methodology behind harmonic radar tracking and its potential ability to meet our needs. Researchers who had previously used this technology with success were contacted and their methodologies were discussed, and the single vendor of harmonic radar technology was contacted to obtained detailed information about the system and its costs. Methodology for implantation of harmonic radar was also investigated, and 2 veterinarians were contacted to assess their interest in the project, their ability to carry out the needed surgery, and to finalize implantation costs and feasibility of proposed surgery methods.

A gap in the usefulness of harmonic radar was determined to be the lack of ability to identify individual snakes once they were re-located. Other technologies that would be required to successfully track snakes with harmonic radar were researched, and passive integrated transponder (PIT) tagging was determined to be the best solution. PIT tags with optimal read distances were compared across several manufacturers and one suiting the needs of this study was identified.

Once the next steps and technologies were chosen for the study, study methods, timelines and approximate survey locations were drafted. Methods were developed from research into the use of harmonic radar by other studies, the researchers' knowledge on the habits of the study species and the best methods to find them (gained during ASPI), and survey sites were selected based on outstanding or interesting areas identified during ASPI. The nongame wildlife specialist out of Rochester, MN was also consulted to aid in developing methods for this survey as she had just completed a different remote monitoring project with snakes in SE Minnesota.

Project proposers then met with the State Wildlife Grant coordinator, their supervisors, and the regional plant ecologist in order to refine methods, decide on project feasibility and begin the grant application process. Detailed budges were created at this time and an official state wildlife grant (SWG) proposal was written (Appendix IV). Sources of match money and time were sought, identified, and/or applied for. A grant to provide match money was obtained from the Minnesota Herpetological Society. Match in the form of volunteer donation of time was solicited from the Minnesota Herpetological Society, Conservation Corps of Minnesota, Great River Greening, Friends of Sherburne and other individuals interested in the project.

Discussion of Management Recommendations and Conservation Concerns

Throughout the course of this project several interesting trends, as well as several troubling conservation concerns became apparent.

Habitat

Open, sandy soil appears to be a critical habitat component for the majority of the target SGCN and rare plants documented during this project. Open, sandy soil in areas with abundant gopher mounds, dunes, sandy blow out areas, or thin vegetative cover became a relatively reliable predictor of the presence of many target SGCN, particularly plains pocket mice, gophersnakes, western hognose snakes and the jumping spider *M. arizonensis*. In the case of the jumping spider, the association with open soil is most likely attributed to the presence of large-flowered penstemon, a prairie specialist, in these areas. Areas of habitat that are otherwise very high quality but represent later successional stages of oak savanna with much denser vegetation produced lower species diversity and abundance for rare targeted animals.

Maintaining these open, sandy soils on the Anoka Sand Plain may be critical to maintaining SGCN species in this area, thus it is imperative that managers leave a number of open sand patches unseeded. Managers in other states have tried to maintain open soils in oak savanna habitat by disturbing the soil with a variety of mechanical means in areas that may otherwise be overgrown by vegetation

Other organisms

Several non-target species were detected during this study (e.g. pocket gophers, coyotes, striped skunks, raccoons, and others). Of particular interest was the number of mesopredators (e.g. skunks, coyotes, raccoons, and weasels) and pocket gophers.

Although we did not survey for mesopredators, they appeared to be extremely common in Sherburne NWR, Sand Dunes State Forest and Uncas Dunes SNA. We frequently saw Blanding's turtles lay eggs and then observed the nest destroyed the following day. High rates of predation can significantly reduce recruitment levels. During the course of the study only one Blanding's turtle under five years of age was found alive. Further investigation of the impact of predation on these Blanding's turtles populations is needed.

Pocket gophers provide natural soil disturbance creating open, sandy soils used by several other species (e.g. western hognose snakes, gophersnakes, northern prairie skinks, plains pocket mice, tiger salamanders, and tiger beetles), and may be an important species for maintaining habitat on prairies and oak savannas of the Anoka Sand Plain. However, pocket gophers are considered pest species by some land managers and in the past they were killed with strychnine in the Sand Dunes State Forest because of their tendency to destroy planted

pines. Although strychnine is no longer used, they are sometimes trapped and removed in Sand Dunes State Forest and there is still a bounty on them in these counties. Information about the important role pocket gophers play in this ecological community should be communicated to land managers and the public whenever possible.

Human Threats

Anthropogenic threats exist for several of the targeted SGCN, and serve only to compound the concerns discussed above.

Legal and illegal collection of reptiles and amphibians can seriously threaten populations in this area, especially for rare species. Our results indicate low populations of our targeted species which could be further reduced or eliminated by collection.

Road mortality is another threat in and around many of the managed areas surveyed during this study. Roads present two major negative impacts to animal meta-populations; direct mortality and habitat fragmentation. During the course of surveys in 2008 and 2009 road mortality was documented whenever it was observed by field staff. This lead to the creation of maps (Fig. 8 and Fig. 9) showing areas with frequent road mortality. Roads seemed particularly troublesome when they were large, paved, and ran through areas with suitable habitat on either side of them. This information will be shared with the land mangers to determine what might be done to minimize road mortality in the areas where mortality was concentrated.

Animals typically travel between habitat types in order to complete their annual life cycle. This is especially true here in Minnesota, where the long cold winters necessitate the use of over-wintering sites that meet very specific criteria (Harvey and Weatherhead 2006). Often these over-wintering areas are not the same habitats that a species uses for breeding, nesting, and foraging. Because of this, many Minnesota species move between habitats seasonally. When roads exist between these habitats, mortality is more likely to occur. This information will also be shared with environmental review staff to be considered when commenting on road development.

While prescribed fire is an important component to any prairie or oak savanna habitat management, it can injure or kill many SGCN, and can lead to local extirpation of some species if not done in a manner that provides refuge to animals in the fire area. When prescribed fire is being utilized, the presence of SGCN, particularly those with low or slow mobility (e.g. jumping spiders and Blanding's turtles), should be considered. It is advisable to limit the size or compartmentalize burns and maintain refugia for animals so that some survive and re-colonize the area after management has been completed. Caution should also be taken ensure that animals are not directed towards busy roads when fleeing from the fire.

Other management activities such as tree or prairie planting and pesticide and herbicide treatments, can have a negative impact on SGCN if their needs are not considered during the creation of management plans. The use of heavy equipment in habitat suitable for ground-dwelling SGCN should be limited to when the ground is frozen to prevent soil compaction trapping ground dwelling SGCN, leading to high mortality.

Acknowledgements

We wish to thank the Minnesota State Wildlife Grants Program for funding these surveys. Without this financial support, this project would not have been possible. Thanks also are extended to State and Federal Wildlife Managers and State Parks personnel for their valuable advice and assistance with this project. Thanks to the University of Minnesota for allowing us to work on their lands at Cedar Creek.

Literature Cited

Center for Conservation Biology. 2009. Instructions for Conducting the Nightjar Survey Network. Biology Department, College of William and Mary. www.ccb-wm.org/nightjar/protocols.htm

Congdon, Justin D., Aurthur E. Dunham and R.C. Van Loben Sels. 1993. Delayed sexual maturity and demographics of Blanding's Turtles (Emydoidea Blandingii) Implcations for conservation and management of Long-Lives Oragnisms. Conservation Biology: Vol. 7, No. 4 pp. 826-833.

Harvey, D. S., and Patrick J. Weatherhead. 2006. Hibernation site selection by Eastern Massasagua (*Sistrurus catenatus catenatus)* near their northern range limit. Journal of Herpetology Vol. 40 No. 1 pp.66-73.

Hazard, E. B. 1982. The Mammals of Minnesota. University of Minnesota Press.

Marschner, F. J. 1974. *The Original Vegetation of Minnesota*. Compiled from U.S. General Land Office Survey notes. North Central Forest Experiment Station, Forest Service, U.S. Department of Agriculture

Minnesota Department of Natural Resources. 2010. Rare Species Guide. Division of Ecological Services, Minnesota Department of Natural Resources. http://www.dnr.state.mn.us/rsg/index.html

Minnesota Department of Natural Resources. 2009. An Evaluation of the Ecological Significance of the Sand Dunes State Forest; Sherburne County, Minnesota. Division of Ecological Services, Minnesota Department of Natural Resources.

Minnesota Department of Natural Resources. 2007. A Handbook for Collecting Vegetation Plot Data in Minnesota: The Relevé Method. Division of Ecological Services, Minnesota Department of Natural Resources.

Minnesota Department of Natural Resources. 2006. Tomorrow's habitat for the wild and rare: an action plan for Minnesota Wildlife, Comprehensive Wildlife Conservation Strategy. Division of Ecological Services, Minnesota Department of Natural Resources.

Pappas, M.J., J.D. Congdon, B.J. Brecke and J.D. Capps. 2009. Orientation and dispersal of hatchling Blanding's turtles (*Emydoidea blandingii)* from experimental nests. Canadian Journal of Zoology. Vol. 87 pp. 755-766.

RodrÍguez-Robles,J. A., and M. J. Lannoo. *2003*. Home ranges of gopher snakes (Pituophis catenifer, Colubridae) in Central California. Copeia: Vol. 2003, No. 2, pp. 391-396.

Table 1. Species in greatest conservation need thought to occur on the Anoka Sand Plain Subsection and target species for survey (highlighted)						
Species Group	Common Name	Scientific Name	Savanna/ Prairie Species	State Legal Status	Federal Legal Status	NHIS*
Amphibians	Common Mudpuppy	Necturus maculosus		NL	NL	
Birds	Upland Sandpiper	Bartramia longicauda	1	NL	NL	Y
Birds	Northern Harrier	Circus cyaneus		NL	NL	
Birds	Bobolink	Dolichonyx oryzivorus	1	NL	NL	
Birds	Peregrine Falcon	Falco peregrinus		THR	NL	Y
Birds	Loggerhead Shrike	Lanius ludovicianus	1	THR	NL	Y
Birds	Red-headed Woodpecker	Melanerpes erythrocephalus	1	NL	NL	
Birds	Dickcissel	Spiza americana	1	NL	NL	
Birds	Field Sparrow	Spizella pusilla	1	NL	NL	
Birds	Le Conte's Sparrow	Ammodramus leconteii		NL	NL	
Birds	Northern Pintail	Anas acuta		NL	NL	
Birds	American Bittern	Botaurus lentiginosus		NL	NL	Y
Birds	Sedge Wren	Cistothorus platensis		NL	NL	
Birds	Eastern Meadowlark	Sturnella magna	1	NL	NL	
Birds	Buff-breasted Sandpiper	Tryngites subruficollis		NL	NL	
Birds	American Woodcock	Scolopax minor		NL	NL	
Birds	Northern Rough-winged Swallow	Stelgidopteryx serripennis		NL	NL	
Birds	Blue-winged Warbler	Vermivora pinus		NL	NL	
Birds	Eastern Wood-pewee	Contopus virens		NL	NL	
Birds	Rose-breasted Grosbeak	Pheucticus ludovicianus	1	NL	NL	
Birds	Black-billed Cuckoo	Coccyzus erythropthalmus		NL	NL	
Birds	Willow Flycatcher	Empidonax traillii		NL	NL	
Birds	Bald Eagle	Haliaeetus leucocephalus		SPC	THR	Y
Birds	Brown Thrasher	Toxostoma rufum	1	NL	NL	
Birds	Ruddy Turnstone	Arenaria interpres		NL	NL	
Birds	Red-shouldered Hawk	Buteo lineatus		SPC	NL	Y
Birds	Dunlin	Calidris alpina		NL	NL	
Birds	White-rumped Sandpiper	Calidris fuscicollis		NL	NL	
Birds	Semipalmated Sandpiper	Calidris pusilla		NL	NL	
Birds	Whip-poor-will	Caprimulgus vociferus	1	NL	NL	
Birds	Veery	Catharus fuscescens		NL	NL	
Birds	Black Tern	Chlidonias niger		NL	NL	
Birds	Common Nighthawk	Chordeiles minor		NL	NL	
Birds	Marsh Wren	Cistothorus palustris		NL	NL	
Birds	Trumpeter Swan	Cygnus buccinator		THR	NL	Y
Birds	Cerulean Warbler	Dendroica cerulea		SPC	NL	Y
Birds	Least Flycatcher	Empidonax minimus		NL	NL	
Birds	Common Moorhen	Gallinula chloropus		NL	NL	
Birds	Common Loon	Gavia immer		NL	NL	
Birds	Wood Thrush	Hylocichla mustelina		NL	NL	
Birds	Least Bittern	Ixobrychus exilis		NL	NL	
Birds	Short-billed Dowitcher	Limnodromus griseus		NL	NL	
Birds	Hudsonian Godwit	Limosa haemastica		NL	NL	
Birds	Swamp Sparrow	Melospiza georgiana		NL	NL	
Birds	Whimbrel	Numenius phaeopus		NL	NL	
Birds	Black-crowned Night-heron	Nycticorax nycticorax		NL	NL	C
Birds	Wilson's Phalarope	Phalaropus tricolor		THR	NL	Y

Species Group	Common Name	Scientific Name	Savanna/ Prairie Species	State Legal Status	Federal Legal Status	NHIS*
Birds	American Golden-plover	Pluvialis dominica		NL	NL	
Birds	Red-necked Grebe	Podiceps grisegena		NL	NL	C
Birds	Eared Grebe	Podiceps nigricollis		NL	NL	C
Birds	Virginia Rail	Rallus limicola		NL	NL	
Birds	American Avocet	Recurvirostra americana		NL	NL	
Birds	Ovenbird	Seiurus aurocapillus		NL	NL	
Birds	Louisiana Waterthrush	Seiurus motacilla		SPC	NL	Y
Birds	Yellow-bellied Sapsucker	Sphyrapicus varius		NL	NL	
Birds	Greater Yellowlegs	Tringa melanoleuca		NL	NL	
Fishes	Lake Sturgeon	Acipenser fulvescens		SPC	NL	Y
Fishes	Greater Redhorse	Moxostoma valenciennesi		NL	NL	
Fishes	Least Darter	Etheostoma microperca		SPC	NL	Y
Fishes	Pugnose Shiner	Notropis anogenus		SPC	NL	Y
Insects	Leonard's Skipper	Hesperia leonardus leonardus	1	SPC	NL	Y
Insects	Uncas Skipper	Hesperia uncas	1	END	NL	Y
Insects	A Tiger Beetle	Cincindela lepida	1	THR	NL	Y
Insects	A Tiger Beetle	Cicindela patruela patruela	1	SPC	NL	Y
Insects	Persius Duskywing	Erynnis persius	1	END	NL	Y
Insects	Two-spotted Skipper	Euphyes bimacula illinois		NL	NL	Y
Insects	Karner Blue	Lycaeides melissa samuelis	1	END	END	Y
Insects	Regal Fritillary	Speyeria idalia	1	SPC	NL	Y
Insects	A Caddisfly	Agapetus tomus		SPC	NL	Y
Insects	Bog Copper	Epidemia epixanthe michiganensis		NL	NL	Y
Mammals	Prairie Vole	Microtus ochrogaster		SPC	NL	Y
Mammals	Western Harvest Mouse	Reithrodontomys megalotis	1	NL	NL	Y
Mammals	Franklin's Ground Squirrel	Spermophilus franklinii		NL	NL	
Mammals	Eastern Spotted Skunk	Spilogale putorius	1	NL	NL	Y
Mammals	American Badger	Taxidea taxus		NL	NL	
Mammals	Least Weasel	Mustela nivalis		SPC	NL	Y
Mammals	Plains Pocket Mouse	Perognathus flavescens	1	SPC	NL	Y
Mammals	Northern Myotis	Myotis septentrionalis		SPC	NL	Y
Mollusks	Mucket mussel	Actinonaias ligamentina		THR	NL	Y
Mollusks	Elktoe	Alasmidonta marginata		THR	NL	Y
Mollusks	Purple Wartyback	Cyclonaias tuberculata		THR	NL	Y
Mollusks	Spike	Elliptio dilatata		SPC	NL	Y
Mollusks	Creek Heelsplitter	Lasmigona compressa		SPC	NL	Y
Mollusks	Black Sandshell	Ligumia recta		SPC	NL	Y
Mollusks	Monkeyface	Quadrula metanevra		THR	NL	Y
Mollusks	Wartyback	Quadrula nodulata		THR	NL	Y
Mollusks	Fawnsfoot	Truncilla donaciformis		NL	NL	
Reptiles	Eastern Fox Snake	Elaphe vulpina	1	NL	NL	Y
Reptiles	Blanding's Turtle	Emydoidea blandingii	1	THR	NL	Y
Reptiles	Eastern Hognose Snake	Heterodon platirhinos	1	NL	NL	Y
Reptiles	Smooth Green Snake	Liochlorophis vernalis		NL	NL	
Reptiles	Gopher Snake	Pituophis catenifer	1	SPC	NL	Y
Reptiles	Western Hognose Snake	Heterodon nasicus	1	SPC	NL	Y
Reptiles	Common Snapping Turtle	Chelydra serpentina		SPC	NL	Y
Reptiles	Wood Turtle	Clemmys insculpta		THR	NL	Y
Spiders	A Jumping Spider	Metaphidippus arizonensis	1	SPC	NL	Y
Spiders	A Jumping Spider	Paradamoetas fontana		SPC	NL	Y
Spiders	A Jumping Spider	Tutelina formicaria	1	SPC	NL	Y

*NHIS = species tracked in the Natural Heritage Information System (C = colonial waterbird)

Table 2. Phenology used to survey for target SGCN in the Anoka Sand Plain Subsection.

Species Group	Scientific Name	Common Name	April	May	June	July	Aug	Sept	Oct
Birds	Lanius ludovicianus	Loggerhead Shrike			Point counts/targeted searches	Targeted searches			
Birds	Melanerpes erythrocephalus	Red-headed Woodpecker			Point counts/targeted searches	record observations			
Birds	Spizella pusilla	Field Sparrow			Point counts	record observations			
Birds	Sturnella magna	Eastern Meadowlark			Point counts	record observations			
Birds	Toxostoma rufum	Brown Thrasher			Point counts	record observations			
Birds	Caprimulgus vociferus	Whip-poor-will			Night surveys	record observations			
Insects	Hesperia leonardus leonardus	Leonard's Skipper					Flight period		
Insects	Hesperia uncas	Uncas Skipper			Flight period				
Insects	Cincindela lepida	A Tiger Beetle							
Insects	Cicindela patruela patruela	A Tiger Beetle							
Insects	Lycaeides melissa samuelis	Karner Blue		first flight period		second flight period			
Mammals	Reithrodontomys megalotis	Western Harvest Mouse							
Mammals	Perognathus flavescens	Plains Pocket Mouse							
Reptiles	Emydoidea blandingii	Blanding's Turtle			nesting				
Reptiles	Pituophis catenifer	Gopher Snake							
Reptiles	Heterodon nasicus	Western Hognose Snake							
Spiders	Metaphidippus arizonensis	A Jumping Spider							
Spiders	Tutelina formicaria	A Jumping Spider							

prime time to survey

reasonable time to survey

Table 3. Species in Greatest Conservation Need observed in each managed area

Species Group	Scientific Name	Common Name	Bunker Hills	Cedar Creek	Helen Allison	Oak Savanna Park	Rice Lake	Sand Dunes	Sherburne NWR	Uncas Dunes	Wild River
Bird	*Botaurus lentiginosus*	American Bittern		x							
Bird	*Pelecanus erythrorhynchos*	American White Pelican							x		
Bird	*Haliaeetus leucocephalus*	Bald Eagle		x				x			
Bird	*Chlidonias niger*	Black Tern							x		
Bird	*Coccyzus erythropthalmus*	Black-billed Cuckoo							x	x	
Bird	*Vermivora pinus*	Blue-winged Warbler					x	x	x	x	x
Bird	*Toxostoma rufum*	Brown Thrasher	x	x	x	x		x	x	x	x
Bird	*Gavia immer*	Common Loon		x	x			x	x	x	
Bird	*Chordeiles minor*	Common Nighthawk					x		x		
Bird	*Spiza americana*	Dickcissel							x		
Bird	*Sturnella magna*	Eastern Meadowlark		x			x		x		
Bird	*Contopus virens*	Eastern Wood-pewee	x	x	x	x	x	x	x	x	x
Bird	*Spizella pusilla*	Field Sparrow	x	x	x	x	x	x	x	x	x
Bird	*Vermivora chrysoptera*	Golden-winged Warbler						x		x	x
Bird	*Ammodramus savannarum*	Grasshopper Sparrow	x	x		x		x	x	x	x
Bird	*Ixobrychus exilis*	Least Bittern							x		
Bird	*Empidonax minimus*	Least Flycatcher		x					x		
Bird	*Cistothorus palustris*	Marsh Wren							x		
Bird	*Circus cyaneus*	Northern Harrier	x	x							
Bird	*Contopus cooperi*	Olive-sided Flycatcher						x			
Bird	*Seiurus aurocapillus*	Ovenbird	x	x		x	x	x	x	x	x
Bird	*Melanerpes erythrocephalus*	Red-headed Woodpecker		x	x			x	x		
Bird	*Buteo lineatus*	Red-shouldered Hawk					x	x			
Bird	*Pheucticus ludovicianus*	Rose-breasted Grosbeak	x	x	x	x		x	x	x	x
Bird	*Cistothorus platensis*	Sedge Wren		x							x
Bird	*Melospiza georgiana*	Swamp Sparrow		x					x	x	x
Bird	*Cygnus buccinator*	Trumpeter Swan							x	x	
Bird	*Catharus fuscescens*	Veery		x				x	x		
Bird	*Caprimulgus vociferus*	Whip-poor-will	x	x				x	x	x	
Bird	*Lanius ludovicianus*	Eastern Towhee*	x	x	x		x	x	x	x	x
Bird	*Chondestes grammacus*	Lark Sparrow*	x	x	x		x	x	x	x	x
Bird	*Lanius ludovicianus*	Loggerhead Shrike									
Bird	*Hylocichla mustelina*	Wood Thrush									x
Insects	*Cicindela patruela patruela*	A Tiger Beetle	x			x		x	x	x	
Insects	*Cicindela lepida*	A Tiger Beetle									
Insects	*Hesperia leonardus leonardus*	Leonard's Skipper	x		x			x		x	
Insects	*Hesperia uncas*	Uncas Skipper									
Insects	*Lycaeides melissa samuelis*	Karner Blue									
Mammal	*Perognathus flavescens*	Plains Pocket Mouse	x			x		x	x		
Mammal	*Reithrodontomys megalotis*	Western Harvest Mouse									
Reptile	*Chelydra serpentina*	Common Snapping Turtle	x	x				x	x	x	x
Reptile	*Emydoidea blandingii*	Blanding's Turtle		x				x	x		x
Reptile	*Heterodon nasicus*	Western Hognose Snake	x					x	x	x	
Reptile	*Heterodon platirhinos*	Eastern Hognose Snake		x							x
Reptile	*Liochlarophis vernalis*	Smooth Green Snake		x				x	x		x
Reptile	*Pituophis catenifer*	Gopher Snake	x	x	x	x		x	x	x	x
Spiders	*Metaphidippus arizonensis*	A Jumping Spider	x	x	x	x			x	x	x
Spiders	*Tutelina formicaria*	A Jumping Spider									

* indicates non-SGCN species included because of their special habitat needs within the Anoka Sand Plain

Target species of the Anoka Sandplain Survey are highlighted in purple

Table 4. Mammal species and total number of individuals in each managed area. Grey highlighted indicates target SGCN**Alphabetical by scientific name.**

Managed Area	Common Name	Scientific Name	No. of individuals 2008	No. of individuals 2009	Total no. of individuals found	SGCN	Target SGCN	State status	Federal Status
Bunker Hills Regional Park	Meadow vole	*Microtus pennsylvanicus*	0	12	12	N	N	NL	NL
Bunker Hills Regional Park	Plains pocket mouse	*Perognathus flavescens*	9	0	9	Y	Y	SPC	NL
Bunker Hills Regional Park	White-footed deermouse	*Peromyscus leucopus*	25	37	62	N	N	NL	NL
Bunker Hills Regional Park	Prairie deermouse	*Peromyscus maniculatus bairdi*	7	8	15	N	N	NL	NL
Bunker Hills Regional Park	Cinereus shrew	*Sorex cinereus*	0	2	2	N	N	NL	NL
Bunker Hills Regional Park	Thirteen-lined ground squirre	*Spermophilus tridecemlineatus*	1	0	1	N	N	NL	NL
Bunker Hills Regional Park	Eastern chipmunk	*Tamias striatus*	0	1	1	N	N	NL	NL
Cedar Creek Natural History Area	Northern short-tailed shrew	*Blarina brevicauda*	0	2	2	N	N	NL	NL
Cedar Creek Natural History Area	Meadow vole	*Microtus pennsylvanicus*	0	8	8	N	N	NL	NL
Cedar Creek Natural History Area	White-footed deermouse	*Peromyscus leucopus*	1	13	14	N	N	NL	NL
Cedar Creek Natural History Area	Prairie deermouse	*Peromyscus maniculatus bairdi*	0	6	6	N	N	NL	NL
Cedar Creek Natural History Area	Cinereus shrew	*Sorex cinereus*	0	1	1	N	N	NL	NL
Helen Allison Scientific and Naural Area	Northern short-tailed shrew	*Blarina brevicauda*	1	0	1	N	N	NL	NL
Helen Allison Scientific and Naural Area	White-footed deermouse	*Peromyscus leucopus*	6	0	6	N	N	NL	NL
Helen Allison Scientific and Naural Area	Prairie deermouse	*Peromyscus maniculatus bairdi*	1	1	2	N	N	NL	NL
Oak Savanna Park Reserve	Meadow vole	*Microtus pennsylvanicus*	1	0	1	N	N	NL	NL
Oak Savanna Park Reserve	Plains pocket mouse	*Perognathus flavescens*	0	3	3	Y	Y	SPC	NL
Oak Savanna Park Reserve	White-footed deermouse	*Peromyscus leucopus*	6	7	13	N	N	NL	NL
Rice Lake Scientific and Natural Area	Northern short-tailed shrew	*Blarina brevicauda*	0	1	1	N	N	NL	NL
Rice Lake Scientific and Natural Area	Meadow vole	*Microtus pennsylvanicus*	2	0	2	N	N	NL	NL
Rice Lake Scientific and Natural Area	Prairie deermouse	*Peromyscus maniculatus bairdi*	2	0	2	N	N	NL	NL
Rice Lake Scientific and Natural Area	Cinereus shrew	*Sorex cinereus*	1	0	1	N	N	NL	NL
Sand Dunes State Forest	Meadow vole	*Microtus pennsylvanicus*	2	0	2	N	N	NL	NL
Sand Dunes State Forest	Plains pocket mouse	*Perognathus flavescens*	0	6	6	Y	Y	SPC	NL
Sand Dunes State Forest	White-footed deermouse	*Peromyscus leucopus*	28	6	34	N	N	NL	NL
Sand Dunes State Forest	Prairie deermouse	*Peromyscus maniculatus bairdi*	1	4	5	N	N	NL	NL
Sherburne National Wildlife Refuge	Northern short-tailed shrew	*Blarina brevicauda*	0	2	2	N	N	NL	NL
Sherburne National Wildlife Refuge	Meadow vole	*Microtus pennsylvanicus*	0	2	2	N	N	NL	NL
Sherburne National Wildlife Refuge	Plains pocket mouse	*Perognathus flavescens*	1	15	16	Y	Y	SPC	NL
Sherburne National Wildlife Refuge	White-footed deermouse	*Peromyscus leucopus*	11	107	118	N	N	NL	NL
Sherburne National Wildlife Refuge	Prairie deermouse	*Peromyscus maniculatus bairdi*	8	9	17	N	N	NL	NL
Sherburne National Wildlife Refuge	Eastern mole	*Scalopus aquaticus*	0	1	1	N	N	NL	NL
Sherburne National Wildlife Refuge	Thirteen-lined ground squirre	*Spermophilus tridecemlineatus*	0	2	2	N	N	NL	NL
Sherburne National Wildlife Refuge	Meadow jumping mouse	*Zapus hudsonius*	5	1	6	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	White-footed deermouse	*Peromyscus leucopus*	6	9	15	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Prairie deermouse	*Peromyscus maniculatus bairdi*	1	0	1	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Eastern chipmunk	*Tamias striatus*	0	1	1	N	N	NL	NL
Wild River State Park	Pine martin	*Martes americana*	1	0	1	N	N	NL	NL
Wild River State Park	Meadow vole	*Microtus pennsylvanicus*	9	3	12	N	N	NL	NL
Wild River State Park	White-footed deermouse	*Peromyscus leucopus*	17	6	23	N	N	NL	NL
Wild River State Park	Prairie deermouse	*Peromyscus maniculatus bairdi*	4	4	8	N	N	NL	NL
Wild River State Park	Thirteen-lined ground squirre	*Spermophilus tridecemlineatus*	1	0	1	N	N	NL	NL
Wild River State Park	American black bear	*Ursus americanus*	0	1	1	N	N	NL	NL
Wild River State Park	Meadow jumping mouse	*Zapus hudsonius*	7	0	7	N	N	NL	NL

Table 5. Bird species and number of observations in each managed area. Grey highlighted indicates target SGCN. Alphabetical by common name.
Observations do not nessesarily indicate counts of unique individuals.

Managed Area	Common Name	No. of observations 2008	No. of observations 2009	Total no. of observations	SGCN	Target SGCN	State status	Federal Status
Sherburne National Wildlife Refuge	American Crow	6	4	10	N	N	NL	NL
Sherburne National Wildlife Refuge	American Goldfinch	14	7	21	N	N	NL	NL
Sherburne National Wildlife Refuge	American Robin	8	6	14	N	N	NL	NL
Sherburne National Wildlife Refuge	Baltimore Oriole	15	7	22	N	N	NL	NL
Sherburne National Wildlife Refuge	Barn Swallow	2	0	2	N	N	NL	NL
Sherburne National Wildlife Refuge	Black Tern	6	1	7	Y	N	NL	NL
Sherburne National Wildlife Refuge	Black-billed Cuckoo	3	1	4	Y	N	NL	NL
Sherburne National Wildlife Refuge	Black-capped Chickadee	0	3	3	N	N	NL	NL
Sherburne National Wildlife Refuge	Blue Jay	15	13	28	N	N	NL	NL
Sherburne National Wildlife Refuge	Blue-winged Teal	6	0	6	N	N	NL	NL
Sherburne National Wildlife Refuge	Blue-winged Warbler	1	1	2	Y	Y	NL	NL
Sherburne National Wildlife Refuge	Brown Thrasher	12	7	19	Y	Y	NL	NL
Sherburne National Wildlife Refuge	Brown-headed Cowbird	11	9	20	N	N	NL	NL
Sherburne National Wildlife Refuge	Canada Goose	17	0	17	N	N	NL	NL
Sherburne National Wildlife Refuge	Cedar Waxwing	3	5	8	N	N	NL	NL
Sherburne National Wildlife Refuge	Chestnut-sided Warbler	3	6	9	N	N	NL	NL
Sherburne National Wildlife Refuge	Chipping Sparrow	0	8	8	N	N	NL	NL
Sherburne National Wildlife Refuge	Clay-colored Sparrow	0	2	2	N	N	NL	NL
Sherburne National Wildlife Refuge	Cliff Swallow	3	1	4	N	N	NL	NL
Sherburne National Wildlife Refuge	Common Moorhen	0	1	1	Y	N	SPC	NL
Sherburne National Wildlife Refuge	Commnon Grackle	4	0	4	N	N	NL	NL
Sherburne National Wildlife Refuge	Common Loon	4	0	4	Y	N	NL	NL
Sherburne National Wildlife Refuge	Common Nighthawk	1	0	1	Y	N	NL	NL
Sherburne National Wildlife Refuge	Common Yellowthroat	27	11	38	N	N	NL	NL
Sherburne National Wildlife Refuge	Cooper's Hawk	2	1	3	N	N	NL	NL
Sherburne National Wildlife Refuge	Double-crested Cormorant	1	0	1	N	N	NL	NL
Sherburne National Wildlife Refuge	Dicksissel	1	1	2	Y	N	NL	NL
Sherburne National Wildlife Refuge	Downy Woodpecker	1	3	4	N	N	NL	NL
Sherburne National Wildlife Refuge	Eastern Bluebird	7	7	14	N	N	NL	NL
Sherburne National Wildlife Refuge	Eastern Kingbird	5	9	14	N	N	NL	NL
Sherburne National Wildlife Refuge	Eastern Meadowlark	1	0	1	Y	Y	NL	NL
Sherburne National Wildlife Refuge	Eastern Towhee	12	11	23	N	N	NL	NL
Sherburne National Wildlife Refuge	Eastern Wood-Pewee	1	9	10	Y	N	NL	NL
Sherburne National Wildlife Refuge	Field Sparrow	24	18	42	Y	Y	NL	NL
Sherburne National Wildlife Refuge	Grasshopper Sparrow	5	10	15	N	N	NL	NL
Sherburne National Wildlife Refuge	Gray Catbird	13	9	22	N	N	NL	NL
Sherburne National Wildlife Refuge	Great Blue Heron	4	0	4	N	N	NL	NL
Sherburne National Wildlife Refuge	Great Crested Flycatcher	14	3	17	N	N	NL	NL
Sherburne National Wildlife Refuge	Great Horned Owl	1	0	1	N	N	NL	NL
Sherburne National Wildlife Refuge	Green Heron	4	2	6	N	N	NL	NL
Sherburne National Wildlife Refuge	Hairy Woodpecker	1	1	2	N	N	NL	NL
Sherburne National Wildlife Refuge	Hooded Merganser	1	0	1	N	N	NL	NL
Sherburne National Wildlife Refuge	Horned Lark	1	0	1	N	N	NL	NL
Sherburne National Wildlife Refuge	House Wren	16	4	20	N	N	NL	NL
Sherburne National Wildlife Refuge	Indigo Bunting	7	5	12	N	N	NL	NL
Sherburne National Wildlife Refuge	Killdeer	4	4	8	N	N	NL	NL
Sherburne National Wildlife Refuge	Lark Sparrow	1	5	6	N	N	NL	NL
Sherburne National Wildlife Refuge	Least Bittern	1	0	1	Y	N	NL	NL
Sherburne National Wildlife Refuge	Least Flycatcher	1	3	4	Y	N	NL	NL
Sherburne National Wildlife Refuge	Mallard	7	1	8	N	N	NL	NL
Sherburne National Wildlife Refuge	Marsh Wren	3	0	3	Y	N	NL	NL
Sherburne National Wildlife Refuge	Mourning Dove	23	8	31	N	N	NL	NL
Sherburne National Wildlife Refuge	Northern Cardinal	4	0	4	N	N	NL	NL
Sherburne National Wildlife Refuge	Northern Flicker	3	0	3	N	N	NL	NL
Sherburne National Wildlife Refuge	Pied-billed Grebe	4	0	4	N	N	NL	NL
Sherburne National Wildlife Refuge	Orchard Oriole	0	3	3	N	N	NL	NL
Sherburne National Wildlife Refuge	Pileated Woodpecker	1	2	3	N	N	NL	NL
Sherburne National Wildlife Refuge	Red-bellied Woodpecker	2	1	3	N	N	NL	NL
Sherburne National Wildlife Refuge	Red-winged Blackbird	28	7	35	N	N	NL	NL
Sherburne National Wildlife Refuge	Red-eyed Vireo	8	3	11	N	N	NL	NL
Sherburne National Wildlife Refuge	Red-headed Woodpecker	7	4	11	Y	Y	NL	NL
Sherburne National Wildlife Refuge	Red-tailed Hawk	0	2	2	N	N	NL	NL
Sherburne National Wildlife Refuge	Ring-necked Pheasant	7	2	9	N	N	NL	NL
Sherburne National Wildlife Refuge	Ruby-throated Hummingbird	1	0	1	N	N	NL	NL
Sherburne National Wildlife Refuge	Rose-breasted Grosbeak	24	8	32	Y	N	NL	NL
Sherburne National Wildlife Refuge	Sandhill Crane	23	6	29	N	N	NL	NL
Sherburne National Wildlife Refuge	Scarlet Tanager	7	6	13	N	N	NL	NL
Sherburne National Wildlife Refuge	Song Sparrow	22	4	26	N	N	NL	NL
Sherburne National Wildlife Refuge	Sora	7	0	7	N	N	NL	NL
Sherburne National Wildlife Refuge	Swamp Sparrow	3	0	3	Y	N	NL	NL

Table 5. Bird species and number of observations in each managed area. Grey highlighted indicates target SGCN. Alphabetical by common name. **Observations do not nessesarily indicate counts of unique individuals.**

Managed Area	Common Name	No. of observations 2008	No. of observations 2009	Total no. of observations	SGCN	Target SGCN	State status	Federal Status
Sherburne National Wildlife Refuge	Tree Swallow	12	5	17	N	N	NL	NL
Sherburne National Wildlife Refuge	Trumpter Swan	4	4	8	Y	N	THR	NL
Sherburne National Wildlife Refuge	Veery	2	0	2	Y	N	NL	NL
Sherburne National Wildlife Refuge	Vesper Sparrow	7	6	13	N	N	NL	NL
Sherburne National Wildlife Refuge	Warbling Vireo	5	3	8	N	N	NL	NL
Sherburne National Wildlife Refuge	White-breasted Nuthatch	3	3	6	N	N	NL	NL
Sherburne National Wildlife Refuge	Whip-poor-will	1	0	1	Y	Y	NL	NL
Sherburne National Wildlife Refuge	Wild Turkey	7	1	8	N	N	NL	NL
Sherburne National Wildlife Refuge	Wilson's Snipe	4	1	5	N	N	NL	NL
Sherburne National Wildlife Refuge	Wood Duck	2	0	2	N	N	NL	NL
Sherburne National Wildlife Refuge	Yellow Warbler	15	13	28	N	N	NL	NL
Sherburne National Wildlife Refuge	Yellow-headed Blackbird	14	0	14	N	N	NL	NL
Sherburne National Wildlife Refuge	Yellow-bellied Sapsucker	0	1	1	Y	N	NL	NL
Sherburne National Wildlife Refuge	Yellow-throated Vireo	9	4	13	N	N	NL	NL
Bunker Hills Regional Park	American Crow	7	11	18	N	N	NL	NL
Bunker Hills Regional Park	American Goldfinch	12	12	24	N	N	NL	NL
Bunker Hills Regional Park	American Redstart	0	1	1	N	N	NL	NL
Bunker Hills Regional Park	American Robin	6	10	16	N	N	NL	NL
Bunker Hills Regional Park	Baltimore Oriole	6	12	18	N	N	NL	NL
Bunker Hills Regional Park	Black-capped Chickadee	7	8	15	N	N	NL	NL
Bunker Hills Regional Park	Blue Jay	7	11	18	N	N	NL	NL
Bunker Hills Regional Park	Blue-gray Gnatcatcher	1	0	1	N	N	NL	NL
Bunker Hills Regional Park	Brown Thrasher	6	8	14	Y	Y	NL	NL
Bunker Hills Regional Park	Brown-headed Cowbird	12	15	27	N	N	NL	NL
Bunker Hills Regional Park	Canada Goose	0	2	2	N	N	NL	NL
Bunker Hills Regional Park	Cedar Waxwing	5	1	6	N	N	NL	NL
Bunker Hills Regional Park	Chimney Swift	3	1	4	N	N	NL	NL
Bunker Hills Regional Park	Clay-colored Sparrow	1	0	1	N	N	NL	NL
Bunker Hills Regional Park	Chipping Sparrow	7	8	15	N	N	NL	NL
Bunker Hills Regional Park	Common Yellowthroat	1	0	1	N	N	NL	NL
Bunker Hills Regional Park	Common Grackle	1	5	6	N	N	NL	NL
Bunker Hills Regional Park	Downy Woodpecker	4	5	9	N	N	NL	NL
Bunker Hills Regional Park	Eastern Bluebird	12	12	24	N	N	NL	NL
Bunker Hills Regional Park	Eastern Kingbird	5	12	17	N	N	NL	NL
Bunker Hills Regional Park	Eastern Phoebe	0	1	1	N	N	NL	NL
Bunker Hills Regional Park	Eastern Towhee	7	6	13	N	N	NL	NL
Bunker Hills Regional Park	Eastern Wood-Pewee	6	2	8	Y	N	NL	NL
Bunker Hills Regional Park	European Starling	0	1	1	N	N	NL	NL
Bunker Hills Regional Park	Field Sparrow	8	9	17	Y	Y	NL	NL
Bunker Hills Regional Park	Grasshopper Sparrow	2	3	5	N	N	NL	NL
Bunker Hills Regional Park	Gray Catbird	3	3	6	N	N	NL	NL
Bunker Hills Regional Park	Great Blue Heron	0	1	1	N	N	NL	NL
Bunker Hills Regional Park	Great Crested Flycatcher	7	6	13	N	N	NL	NL
Bunker Hills Regional Park	Great Egret	0	1	1	N	N	NL	NL
Bunker Hills Regional Park	Hairy Woodpecker	1	1	2	N	N	NL	NL
Bunker Hills Regional Park	House Wren	6	10	16	N	N	NL	NL
Bunker Hills Regional Park	Indigo Bunting	3	3	6	N	N	NL	NL
Bunker Hills Regional Park	Killdeer	2	0	2	N	N	NL	NL
Bunker Hills Regional Park	Lark Sparrow	8	7	15	N	N	NL	NL
Bunker Hills Regional Park	Mallard	0	1	1	N	N	NL	NL
Bunker Hills Regional Park	Mourning Dove	10	9	19	N	N	NL	NL
Bunker Hills Regional Park	Northern Cardinal	6	8	14	N	N	NL	NL
Bunker Hills Regional Park	Northern Flicker	0	3	3	N	N	NL	NL
Bunker Hills Regional Park	Northern Harrier	1	1	2	Y	N	NL	NL
Bunker Hills Regional Park	Northern Rough-winged Swallow	0	2	2	Y	N	NL	NL
Bunker Hills Regional Park	Ovenbird	0	1	1	Y	N	NL	NL
Bunker Hills Regional Park	Red-bellied Woodpecker	1	2	3	N	N	NL	NL
Bunker Hills Regional Park	Red-breasted Nuthatch	0	1	1	N	N	NL	NL
Bunker Hills Regional Park	Red-eyed Vireo	3	4	7	N	N	NL	NL
Bunker Hills Regional Park	Red-tailed Hawk	1	0	1	N	N	NL	NL
Bunker Hills Regional Park	Red-winged Blackbird	1	4	5	N	N	NL	NL
Bunker Hills Regional Park	Ring-necked Pheasant	4	5	9	N	N	NL	NL
Bunker Hills Regional Park	Ring-billed Gull	1	0	1	N	N	NL	NL
Bunker Hills Regional Park	Rose-breasted Grosbeak	0	1	1	Y	N	NL	NL
Bunker Hills Regional Park	Sharp-shinned Hawk	1	0	1	N	N	NL	NL
Bunker Hills Regional Park	Sandhill Crane	4	1	5	N	N	NL	NL
Bunker Hills Regional Park	Scarlet Tanager	2	2	4	N	N	NL	NL
Bunker Hills Regional Park	Song Sparrow	1	3	4	N	N	NL	NL
Bunker Hills Regional Park	Tennessee Warbler	0	2	2	N	N	NL	NL

Table 5. Bird species and number of observations in each managed area. Grey highlighted indicates target SGCN. Alphabetical by common name.
Observations do not nessesarily indicate counts of unique individuals.

Managed Area	Common Name	No. of observations 2008	No. of observations 2009	Total no. of observations	SGCN	Target SGCN	State status	Federal Status
Bunker Hills Regional Park	Tree Swallow	6	2	8	N	N	NL	NL
Bunker Hills Regional Park	Wood Duck	1	0	1	N	N	NL	NL
Bunker Hills Regional Park	Whip-poor-will	3	1	4	Y	Y	NL	NL
Bunker Hills Regional Park	White-breasted Nuthatch	3	7	10	N	N	NL	NL
Bunker Hills Regional Park	Wild Turkey	0	1	1	N	N	NL	NL
Sand Dunes State Forest	American Crow	13	5	18	N	N	NL	NL
Sand Dunes State Forest	American Goldfinch	7	5	12	N	N	NL	NL
Sand Dunes State Forest	American Kestrel	2	1	3	N	N	NL	NL
Sand Dunes State Forest	American Redstart	2	0	2	N	N	NL	NL
Sand Dunes State Forest	American Robin	4	2	6	N	N	NL	NL
Sand Dunes State Forest	American Tree Sparrow	0	1	1	N	N	NL	NL
Sand Dunes State Forest	Bald Eagle	1	1	2	Y	N	SPC	THR
Sand Dunes State Forest	Barn Swallow	0	1	1	N	N	NL	NL
Sand Dunes State Forest	Black-and-white Warbler	0	2	2	N	N	NL	NL
Sand Dunes State Forest	Black-capped Chickadee	5	7	12	N	N	NL	NL
Sand Dunes State Forest	Blue Jay	16	6	22	N	N	NL	NL
Sand Dunes State Forest	Blue-winged Warbler	0	4	4	Y	Y	NL	NL
Sand Dunes State Forest	Brown Thrasher	4	3	7	Y	Y	NL	NL
Sand Dunes State Forest	Brown-headed Cowbird	4	10	14	N	N	NL	NL
Sand Dunes State Forest	Cedar Waxwing	0	3	3	N	N	NL	NL
Sand Dunes State Forest	Chestnut-sided Warbler	4	3	7	N	N	NL	NL
Sand Dunes State Forest	Chipping Sparrow	7	8	15	N	N	NL	NL
Sand Dunes State Forest	Cooper's Hawk	1	0	1	N	N	NL	NL
Sand Dunes State Forest	Common Grackle	0	1	1	N	N	NL	NL
Sand Dunes State Forest	Common Loon	1	2	3	Y	N	NL	NL
Sand Dunes State Forest	Common Raven	2	3	5	N	N	NL	NL
Sand Dunes State Forest	Common Yellowthroat	7	5	12	N	N	NL	NL
Sand Dunes State Forest	Eastern Wood-pewee	1	0	1	Y	N	NL	NL
Sand Dunes State Forest	Eastern Bluebird	3	1	4	N	N	NL	NL
Sand Dunes State Forest	Eastern Kingbird	0	1	1	N	N	NL	NL
Sand Dunes State Forest	Eastern Towhee	11	9	20	N	N	NL	NL
Sand Dunes State Forest	European Starling	0	1	1	N	N	NL	NL
Sand Dunes State Forest	Field Sparrow	9	6	15	Y	Y	NL	NL
Sand Dunes State Forest	Golden-winged Warbler	0	1	1	N	N	NL	NL
Sand Dunes State Forest	Grasshopper Sparrow	3	2	5	N	N	NL	NL
Sand Dunes State Forest	Gray Catbird	5	2	7	N	N	NL	NL
Sand Dunes State Forest	Great Crested Flycatcher	6	2	8	N	N	NL	NL
Sand Dunes State Forest	Hairy Woodpecker	1	0	1	N	N	NL	NL
Sand Dunes State Forest	House Finch	1	0	1	N	N	NL	NL
Sand Dunes State Forest	House Wren	6	4	10	N	N	NL	NL
Sand Dunes State Forest	Indigo Bunting	7	3	10	N	N	NL	NL
Sand Dunes State Forest	Lark Sparrow	1	3	4	N	N	NL	NL
Sand Dunes State Forest	Mourning Dove	12	2	14	N	N	NL	NL
Sand Dunes State Forest	Mourning Warbler	0	2	2	N	N	NL	NL
Sand Dunes State Forest	Nashville Warbler	0	2	2	N	N	NL	NL
Sand Dunes State Forest	Northern Cardinal	10	2	12	N	N	NL	NL
Sand Dunes State Forest	Northern Flicker	0	2	2	N	N	NL	NL
Sand Dunes State Forest	Olive-sided Flycatcher	1	0	1	N	N	NL	NL
Sand Dunes State Forest	Ovenbird	5	7	12	Y	N	NL	NL
Sand Dunes State Forest	Pileated Woodpecker	3	0	3	N	N	NL	NL
Sand Dunes State Forest	Red-bellied Woodpecker	1	0	1	N	N	NL	NL
Sand Dunes State Forest	Red-breasted Nuthatch	1	0	1	N	N	NL	NL
Sand Dunes State Forest	Red-eyed Vireo	7	5	12	N	N	NL	NL
Sand Dunes State Forest	Red-winged Blackbird	5	0	5	N	N	NL	NL
Sand Dunes State Forest	Ring-necked Pheasant	1	0	1	N	N	NL	NL
Sand Dunes State Forest	Red-headed Woodpecker	1	0	1	Y	Y	NL	NL
Sand Dunes State Forest	Red-shouldered Hawk	1	2	3	Y	N	SPC	NL
Sand Dunes State Forest	Red-tailed Hawk	3	1	4	N	N	NL	NL
Sand Dunes State Forest	Rose-breasted Grosbeak	1	2	3	Y	N	NL	NL
Sand Dunes State Forest	Sandhill Crane	6	0	6	N	N	NL	NL
Sand Dunes State Forest	Song Sparrow	3	0	3	N	N	NL	NL
Sand Dunes State Forest	Scarlet Tanager	6	4	10	N	N	NL	NL
Sand Dunes State Forest	Tree Swallow	1	2	3	N	N	NL	NL
Sand Dunes State Forest	Turkey Vulture	1	0	1	N	N	NL	NL
Sand Dunes State Forest	Veery	1	0	1	Y	N	NL	NL
Sand Dunes State Forest	Vesper Sparrow	4	1	5	N	N	NL	NL
Sand Dunes State Forest	Wild Turkey	1	0	1	N	N	NL	NL
Sand Dunes State Forest	Wood Duck	1	0	1	N	N	NL	NL
Sand Dunes State Forest	Whip-poor-will	1	21	22	Y	Y	NL	NL
Sand Dunes State Forest	White-breasted Nuthatch	3	3	6	N	N	NL	NL

Table 5. Bird species and number of observations in each managed area. Grey highlighted indicates target SGCN. Alphabetical by common name.
Observations do not nessesarily indicate counts of unique individuals.

Managed Area	Common Name	No. of observations 2008	No. of observations 2009	Total no. of observations	SGCN	Target SGCN	State status	Federal Status
Sand Dunes State Forest	Yellow-throated Vireo	2	0	2	N	N	NL	NL
Sand Dunes State Forest	Yellow Warbler	4	2	6	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	American Crow	5	3	8	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	American Goldfinch	2	1	3	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	American Robin	0	1	1	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Barn Swallow	0	1	1	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Black-billed Cuckoo	1	0	1	Y	N	NL	NL
Uncas Dunes Scientific and Natural Area	Black-and-white Warbler	0	1	1	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Black-capped Chickadee	2	2	4	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Blue Jay	4	5	9	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Blue-gray Gnatcatcher	0	6	6	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Blue-winged Warbler	1	2	3	Y	Y	NL	NL
Uncas Dunes Scientific and Natural Area	Brown Thrasher	1	0	1	Y	Y	NL	NL
Uncas Dunes Scientific and Natural Area	Brown-headed Cowbird	1	10	11	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Cedar Waxwing	1	4	5	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Chestnut-sided Warbler	0	3	3	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Chipping Sparrow	3	4	7	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Common Loon	1	2	3	Y	N	NL	NL
Uncas Dunes Scientific and Natural Area	Common Yellowthroat	0	1	1	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Eastern Bluebird	1	4	5	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Eastern Phoebe	1	0	1	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Eastern Kingbird	0	2	2	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Eastern Towhee	6	7	13	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Eastern Wood-Pewee	3	3	6	Y	N	NL	NL
Uncas Dunes Scientific and Natural Area	Field Sparrow	3	7	10	Y	Y	NL	NL
Uncas Dunes Scientific and Natural Area	Golden-winged Warbler	0	2	2	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Grasshopper Sparrow	0	1	1	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Gray Catbird	0	3	3	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Great Crested Flycatcher	3	7	10	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Hairy Woodpecker	0	3	3	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	House Wren	0	1	1	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Indigo Bunting	3	6	9	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Killdeer	0	1	1	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Lark Sparrow	1	4	5	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Mourning Dove	0	3	3	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Northern Cardinal	0	1	1	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Ovenbird	5	6	11	Y	N	NL	NL
Uncas Dunes Scientific and Natural Area	Pileated Woodpecker	0	3	3	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Red-eyed Vireo	5	8	13	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Red-tailed Hawk	0	1	1	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Red-winged Blackbird	0	1	1	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Rose-breasted Grosbeak	4	4	8	Y	N	NL	NL
Uncas Dunes Scientific and Natural Area	Ruby-throated Hummingbird	0	1	1	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Sandhill Crane	1	1	2	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Scarlet Tanager	2	4	6	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Tennessee Warbler	0	1	1	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Tree Swallow	0	2	2	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Trumpter Swan	1	0	1	Y	N	THR	NL
Uncas Dunes Scientific and Natural Area	Whip-poor-will	0	3	3	Y	Y	NL	NL
Uncas Dunes Scientific and Natural Area	White-breasted Nuthatch	3	5	8	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Wild Turkey	1	2	3	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Yellow-headed Blackbird	0	1	1	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Yellow-throated Vireo	0	1	1	N	N	NL	NL
Rice Lake Scientific and Natural Area	American Crow	5	3	8	N	N	NL	NL
Rice Lake Scientific and Natural Area	American Goldfinch	3	5	8	N	N	NL	NL
Rice Lake Scientific and Natural Area	Barn Swallow	1	0	1	N	N	NL	NL
Rice Lake Scientific and Natural Area	Black-capped Chickadee	0	3	3	N	N	NL	NL
Rice Lake Scientific and Natural Area	Blue Jay	2	3	5	N	N	NL	NL
Rice Lake Scientific and Natural Area	Blue-gray Gnatcatcher	0	3	3	N	N	NL	NL
Rice Lake Scientific and Natural Area	Blue-winged Warbler	1	0	1	Y	Y	NL	NL
Rice Lake Scientific and Natural Area	Brown-headed Cowbird	2	2	4	N	N	NL	NL
Rice Lake Scientific and Natural Area	Cedar Waxwing	1	6	7	N	N	NL	NL
Rice Lake Scientific and Natural Area	Chipping Sparrow	2	5	7	N	N	NL	NL
Rice Lake Scientific and Natural Area	Common Nighthawk	1	0	1	Y	N	NL	NL
Rice Lake Scientific and Natural Area	Downy Woodpecker	1	0	1	N	N	NL	NL
Rice Lake Scientific and Natural Area	Common Yellowthroat	2	0	2	N	N	NL	NL
Rice Lake Scientific and Natural Area	Eastern Bluebird	1	1	2	N	N	NL	NL
Rice Lake Scientific and Natural Area	Eastern Phoebe	0	1	1	N	N	NL	NL
Rice Lake Scientific and Natural Area	Eastern Towhee	2	3	5	N	N	NL	NL
Rice Lake Scientific and Natural Area	Eastern Wood-Pewee	1	3	4	Y	N	NL	NL

Table 5. Bird species and number of observations in each managed area. Grey highlighted indicates target SGCN. Alphabetical by common name.
Observations do not nessesarily indicate counts of unique individuals.

Managed Area	Common Name	No. of observations 2008	No. of observations 2009	Total no. of observations	SGCN	Target SGCN	State status	Federal Status
Rice Lake Scientific and Natural Area	Field Sparrow	4	4	8	Y	Y	NL	NL
Rice Lake Scientific and Natural Area	Gray Catbird	2	2	4	N	N	NL	NL
Rice Lake Scientific and Natural Area	Great Crested Flycatcher	3	1	4	N	N	NL	NL
Rice Lake Scientific and Natural Area	House Wren	2	0	2	N	N	NL	NL
Rice Lake Scientific and Natural Area	Indigo Bunting	2	3	5	N	N	NL	NL
Rice Lake Scientific and Natural Area	Lark Sparrow	4	3	7	N	N	NL	NL
Rice Lake Scientific and Natural Area	Mourning Dove	3	0	3	N	N	NL	NL
Rice Lake Scientific and Natural Area	Nashville Warbler	2	0	2	N	N	NL	NL
Rice Lake Scientific and Natural Area	Northern Cardinal	1	3	4	N	N	NL	NL
Rice Lake Scientific and Natural Area	Ovenbird	2	0	2	Y	N	NL	NL
Rice Lake Scientific and Natural Area	Pileated Woodpecker	1	0	1	N	N	NL	NL
Rice Lake Scientific and Natural Area	Red-eyed Vireo	3	1	4	N	N	NL	NL
Rice Lake Scientific and Natural Area	Red shouldered Hawk	1	0	1	Y	N	SPC	NL
Rice Lake Scientific and Natural Area	Song Sparrow	1	0	1	N	N	NL	NL
Rice Lake Scientific and Natural Area	Scarlet Tanager	0	3	3	N	N	NL	NL
Rice Lake Scientific and Natural Area	Tree Swallow	1	0	1	N	N	NL	NL
Rice Lake Scientific and Natural Area	Turkey Vulture	1	1	2	N	N	NL	NL
Rice Lake Scientific and Natural Area	Yellow Warbler	1	0	1	N	N	NL	NL
Rice Lake Scientific and Natural Area	Vesper Sparrow	0	1	1	N	N	NL	NL
Rice Lake Scientific and Natural Area	White-breasted Nuthatch	1	1	2	N	N	NL	NL
Oak Savanna Park Reserve	American Crow	6	1	7	N	N	NL	NL
Oak Savanna Park Reserve	American Robin	2	0	2	N	N	NL	NL
Oak Savanna Park Reserve	American Goldfinch	0	2	2	N	N	NL	NL
Oak Savanna Park Reserve	Black-capped Chickadee	4	2	6	N	N	NL	NL
Oak Savanna Park Reserve	Barn Swallow	1	0	1	N	N	NL	NL
Oak Savanna Park Reserve	Blue Jay	3	5	8	N	N	NL	NL
Oak Savanna Park Reserve	Brown Thrasher	1	1	2	Y	Y	NL	NL
Oak Savanna Park Reserve	Brown-headed Cowbird	2	6	8	N	N	NL	NL
Oak Savanna Park Reserve	Canada Goose	1	0	1	N	N	NL	NL
Oak Savanna Park Reserve	Chipping Sparrow	3	0	3	N	N	NL	NL
Oak Savanna Park Reserve	Downy Woodpecker	1	0	1	N	N	NL	NL
Oak Savanna Park Reserve	Cedar Waxwing	0	1	1	N	N	NL	NL
Oak Savanna Park Reserve	Eastern Bluebird	3	0	3	N	N	NL	NL
Oak Savanna Park Reserve	Eastern Wood-Pewee	1	2	3	Y	N	NL	NL
Oak Savanna Park Reserve	Field Sparrow	6	8	14	Y	Y	NL	NL
Oak Savanna Park Reserve	Gray Catbird	0	2	2	N	N	NL	NL
Oak Savanna Park Reserve	Great Crested Flycatcher	4	4	8	N	N	NL	NL
Oak Savanna Park Reserve	Indigo Bunting	4	5	9	N	N	NL	NL
Oak Savanna Park Reserve	Northern Cardinal	7	1	8	N	N	NL	NL
Oak Savanna Park Reserve	Ovenbird	4	0	4	Y	N	NL	NL
Oak Savanna Park Reserve	Mourning Dove	0	1	1	N	N	NL	NL
Oak Savanna Park Reserve	Northern Cardinal	7	1	8	N	N	NL	NL
Oak Savanna Park Reserve	Red-eyed Vireo	6	1	7	N	N	NL	NL
Oak Savanna Park Reserve	Red-tailed Hawk	1	0	1	N	N	NL	NL
Oak Savanna Park Reserve	Rose-breasted Grosbeak	1	0	1	Y	N	NL	NL
Oak Savanna Park Reserve	Sandhill Crane	1	0	1	N	N	NL	NL
Oak Savanna Park Reserve	Scarlet Tanager	4	4	8	N	N	NL	NL
Oak Savanna Park Reserve	White-breasted Nuthatch	1	4	5	N	N	NL	NL
Cedar Creek Natural History Area	American Crow	8	8	16	N	N	NL	NL
Cedar Creek Natural History Area	American Goldfinch	8	6	14	N	N	NL	NL
Cedar Creek Natural History Area	American Redstart	2	1	3	N	N	NL	NL
Cedar Creek Natural History Area	American Robin	9	7	16	N	N	NL	NL
Cedar Creek Natural History Area	Barn Swallow	3	0	3	N	N	NL	NL
Cedar Creek Natural History Area	Black-capped Chickadee	8	4	12	N	N	NL	NL
Cedar Creek Natural History Area	Blue Jay	8	7	15	N	N	NL	NL
Cedar Creek Natural History Area	Blue-gray Gnatcatcher	0	3	3	N	N	NL	NL
Cedar Creek Natural History Area	Brown Thrasher	3	5	8	Y	Y	NL	NL
Cedar Creek Natural History Area	Brown-headed Cowbird	6	9	15	N	N	NL	NL
Cedar Creek Natural History Area	Canada Goose	2	1	3	N	N	NL	NL
Cedar Creek Natural History Area	Cedar Waxwing	4	3	7	N	N	NL	NL
Cedar Creek Natural History Area	Chipping Sparrow	11	7	18	N	N	NL	NL
Cedar Creek Natural History Area	Clay-colored Sparrow	0	4	4	N	N	NL	NL
Cedar Creek Natural History Area	Common Loon	1	0	1	Y	N	NL	NL
Cedar Creek Natural History Area	Common Yellowthroat	8	1	9	N	N	NL	NL
Cedar Creek Natural History Area	Downy Woodpecker	0	2	2	N	N	NL	NL
Cedar Creek Natural History Area	Eastern Meadowlark	7	0	7	Y	Y	NL	NL
Cedar Creek Natural History Area	Eastern Bluebird	0	6	6	N	N	NL	NL
Cedar Creek Natural History Area	Eastern Kingbird	10	3	13	N	N	NL	NL
Cedar Creek Natural History Area	Eastern Phoebe	1	1	2	N	N	NL	NL
Cedar Creek Natural History Area	Eastern Towhee	7	6	13	N	N	NL	NL

Table 5. Bird species and number of observations in each managed area. Grey highlighted indicates target SGCN. Alphabetical by common name.
Observations do not nessesarily indicate counts of unique individuals.

Managed Area	Common Name	No. of observations 2008	No. of observations 2009	Total no. of observations	SGCN	Target SGCN	State status	Federal Status
Cedar Creek Natural History Area	Eastern Wood-Pewee	6	4	10	Y	N	NL	NL
Cedar Creek Natural History Area	European Starling	0	1	1	N	N	NL	NL
Cedar Creek Natural History Area	Field Sparrow	16	13	29	Y	Y	NL	NL
Cedar Creek Natural History Area	Grasshopper Sparrow	7	1	8	N	N	NL	NL
Cedar Creek Natural History Area	Gray Catbird	4	3	7	N	N	NL	NL
Cedar Creek Natural History Area	Great Crested Flycatcher	4	1	5	N	N	NL	NL
Cedar Creek Natural History Area	Horned Lark	2	0	2	N	N	NL	NL
Cedar Creek Natural History Area	Hairy Woodpecker	0	2	2	N	N	NL	NL
Cedar Creek Natural History Area	House Wren	4	5	9	N	N	NL	NL
Cedar Creek Natural History Area	Indigo Bunting	4	5	9	N	N	NL	NL
Cedar Creek Natural History Area	Killdeer	1	0	1	N	N	NL	NL
Cedar Creek Natural History Area	Lark Sparrow	9	10	19	N	N	NL	NL
Cedar Creek Natural History Area	Least Flycatcher	3	1	4	Y	N	NL	NL
Cedar Creek Natural History Area	Mallard	2	0	2	N	N	NL	NL
Cedar Creek Natural History Area	Mourning Dove	11	8	19	N	N	NL	NL
Cedar Creek Natural History Area	Northern Cardinal	1	2	3	N	N	NL	NL
Cedar Creek Natural History Area	Northern Flicker	3	0	3	N	N	NL	NL
Cedar Creek Natural History Area	Northern Harrier	0	1	1	Y	N	NL	NL
Cedar Creek Natural History Area	Red-bellied Woodpecker	1	2	3	N	N	NL	NL
Cedar Creek Natural History Area	Red-eyed Vireo	4	6	10	N	N	NL	NL
Cedar Creek Natural History Area	Red-headed Woodpecker	16	7	23	Y	Y	NL	NL
Cedar Creek Natural History Area	Red-winged Blackbird	10	1	11	N	N	NL	NL
Cedar Creek Natural History Area	Ring-necked Pheasant	1	3	4	N	N	NL	NL
Cedar Creek Natural History Area	Rose-breasted Grosbeak	1	1	2	Y	N	NL	NL
Cedar Creek Natural History Area	Sedge Wren	2	0	2	Y	N	NL	NL
Cedar Creek Natural History Area	Sandhill Crane	7	2	9	N	N	NL	NL
Cedar Creek Natural History Area	Scarlet Tanager	4	4	8	N	N	NL	NL
Cedar Creek Natural History Area	Song Sparrow	12	5	17	N	N	NL	NL
Cedar Creek Natural History Area	Tree Swallow	3	3	6	N	N	NL	NL
Cedar Creek Natural History Area	Veery	2	0	2	Y	N	NL	NL
Cedar Creek Natural History Area	Vesper Sparrow	1	0	1	N	N	NL	NL
Cedar Creek Natural History Area	Warbling Vireo	1	0	1	N	N	NL	NL
Cedar Creek Natural History Area	White-breasted Nuthatch	3	7	10	N	N	NL	NL
Cedar Creek Natural History Area	Whip-poor-will	1	0	1	Y	Y	NL	NL
Cedar Creek Natural History Area	Wild Turkey	2	3	5	N	N	NL	NL
Cedar Creek Natural History Area	Yellow Warbler	0	1	1	N	N	NL	NL
Cedar Creek Natural History Area	Yellow-throated Vireo	1	1	2	N	N	NL	NL
Helen Allison Scientific and Naural Area	American Crow	3	2	5	N	N	NL	NL
Helen Allison Scientific and Naural Area	American Goldfinch	2	0	2	N	N	NL	NL
Helen Allison Scientific and Naural Area	American Robin	2	1	3	N	N	NL	NL
Helen Allison Scientific and Naural Area	Black-capped Chickadee	3	0	3	N	N	NL	NL
Helen Allison Scientific and Naural Area	Baltimore Oriole	0	1	1	N	N	NL	NL
Helen Allison Scientific and Naural Area	Blue Jay	5	3	8	N	N	NL	NL
Helen Allison Scientific and Naural Area	Blue-gray Gnatcatcher	0	1	1	N	N	NL	NL
Helen Allison Scientific and Naural Area	Brown Thrasher	2	1	3	Y	Y	NL	NL
Helen Allison Scientific and Naural Area	Brown-headed Cowbird	3	1	4	N	N	NL	NL
Helen Allison Scientific and Naural Area	Canada Goose	1	0	1	N	N	NL	NL
Helen Allison Scientific and Naural Area	Common Loon	1	0	1	Y	N	NL	NL
Helen Allison Scientific and Naural Area	Common Yellowthroat	2	0	2	N	N	NL	NL
Helen Allison Scientific and Naural Area	Chipping Sparrow	0	1	1	N	N	NL	NL
Helen Allison Scientific and Naural Area	Eastern Bluebird	0	2	2	N	N	NL	NL
Helen Allison Scientific and Naural Area	Eastern Kingbird	1	2	3	N	N	NL	NL
Helen Allison Scientific and Naural Area	Eastern Towhee	6	1	7	N	N	NL	NL
Helen Allison Scientific and Naural Area	Eastern Phoebe	2	0	2	N	N	NL	NL
Helen Allison Scientific and Naural Area	Eastern Wood-Pewee	3	1	4	Y	N	NL	NL
Helen Allison Scientific and Naural Area	Field Sparrow	8	4	12	Y	Y	NL	NL
Helen Allison Scientific and Naural Area	Gray Catbird	2	0	2	N	N	NL	NL
Helen Allison Scientific and Naural Area	Great Crested Flycatcher	2	3	5	N	N	NL	NL
Helen Allison Scientific and Naural Area	Indigo Bunting	2	2	4	N	N	NL	NL
Helen Allison Scientific and Naural Area	Lark Sparrow	1	1	2	N	N	NL	NL
Helen Allison Scientific and Naural Area	Mourning Dove	4	0	4	N	N	NL	NL
Helen Allison Scientific and Naural Area	Northern Cardinal	2	1	3	N	N	NL	NL
Helen Allison Scientific and Naural Area	Red-headed Woodpecker	4	0	4	Y	Y	NL	NL
Helen Allison Scientific and Naural Area	Pileated Woodpecker	1	0	1	N	N	NL	NL
Helen Allison Scientific and Naural Area	Red-eyed Vireo	2	2	4	N	N	NL	NL
Helen Allison Scientific and Naural Area	Ring-necked Pheasant	2	1	3	N	N	NL	NL
Helen Allison Scientific and Naural Area	Sandhill Crane	4	0	4	N	N	NL	NL
Helen Allison Scientific and Naural Area	Scarlet Tanager	1	0	1	N	N	NL	NL
Helen Allison Scientific and Naural Area	Song Sparrow	1	2	3	N	N	NL	NL
Helen Allison Scientific and Naural Area	Vesper Sparrow	0	1	1	N	N	NL	NL

Table 5. Bird species and number of observations in each managed area. Grey highlighted indicates target SGCN. Alphabetical by common name. **Observations do not nessesarily indicate counts of unique individuals.**

Managed Area	Common Name	No. of observations 2008	No. of observations 2009	Total no. of observations	SGCN	Target SGCN	State status	Federal Status
Helen Allison Scientific and Naural Area	White-breasted Nuthatch	2	1	3	N	N	NL	NL
Helen Allison Scientific and Naural Area	Wild Turkey	0	1	1	N	N	NL	NL
Wild River State Park	Alder Flycatcher	0	3	3	N	N	NL	NL
Wild River State Park	American Crow	4	5	9	N	N	NL	NL
Wild River State Park	American Goldfinch	3	9	12	N	N	NL	NL
Wild River State Park	American Redstart	1	2	3	N	N	NL	NL
Wild River State Park	American Robin	4	4	8	N	N	NL	NL
Wild River State Park	Baltimore Oriole	0	1	1	N	N	NL	NL
Wild River State Park	Black-and-white Warbler	0	2	2	N	N	NL	NL
Wild River State Park	Black-capped Chickadee	0	2	2	N	N	NL	NL
Wild River State Park	Blue Jay	2	6	8	N	N	NL	NL
Wild River State Park	Blue-winged Warbler	5	3	8	Y	Y	NL	NL
Wild River State Park	Brown Thrasher	0	1	1	Y	Y	NL	NL
Wild River State Park	Brown-headed Cowbird	2	8	10	N	N	NL	NL
Wild River State Park	Chestnut-sided Warbler	1	0	1	N	N	NL	NL
Wild River State Park	Canada Goose	0	1	1	N	N	NL	NL
Wild River State Park	Cedar Waxwing	0	5	5	N	N	NL	NL
Wild River State Park	Chipping Sparrow	2	7	9	N	N	NL	NL
Wild River State Park	Clay-colored Sparrow	1	6	7	N	N	NL	NL
Wild River State Park	Common Raven	0	2	2	N	N	NL	NL
Wild River State Park	Common Yellowthroat	0	6	6	N	N	NL	NL
Wild River State Park	Downy Woodpecker	2	4	6	N	N	NL	NL
Wild River State Park	Eastern Bluebird	1	4	5	N	N	NL	NL
Wild River State Park	Eastern Phoebe	1	3	4	N	N	NL	NL
Wild River State Park	Eastern Towhee	3	5	8	N	N	NL	NL
Wild River State Park	Eastern Wood-Pewee	3	4	7	Y	N	NL	NL
Wild River State Park	Field Sparrow	4	11	15	Y	Y	NL	NL
Wild River State Park	Golden-winged Warbler	2	5	7	N	N	NL	NL
Wild River State Park	Grasshopper Sparrow	1	3	4	N	N	NL	NL
Wild River State Park	Gray Catbird	2	5	7	N	N	NL	NL
Wild River State Park	Great Blue Heron	0	1	1	N	N	NL	NL
Wild River State Park	Great Crested Flycatcher	2	2	4	N	N	NL	NL
Wild River State Park	Hairy Woodpecker	1	1	2	N	N	NL	NL
Wild River State Park	Henslow's Sparrow	0	3	3	N	N	NL	NL
Wild River State Park	House Wren	1	3	4	N	N	NL	NL
Wild River State Park	Indigo Bunting	3	7	10	N	N	NL	NL
Wild River State Park	Lark Sparrow	0	2	2	N	N	NL	NL
Wild River State Park	Mourning Dove	1	5	6	N	N	NL	NL
Wild River State Park	Nashville Warbler	0	1	1	N	N	NL	NL
Wild River State Park	Northern Cardinal	0	1	1	N	N	NL	NL
Wild River State Park	Ovenbird	1	7	8	Y	N	NL	NL
Wild River State Park	Pileated Woodpecker	1	2	3	N	N	NL	NL
Wild River State Park	Red-bellied Woodpecker	0	2	2	N	N	NL	NL
Wild River State Park	Red-eyed Vireo	4	7	11	N	N	NL	NL
Wild River State Park	Red-winged Blackbird	0	1	1	N	N	NL	NL
Wild River State Park	Ring-necked Pheasant	1	9	10	N	N	NL	NL
Wild River State Park	Rose-breasted Grosbeak	2	4	6	Y	N	NL	NL
Wild River State Park	Savannah Sparrow	0	2	2	N	N	NL	NL
Wild River State Park	Scarlet Tanager	2	5	7	N	N	NL	NL
Wild River State Park	Sedge Wren	0	2	2	Y	N	NL	NL
Wild River State Park	Song Sparrow	3	6	9	N	N	NL	NL
Wild River State Park	Tree Swallow	1	2	3	N	N	NL	NL
Wild River State Park	Vesper Sparrow	0	2	2	N	N	NL	NL
Wild River State Park	White-breasted Nuthatch	3	5	8	N	N	NL	NL
Wild River State Park	Wild Turkey	0	1	1	N	N	NL	NL
Wild River State Park	Wood Thrush	0	2	2	Y	N	NL	NL
Wild River State Park	Yellow Warbler	3	8	11	N	N	NL	NL
Wild River State Park	Yellow-bellied Sapsucker	0	1	1	Y	N	NL	NL
Wild River State Park	Yellow-throated Vireo	2	1	3	N	N	NL	NL

Table 6. Reptile and amphibian species recorded and number of individuals observed in each managed area**Grey highlighted indicates target SGCN. Abundance not recorded for non-target species. Alphabetical by scientific name.**

Managed Area	Common Name	Scientific Name	No. of individuals 2008	No. of individuals 2009	Total no. of individuals	SGCN	Target SGCN	State status	Federal Status
Bunker Hills Regional Park	Eastern tiger salamander	*Ambystoma tigrinum*				N	N	NL	NL
Bunker Hills Regional Park	American toad	*Anaxyrus americanus*				N	N	NL	NL
Bunker Hills Regional Park	Snapping turtle	*Chelydra serpentina*	1	1	2	Y	N	SPC	NL
Bunker Hills Regional Park	Painted turtle	*Chrysemys picta*				N	N	NL	NL
Bunker Hills Regional Park	Western hognose snake	*Heterodon nasicus*	4	2	6	Y	Y	SPC	NL
Bunker Hills Regional Park	Cope's gray treefrog	*Hyla chrysoscelis*				N	N	NL	NL
Bunker Hills Regional Park	Gophersnake	*Pituophis catenifer*	6	9	15	Y	Y	SPC	NL
Bunker Hills Regional Park	Prairie skink	*Plestiodon septentrionalis*				N	N	NL	NL
Bunker Hills Regional Park	Boreal chorus frog	*Pseudacris maculata*				N	N	NL	NL
Bunker Hills Regional Park	Common gartersnake	*Thamnophis sirtalis*				N	N	NL	NL
Cedar Creek Natural History Area	American toad	*Anaxyrus americanus*				N	N	NL	NL
Cedar Creek Natural History Area	Painted turtle	*Chrysemys picta*				N	N	NL	NL
Cedar Creek Natural History Area	Blanding's turtle	*Emydoidea blandingii*	2	2	4	Y	Y	THR	NL
Cedar Creek Natural History Area	Eastern hognose snake	*Heterodon platirhinos*		3	3	Y	N	NL	NL
Cedar Creek Natural History Area	Cope's gray treefrog	*Hyla chrysoscelis*				N	N	NL	NL
Cedar Creek Natural History Area	Gray treefrog	*Hyla versicolor*				N	N	NL	NL
Cedar Creek Natural History Area	Smooth greensnake	*Opheodrys vernalis*	0	1	1	Y	N	NL	NL
Cedar Creek Natural History Area	Gophersnake	*Pituophis catenifer*	7	10	17	Y	Y	SPC	NL
Cedar Creek Natural History Area	Prairie skink	*Plestiodon septentrionalis*				N	N	NL	NL
Cedar Creek Natural History Area	Spring peeper	*Pseudacris crucifer*				N	N	NL	NL
Cedar Creek Natural History Area	Boreal chorus frog	*Pseudacris maculata*				N	N	NL	NL
Cedar Creek Natural History Area	Common gartersnake	*Thamnophis sirtalis*				N	N	NL	NL
Helen Allison Scientific and Naural Area	American toad	*Anaxyrus americanus*				N	N	NL	NL
Helen Allison Scientific and Naural Area	Northern leopard frog	*Lithobates pipiens*				N	N	NL	NL
Helen Allison Scientific and Naural Area	Gophersnake	*Pituophis catenifer*	0	2	2	Y	Y	SPC	NL
Helen Allison Scientific and Naural Area	Prairie skink	*Plestiodon septentrionalis*				N	N	NL	NL
Helen Allison Scientific and Naural Area	Boreal chorus frog	*Pseudacris maculata*				N	N	NL	NL
Helen Allison Scientific and Naural Area	Common gartersnake	*Thamnophis sirtalis*				N	N	NL	NL
Oak Savanna Park Reserve	Gray treefrog	*Hyla versicolor*				N	N	NL	NL
Oak Savanna Park Reserve	Gophersnake	*Pituophis catenifer*	1	2	3	Y	Y	SPC	NL
Oak Savanna Park Reserve	Prairie skink	*Plestiodon septentrionalis*				N	N	NL	NL
Rice Lake Scientific and Natural Area	American toad	*Anaxyrus americanus*				N	N	NL	NL
Rice Lake Scientific and Natural Area	Gray treefrog	*Hyla versicolor*				N	N	NL	NL
Rice Lake Scientific and Natural Area	Prairie skink	*Plestiodon septentrionalis*				N	N	NL	NL
Rice Lake Scientific and Natural Area	Boreal chorus frog	*Pseudacris maculata*				N	N	NL	NL
Sand Dunes State Forest	Snapping turtle	*Chelydra serpentina*	1	0	1	Y	N	SPC	NL
Sand Dunes State Forest	Painted turtle	*Chrysemys picta*				N	N	NL	NL
Sand Dunes State Forest	Blanding's turtle	*Emydoidea blandingii*	14	0	14	Y	Y	THR	NL
Sand Dunes State Forest	Western hognose snake	*Heterodon nasicus*	1	1	2	Y	Y	SPC	NL
Sand Dunes State Forest	Cope's gray treefrog	*Hyla chrysoscelis*				N	N	NL	NL
Sand Dunes State Forest	Gray treefrog	*Hyla versicolor*				N	N	NL	NL
Sand Dunes State Forest	Green frog	*Lithobates clamitans*				N	N	NL	NL
Sand Dunes State Forest	Smooth greensnake	*Opheodrys vernalis*	0	1	1	Y	N	NL	NL
Sand Dunes State Forest	Gophersnake	*Pituophis catenifer*	1	17	18	Y	Y	SPC	NL
Sand Dunes State Forest	Prairie skink	*Plestiodon septentrionalis*				N	N	NL	NL

Table 6. Reptile and amphibian species recorded and number of individuals observed in each managed area**Grey highlighted indicates target SGCN. Abundance not recorded for non-target species. Alphabetical by scientific name.**

Managed Area	Common Name	Scientific Name	No. of individuals 2008	No. of individuals 2009	Total no. of individuals	SGCN	Target SGCN	State status	Federal Status
Sand Dunes State Forest	Boreal chorus frog	*Pseudacris maculata*				N	N	NL	NL
Sand Dunes State Forest	Common gartersnake	*Thamnophis sirtalis*				N	N	NL	NL
Sherburne National Wildlife Refuge	Eastern tiger salamander	*Ambystoma tigrinum*				N	N	NL	NL
Sherburne National Wildlife Refuge	American Toad	*Anaxyrus americanus*				N	N	NL	NL
Sherburne National Wildlife Refuge	Snapping turtle	*Chelydra serpentina*	6	1	7	Y	N	SPC	NL
Sherburne National Wildlife Refuge	Painted Turtle	*Chrysemys picta*				N	N	NL	NL
Sherburne National Wildlife Refuge	Blanding's turtle	*Emydoidea blandingii*	22	9	31	Y	Y	THR	NL
Sherburne National Wildlife Refuge	Western hognose snake	*Heterodon nasicus*	6	10	16	Y	Y	SPC	NL
Sherburne National Wildlife Refuge	Cope's gray treefrog	*Hyla chrysoscelis*				N	N	NL	NL
Sherburne National Wildlife Refuge	Gray treefrog	*Hyla versicolor*				N	N	NL	NL
Sherburne National Wildlife Refuge	Green frog	*Lithobates clamitans*				N	N	NL	NL
Sherburne National Wildlife Refuge	Northern leopard frog	*Lithobates pipiens*				N	N	NL	NL
Sherburne National Wildlife Refuge	Mink frog	*Lithobates septentrionalis*				N	N	NL	NL
Sherburne National Wildlife Refuge	Wood frog	*Lithobates sylvaticus*				N	N	NL	NL
Sherburne National Wildlife Refuge	Smooth greensnake	*Opheodrys vernalis*	0	1	1	Y	N	NL	NL
Sherburne National Wildlife Refuge	Gophersnake	*Pituophis catenifer*	31	46	77	Y	Y	SPC	NL
Sherburne National Wildlife Refuge	Prairie skink	*Plestiodon septentrionalis*				N	N	NL	NL
Sherburne National Wildlife Refuge	Boreal chorus frog	*Pseudacris maculata*				N	N	NL	NL
Sherburne National Wildlife Refuge	Red-bellied snake	*Storeria occipitomaculata*				N	N	NL	NL
Sherburne National Wildlife Refuge	Plains gartersnake	*Thamnophis radix*				N	N	NL	NL
Sherburne National Wildlife Refuge	Common gartersnake	*Thamnophis sirtalis*				N	N	NL	NL
Uncas Dunes Scientific and Natural Area	American toad	*Anaxyrus americanus*				N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Painted turtle	*Chrysemys picta*				N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Western hognose snake	*Heterodon nasicus*	1	0	1	Y	Y	SPC	NL
Uncas Dunes Scientific and Natural Area	Green frog	*Lithobates clamitans*				N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Gophersnake	*Pituophis catenifer*	2	1	3	Y	Y	SPC	NL
Uncas Dunes Scientific and Natural Area	Prairie skink	*Plestiodon septentrionalis*				N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Common gartersnake	*Thamnophis sirtalis*				N	N	NL	NL
Wild River State Park	Snapping turtle	*Chelydra serpentina*	0	2	2	Y	N	SPC	NL
Wild River State Park	Painted turtle	*Chrysemys picta*				N	N	NL	NL
Wild River State Park	Blanding's turtle	*Emydoidea blandingii*	1	6	7	Y	Y	THR	NL
Wild River State Park	Northern map turtle	*Graptemys geographica*				N	N	NL	NL
Wild River State Park	Eastern hognose snake	*Heterodon platirhinos*	2	5	7	Y	N	NL	NL
Wild River State Park	Smooth greensnake	*Opheodrys vernalis*	2	1	3	Y	N	NL	NL
Wild River State Park	Gophersnake	*Pituophis catenifer*	2	15	17	Y	Y	SPC	NL
Wild River State Park	Prairie skink	*Plestiodon septentrionalis*				N	N	NL	NL
Wild River State Park	Common gartersnake	*Thamnophis sirtalis*				N	N	NL	NL

Table 7. Invertebrate species and number of observations in each managed area. Grey highlighted indicates target SGCN. Alphabetical by scientific name. **Observations do not nessesarily indicate counts of unique individuals.**

Managed Area	Common Name	Scientific Name	No. of observations 2008	No. of observations 2009	Total no. of observations	SGCN	Target SGCN	State status	Federal Status
Bunker Hills Regional Park	Dusted skipper	*Atrytonopsis hianna*	3	1	4	N	N	NL	NL
Bunker Hills Regional Park	Chequered skipper	*Carterocephalus palaemon*	0	1	1	N	N	NL	NL
Bunker Hills Regional Park	Big sand tiger beetle	*Cicindela formosa*	0	12	12	N	N	NL	NL
Bunker Hills Regional Park	Northern barrens tiger beetle	*Cicindela patruela patruela*	0	2	2	Y	Y	SPC	NL
Bunker Hills Regional Park	Festive tiger beetle	*Cicindela scutellaris lecontei*	0	4	4	N	N	NL	NL
Bunker Hills Regional Park	Common ringlet butterfly	*Coenonympha tullia*	1	1	2	N	N	NL	NL
Bunker Hills Regional Park	Olympia marble butterfly	*Euchloe olympia*	0	3	3	N	N	NL	NL
Bunker Hills Regional Park	Variegated fritillary	*Euptoieta claudia*	0	1	1	N	N	NL	NL
Bunker Hills Regional Park	Leonard's skipper	*Hesperia leonardus*	5	45	50	Y	Y	SPC	NL
Bunker Hills Regional Park	American copper	*Lycaena phlaeas*	0	4	4	N	N	NL	NL
Bunker Hills Regional Park	Jumping spider	*Metaphidippus arizonensis*	0	6	6	Y	Y	SPC	NL
Bunker Hills Regional Park	Northern broken-dash butterfly	*Wallengrenia egeremet*	0	40	40	N	N	NL	NL
Cedar Creek Natural History Area	American copper	*Lycaena phlaeas*	1	0	1	N	N	NL	NL
Cedar Creek Natural History Area	Jumping spider	*Metaphidippus arizonensis*	3	1	4	Y	Y	SPC	NL
Helen Allison Scientific and Naural Area	Big sand tiger beetle	*Cicindela formosa*	1	0	1	N	N	NL	NL
Helen Allison Scientific and Naural Area	Common ringlet butterfly	*Coenonympha tullia*	2	0	2	N	N	NL	NL
Helen Allison Scientific and Naural Area	Leonard's skipper	*Hesperia leonardus*	1	6	7	Y	Y	SPC	NL
Helen Allison Scientific and Naural Area	American copper	*Lycaena phlaeas*	1	0	1	N	N	NL	NL
Helen Allison Scientific and Naural Area	Jumping spider	*Metaphidippus arizonensis*	14	11	25	Y	Y	SPC	NL
Helen Allison Scientific and Naural Area	Coral hairstreak butterfly	*Strymon edwardsii*	1	0	1	N	N	NL	NL
Oak Savanna Park Reserve	Big sand tiger beetle	*Cicindela formosa*	0	1	1	N	N	NL	NL
Oak Savanna Park Reserve	Northern barrens tiger beetle	*Cicindela patruela patruela*	0	1	1	Y	Y	SPC	NL
Oak Savanna Park Reserve	Jumping spider	*Metaphidippus arizonensis*	0	7	7	Y	Y	SPC	NL
Sand Dunes State Forest	Eastern pine elfin	*Callophrys niphon*	1	0	1	N	N	NL	NL
Sand Dunes State Forest	Northern barrens tiger beetle	*Cicindela patruela patruela*	7	0	7	Y	Y	SPC	NL
Sand Dunes State Forest	Festive tiger beetle	*Cicindela scutellaris lecontei*	2	1	3	N	N	NL	NL
Sand Dunes State Forest	Six-spotted tiger beetle	*Cicindela sexguttata*	0	1	1	N	N	NL	NL
Sand Dunes State Forest	Juvenal's duskywing butterfly	*Erynnis juvenalis*	0	1	1	N	N	NL	NL
Sand Dunes State Forest	Olympia marble butterfly	*Euchloe olympia*	0	10	10	N	N	NL	NL
Sand Dunes State Forest	Leonard's skipper	*Hesperia leonardus*	5	10	15	Y	Y	SPC	NL
Sherburne National Wildlife Refuge	Dusted skipper	*Atrytonopsis hianna*	1	0	1	N	N	NL	NL
Sherburne National Wildlife Refuge	Chequered skipper	*Carterocephalus palaemon*	0	1	1	N	N	NL	NL
Sherburne National Wildlife Refuge	Northern barrens tiger beetle	*Cicindela patruela patruela*	4	10	14	Y	Y	SPC	NL
Sherburne National Wildlife Refuge	Festive tiger beetle	*Cicindela scutellaris lecontei*	1	0	1	N	N	NL	NL
Sherburne National Wildlife Refuge	Six-spotted tiger beetle	*Cicindela sexguttata*	1	0	1	N	N	NL	NL
Sherburne National Wildlife Refuge	Dimorphic jumping spider	*Maevia vittata*	0	1	1	N	N	NL	NL
Sherburne National Wildlife Refuge	Jumping spider	*Metaphidippus arizonensis*	0	7	7	Y	Y	SPC	NL
Sherburne National Wildlife Refuge	Jumping spider	*Tutelina elegans*	0	1	1	N	N	NL	NL
Rice Lake Scientific and Natural Area	Coral hairstreak butterfly	*Harkenclenus titus*	0	1	1	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Dusted skipper	*Atrytonopsis hianna*	1	0	1	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Eastern pine elfin	*Callophrys niphon*	1	0	1	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Big sand tiger beetle	*Cicindela formosa*	0	4	4	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Northern barrens tiger beetle	*Cicindela patruela patruela*	0	5	5	Y	Y	SPC	NL
Uncas Dunes Scientific and Natural Area	Festive tiger beetle	*Cicindela scutellaris lecontei*	1	0	1	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Six-spotted tiger beetle	*Cicindela sexguttata*	1	0	1	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Olympia marble butterfly	*Euchloe olympia*	0	1	1	N	N	NL	NL
Uncas Dunes Scientific and Natural Area	Leonard's skipper	*Hesperia leonardus*	6	149	155	Y	Y	SPC	NL
Uncas Dunes Scientific and Natural Area	Jumping spider	*Metaphidippus arizonensis*	1	1	2	Y	Y	SPC	NL
Wild River State Park	Six-spotted tiger beetle	*Cicindela sexguttata*	1	0	1	N	N	NL	NL
Wild River State Park	Common ringlet butterfly	*Coenonympha tullia*	1	0	1	N	N	NL	NL
Wild River State Park	Jumping spider	*Metaphidippus arizonensis*	11	2	13	Y	Y	SPC	NL
Wild River State Park	Checkered white butterfly	*Pontia protodice*	1	0	1	N	N	NL	NL

Table 8. Results of relevès completed on the Anoka Sand Plain

Managed Area	Native Plant Community	Quality Rank	Date Surveyed
Bunker Hills Regional Park	Oak Savanna	B	[redacted]
Cedar Creek Natural History Area	Oak Savanna	B	
Cedar Creek Natural History Area	Oak Woodland	AB	
Helen Allison Savanna Scientific and Natural Area	Oak Savanna	B	
Oak Savanna Park	Oak Savanna	BC	
Oak Savanna Park	Oak Woodland	C	
Rice Lake Savanna Scientific and Natural Area	Oak Savanna	CD	
Rice Lake Savanna Scientific and Natural Area	Oak Woodland	BC	
Sand Dunes State Forest (south)	Oak Savanna	BC	
Sand Dunes State Forest (south)	Oak Woodland	C	
Sherburne National Wildlife Refuge	Oak Savanna	B	
Sherburne National Wildlife Refuge	Oak Woodland	B	
Uncas Dunes SNA South	Oak Savanna	B	
Uncas Dunes SNA North	Oak Savanna	BC	
Wild River State Park	Oak Savanna	BC	

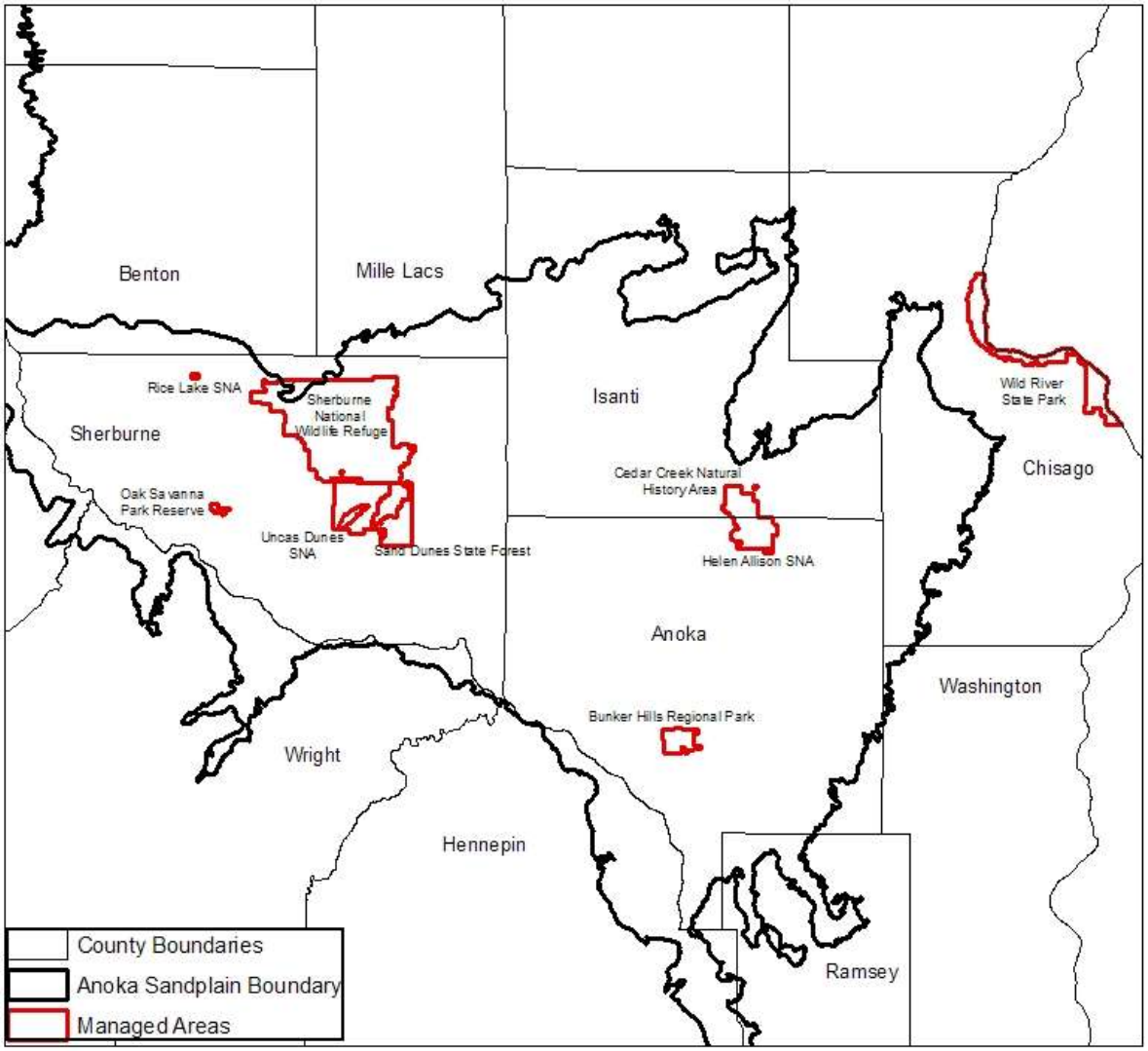


Figure 1. Locations of nine managed area survey sites on the Anoka Sand Plain

Figure removed from this document to protect sensitive species.

Figure 2. Locations of the small mammal trap grids.

Figure removed from this document to protect sensitive species.

Figure 3. Locations of the bird point counts including target and non target SGCN locations.

Figure removed from this document to protect sensitive species.

Figure 4. Locations of turtle traps, drift fence arrays, and cover boards.

Figure removed from this document to protect sensitive species.

Figure 5. Areas searched for SGCN reptiles.

Figure removed from this document to protect sensitive species.

Figure 6. Areas searched for invertebrate SCGN.

Figure removed from this document to protect sensitive species.

Figure 7. Locations of relevé plots.

Figure removed from this document to protect sensitive species.

Figure 8. Locations of dead-on-the-road (DOR) reptiles, amphibians and mammals.

Figure removed from this document to protect sensitive species.

Figure 9. Locations of dead-on-the-road (DOR) reptiles, amphibians and mammals in Sherburne County, MN (Sherburne National Wildlife Refuge, Sand Dunes State Forest, Uncas Dunes SNA, Rice Lake SNA and Oak Savanna Park Reserve).

Figure removed from this document to protect sensitive species.

Figure 10. Areas of open habitat mapped within and adjacent to the nine managed areas surveyed.

Anoka Sand Plain Animal Survey -- Mammal Trapping and Specimen Data

County: _____ **Area Name:** _____

Habitat: _____

Waypt: _____

UTM E: _____

UTM N: _____

Habitat codes:
Upland type: GRA - Grassland GOF - Old Field GNP- Native Prairie GPA - Grazed Pasture
AG - Ag fields OAS - Oak Savanna ED - Edge DF - Deciduous Forest

GPS Accuracy: _____

Landscape: Flat Rolling Steep

Temp: _____ °C / °F **Last night:** _____ °C / °F

wind:	cloud:	precip:
0 none	0 <10% cover	0 none
1 light breeze	1 10-50% cover	1 drizzle to light rain
2 mod. wind, gusts	2 50-90% cover	2 mod. or intermittent
3 strong wind, gusts	3 >90 % cover	3 heavy, thunderstorm

Date: _____ **Hour:** _____ **Trap Day:** _____ **Observer(s):** _____

Station	Trap	Species	Sex	Age	Molt	Weight	Mark	Fate	Bag #	Ext. Repro.		Remarks

Trap	Age	Molt	Mark	Fate	Reproduction	
					Ext. ♂ : X / testes	Ext. ♀ : pregnant/mammae
1 - Mus. Spec.	J - juvenile	0 - no molt	0 - unmarked	E - escaped	1 - abdominal, small	1 - not pregnant 1 - small
2 - Sherman	SA - subadult	1 - molting	1 - marked	C - collected	2 - scrotal, undeveloped	2 - pregnant? 2 - prominent
3 - pitfall	A - adult			R - released	3 - scrotal, developed	3 - pregnant 3 - lactating
4 - rat	U - unknown			X - discarded		

ASP TrapSpecForm 2008

verified_____
EOR_____
database_____
LocNum_____

Anoka Sand Plain Animal Survey -- Mammal Site Habitat

County: _____ **Area Name:** _____ **Waypt:** _____ **LocNum:** _____

Date: _____ **Observer(s):** _____ **GPS Accuracy:** _____

Habitat Description

Terrain (slope, aspect) _____

Soil (texture, moisture) _____

Rock (type, exposure, distribution) _____

Water (type, depth, distribution) _____

Litter (type, thickness, distribution) _____

Debris (type, abundance, distribution) _____

Adjacent habitats and features _____

Comments _____

Layer	Cover	Predominant growth forms (include species, if known)
> 5 m		
2 - 5 m		
1 - 2 m		
0.5 - 1.0 m		
0.1 - 0.5 m		
< 0.1 m		

Cover Categories		Growth Form Categories	
none	0	**WOODY**	***Trees:*** coniferous, deciduous/ upland, lowland
< 5%	1		***Shrubs:*** upland, lowland
5 - 25%	2		***Other woody plants:*** vines, seedlings, "woody" herbaceous
25 - 50%	3	**HERBACEOUS**	***Forbs/Ferns***
50 - 75%	4		***Graminoides***: grasses, sedges
75 - 95%	5		***Mosses:*** sphagnum, feather, brown
> 95%	6		***Fungi/Lichen***

(ASP MML Habitatnew, 2008)

ASP Animal Site Survey - Mammal Site Habitat, Page 2

Grid Set SS DS Fence BS-s BS-d
RS-s RS-d Other: _____
Grid Layout 4x10 2x20 Other: _____
Shermans closed? Yes No

Sketch of grid (indicate N)

Trap Microhabitat (Number up to 3 categories >25% cover; check others if present, at least 5% cover)

Row #																			
Trap #																			
Trap type																			
Standing water																			
Rock/gravel																			
Bare earth																			
Litter/dead vegetation																			
Logs/debris																			
Moss/lichen																			
Graminoid - low (s,g)																			
Graminoid - high (s,g)																			
Herbaceous - low																			
Herbaceous - high																			
Woody - low																			
Woody - high																			
Trees < 5m (√)																			
Trees > 5m (√)																			
Row #																			
Trap #																			
Trap type																			
Standing water																			
Rock/gravel																			
Bare earth																			
Litter/dead vegetation																			
Logs/debris																			
Moss/lichen																			
Graminoid - low (s,g)																			
Graminoid - high (s,g)																			
Herbaceous - low																			
Herbaceous - high																			
Woody - low																			
Woody - high																			
Trees < 5m (√)																			
Trees > 5m (√)																			

Other mammal evidence:

Anoka Sand Plain ANIMAL SURVEY -- point count [ASP_ptct_datasheet_2008]

OBSERVER(S):	
DATE:	
COUNTY:	
TWP: RNG: SEC:	
AREA NAME:	
UTM zone: UTM E: UTM N:	
WAYPT:	Dist. from last pt:

Time (start):				LocNum:
Temperature:		°C / °F		
Wind:	calm	light breeze	mod. wind/ gusts	strong wind/ gusts
Cloud:	0-10%	10-50%	50-90%	90-100%
Precip: NONE	fog	drizzle/ light rain	mod/ intermittent	heavy/ t-storm

Count Data

	5 min			***10 min***		
SPECIES	< 50m	> 50m	misc/BEC	< 50m	> 50m	misc/BEC

Breeding Evidence Codes (BEC) --- [breeding season observation, unless otherwise noted]

ne -- nest with eggs or young	nb -- adult building nest/ carrying nest material
an -- adult on nest	dd -- distraction display, mobbing
uy -- unfledged young away from nest	cf -- carrying food, fecal sac
ac -- adult entering nest cavity/hole	fj -- flying juvenile away from nest

IB -- any other territorial or nesting behavior (not listed above) suggesting bird is nesting nearby.

BSO -- singing male or adult seen in appropriate nesting habitat during breeding season.

Habitat Data - general description:	Comments:

TARGETED BIRD SURVEY DATA SHEET - Page 2 Date_____

Time	Waypt	LocNum (SrcFeat ID)	Species Obs.	Behavior	Habitat Feature	Habitat Type(s)	BEC	Nest Tree Sp.	Nest Tree Ht.	Notes/Comments

Behavior: FL-Flying, PR-Perched, HU-Hunting, OG-On ground, FY-Feeding young, BA-Bathing, RO-Roosting, SI-Singing, SN-Sitting on nest

Habitat feature: SN-Snag, TW-Telephone Wire, NT-Nest Tree, PT-Perching Tree, HS-House/Structure

Habitat type: GRA - Grassland, GOF - Old Field, GNP- Native Prairie, GPA - Grazed Pasture, AG - Ag fields, OAS - Oak Savanna, ED - Edge, DF - Deciduous Forest

Notes: briefly describe any characteristics of the habitat or nest site which you may think are significant. This may include distance from water, proximity to other trees, proximity to foraging habitat, noise levels in the area, or observed human activities in the area which may affect nesting or behavior. If nest is located, include any information which might be useful for another observer to locate the nest at a later date.

Breeding Evidence Codes (BEC) ---	[breeding season observation, unless otherwise noted]
ne -- nest with eggs or young	nb -- adult building nest/ carrying nest material
an -- adult on nest	dd -- distraction display, mobbing
uy -- unfledged young away from nest	cf -- carrying food, fecal sac
ac -- adult entering nest cavity/hole	fj -- flying juvenile away from nest
IB -- any other territorial or nesting behavior (not listed above) suggesting bird is nesting nearby.	
BSO -- singing male or adult seen in appropriate nesting habitat during breeding season.	

ASP Herp Search/Trap Data Sheet

Date:_____ Start Time:_____hrs. End Time:_____hrs.

Observer(s): _____ Site (waypt):_____ UTM E:_____ UTM N:_____ Area Name:_____

Weather: air temp:_____°C / °F water temp:_____°C / °F

Habitat:

wind:
0 none
1 light breeze
2 mod. wind, gusts
3 strong wind, gusts

cloud:
0 <10% cover
1 10-50% cover
2 50-90% cover
3 >90 % cover

precip:
0 none
1 drizzle to light rain
2 mod. or intermittent
3 heavy, thunderstorm

Wetland type: WP – Woodland pool SS – Shrub swamp EM – Emergent marsh WM – Wet Meadow FF - Flooded Field BP – Beaver pond L – Lake RS – River/stream D – Ditch O – Other (write in wetland type)_____

Upland type: GRA - Grassland GOF - Old Field GNP- Native Prairie GPA - Grazed Pasture AG - Ag fields OAS - Oak Savanna ED - Edge DF - Deciduous Forest

Woody Debris: Abund Mod Sparse None

Exposed Rock: Abund Mod Sparse None

Landscape: Flat Rolling Steep

Bare Soil: Abund Mod Sparse None

County:_____

GPS Accuracy (m):_____

Record Num	Waypt Number	Time (24hr)	Technique	Species	Sex	Age	Weight (g)	Measurements (mm)			Repro Status	CIV	Verify	Digi Photo #	Habitat Types	Remarks (notch num; attached sheet; etc.)
								SVL_CL	TBL_CW	PL						

Technique		Sex	Age	Repr. Status	CIV	Verify
S -Search	TH - Turtle trap, hoop	F - Female	M - Metamorph	DVS - Dark vocal sac	1-Occasional calling, space between calls (note #s <10)	S - Specimen
N - Dip Net	TR - Turtle Trap, Rectangular	M - Male	J - Juvenile	SV - Swollen vent	2-Frequent calling, calls distinguishable but with some overlap	P - Photo
R - Road Cruising	TL - Turtle traps, leads	U - Unknown	A - Adult	G - Gravid	3-Continuous calling, calls overlap (indicating intense calling)	O - Observed
I - Incidental	CS - Coverboard, steel		U - Unknown	U - Unknown		H - Heard
	CW - Coverboard, wood					R - Released

ASP Herp Search Trap_2008

verified_____
EOR_____
database_____
LocNum_____

Anoka Sand Plain Drift Fence/Cover Object Data Sheet County:_____ Area Name:_____ Waypoint:_____ UTM E:_____ UTM N:_____

Observer(s): _____ Date:_____ Start Time:_____hrs. End Time:_____hrs. GPS Accuracy:_____

Comments/previous weather: _____

			HERPS								MAMMALS									
Trap/Cover Type-#	Taxa	Species	Sex	Age	Weight	Measurements SVL	Measurements TBL	Repro Status	CIV	Verify	Sex	Age	Molt	Weight	Ext. Repro X/P	Ext. Repro T/M	Fate	Bag #	Photo #	Remarks

Trap Type	Cover	Taxa
BT - Bucket	CS-Steel	HRP
FT - Funnel	CW-Wood	MML
	CF-fabric	
I - Incidental		

Sex	Age	Repr. Status	CIV	Verify
F - female	M-metamorph	DVS - dark vocal sac	1	S - SPE
M - male	J-juvenile	SV - swollen vent	2	P - PHO
U- unknown	A-adult	G - gravid	3	O - OBS
	U-unknown	U - unknown		H - HRD
				R - RLS

Age	Molt
J - juvenile	0 - none
SA - subadult	1 - molt
A - adult	
U - unknown	

Ext. Repro		
♂ : X / testes	♀ : pregnant/mammae	
1 - abdominal, small	1 - not pregnant	1 - small
2 - scrotal, undeveloped	2 - pregnant?	2 - prominent
3 - scrotal, developed	3 - pregnant	3 - lactating

Fate
E - escaped
C - collected
R - released
X - discarded

Drift Fence_Cover_2008

verified_____
EOR_____
database_____
LocNum_____

___ verified
___ EOR
___ database
_____ LocNum

Marked Blanding's Turtle Data Sheet

Date:_____ Staff:_____ Area Name:_____

Waypoint _____ UTM E: _____ UTM N: _____

GPS Accuracy:_____

Corresponding Record Num(?):_____

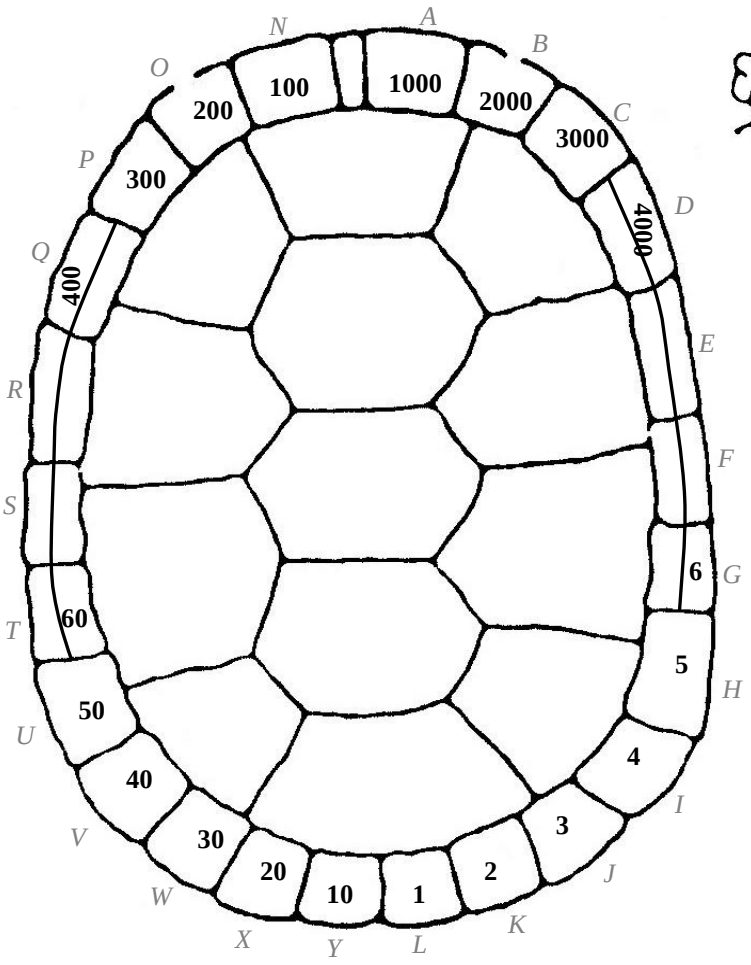
- Use Herp Search/Trap data sheet or Incidental Record form for additional data, link by Record Num

Description of Area/Habitat:

Description of turtle/unique markings (draw below) -

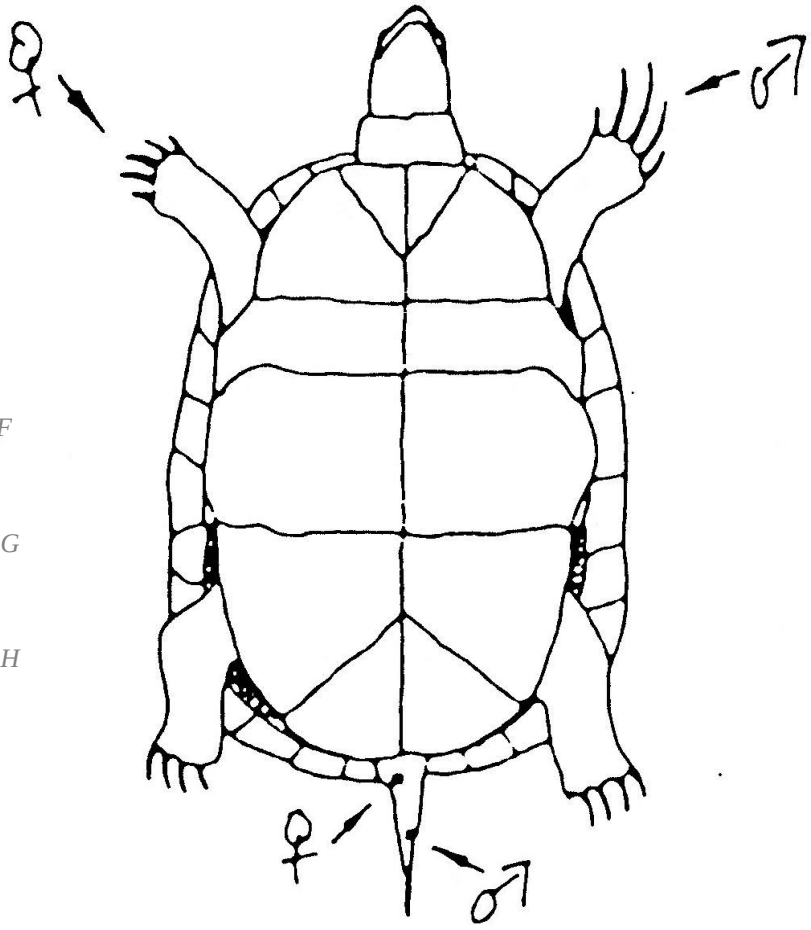
Notch Num:_____

Carapace



Sherburne NWR (Alpha) & Hall 1989 (Numeric) Marking System

Plastron



Photo(s) taken?_____

Comments:

MINNESOTA DEPARTMENT OF NATURAL RESOURCES RELEVE FORM
DNR, Division of Ecological Services, 500 Lafayette Road, Box 25, St. Paul, MN 55155

Map _____
Enter _____
QC _____
Edit _____
Append _____

DNR REVEVE # __ __ __ __ __ __ __

SITE DATA SHEET

GENERAL INFORMATION

DNR RELEVE # __ __ __ __

***Surveyor's ID Code**: __ __ __ (_____)
Surveyor's Releve #: __ __ __ __ __ __ __ __ **Surveyor's Place Name**: _____
Institution: (M)CBS (O)ther _____
Purpose of Releve: (C)lassification (S)ite documentation (R)are species habitat (M)onitoring (O)ther _____
Date: __ __ **Month**: __ __ __ **Year**: __ __ __ __ (e.g. 09 JUL 2004)
MCBS Site #: __ __ __ **County**: _____ ***Ownership**: __ __ __ (_____)

Vegetation: (W)ooded vs. (O)pen **Site**: (U)pland vs. (W)etland
***Native Plant Community Class**: __ __ __ __ __ __ (_____)
***Native Plant Community Type/Subytpe**: __ / __ (_____)
Community Ranking in Releve: __ __
Stand Typical of Community Class/Type: (Y)es (N)o (U)ncertain
If No, identify appropriate modifier: (N)atural disturbance (H)uman disturbance (Y)oung stand (<40 yrs) (O)ther _____
Releve Typical of Stand: (Y)es (N)o
If No, identify appropriate modifier: (H)igher Quality (L)ower Quality (C)anopy Gap (O)ther_____
Plot Location: (F)ar from community boundary (M)oderately far from boundary (C)lose to boundary (E)cotonal

LOCATION INFORMATION

UTM: __ __ __ __ __ __ E / __ __ __ __ __ __ __ N (record in NAD83, Zone 15)
Latitude: __ __ ° __ __' __ __" / **Longitude**: __ __ ° __ __' __ __" (record in NAD27, Zone 15)
UTM Accuracy: _____ meters

Township: __ __ __ __ (e.g. 143N) **Range**: __ __ __ (e.g. 32W) **Section**: __ __ **QRT**: __ __ **QQRT**: __ __

Coordinates Calculated From: (G)PS (M)ap (attach paper copy) **Permanent Marker**: (N)o (Y)es _____

PLOT INFORMATION

Plot Size: __ __ m x __ __ m = __ __ __ m^2
Elevation: __ __ __ __ ft. **Slope**: __ __ (°) or __ __ (%) **Aspect**: __ __ (e.g., NW)
Topographic Context: (C)rest (U)pper (M)iddle (L)ower (T)oe (D)epression (F)lat (?)Uncertain

Soil Profile

	Thickness	Type
Litter:	____ cm	_____ [a]
Humus:	____ cm	_____ [b]

Soil Layers	Depth of Layer: Top	Depth of Layer: Bottom	Texture[c]	Coarse Fragments: Type[d]	Coarse Fragments: Volume[e]
1:	____ cm	(>) ____ cm	_____	_____	_____
2:	____ cm	(>) ____ cm	_____	_____	_____
3:	____ cm	(>) ____ cm	_____	_____	_____
4:	____ cm	(>) ____ cm	_____	_____	_____
5:	____ cm	(>) ____ cm	_____	_____	_____

Depth to Semi-Permeable Layer: __ __ __ cm
Depth to Gley Colors or Redoximorphic Features: __ __ __ cm

Drainage Class:
(E)xcessively
(W)ell
(M)oderately Well
(S)omewhat Poorly
(P)oorly
(V)ery Poorly Drained

Height of Moss Hummocks: __ __ __ cm
Depth of Standing Water: (>) __ __ __ cm
pH of Surface Water: ____ ± ____
Ave. Depth to Bedrock: __ __ __ cm
Exposed Rock: __ __ __ %
Rock Type: _____

[a] leaves, needles, grass, etc. [b] mor, moder, prairie mull, or wormed mull

[c] S = sand, LS = loamy sand, SL = sandy loam, L = loam, SIL = silt loam, SCL = sandy clay loam, CL = clay loam, SICL = silty clay loam, SC = sandy clay, SIC = silty clay, C = clay, RO = rock, PE = peat, MP = mucky peat, MU = muck *If origin of peat or mucky peat is known, add suffix to two-letter code:* -m = moss, -s = sedge

[d] Gr = gravel, Co = cobbles, St = stones, Bo = boulders [e] 0 = <15%, 1 = 15-35%, 2 = 35-60%, 3 = 60-90%, 4 = >90%, ? = unknown

Remarks: _____

TREE DIAMETERS

Species	L/D	DBH (cm)	
			Max: ____
			Min: ____
			Mod:____

Notes:

* Variables with computerized code dictionaries

VEGETATION DATA SHEET

DNR RELEVE # __ __ __ __

Surveyor's Releve Number: __________________ Surveyor's Name: ____

MN County: ____________________________ Township, Range, Section: _____________________________________

Date: _________________ Surveyor's Place Name: ____

ID	C.S	SPECIES NAME	REMARKS
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		

ID	C.S	SPECIES NAME	REMARKS
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		

ID	C.S	SPECIES NAME	REMARKS
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		
	.		

Life Form

B = broadleaf evergreen
D = broadleaf deciduous
E = needleleaf evergreen
G = graminoids
H = forbs
L = lichens & mosses
C = climbers
K = stem succulents
X = epiphytes

Height

8 >35m
7 = 20-35m
6 = 10-20m
5 = 5-10m
4 = 2-5m
3 = 0.5-2m
2 = 0.1- 0.5m
1 = 0-0.1m

Cover

Group	*Species*	
c	**5**	75-100%
i	**4**	50-75%
p	**3**	25-50%
r	**2**	5-25%
b		1-5%
a		<1%

Abundance

1 <5% cover, many individuals
+ <5% cover, few (2-20) individuals
r <5% cover, single

Sociability

5 = extensive mat
4 = small colonies, broken mat
3 = large group, many plants
2 = small dense clumps
1 = growing singly

Reliability Code

0 = variety certain
1 = cf. var./subsp.
2 = species certain
3 = species complex
4 = cf. species
5 = genus certain
6 = cf. genus
7 = unknown

Selected Remark Codes

DD = dead
DY = dying
GE = germinating
SD = seedling
SP = sprout (coppice)
FR = fruiting
OP = outside plot (<2m)
= specimen collection

___ verified
___ EOR
___ database
_____ LocNum

Nongame Animal Incidental Record Form

Species: _____ County: _____

Date: _____ Time(24hr): _____

Observer(s): _____

Waypoint: _____ UTM E: _____ UTM N: _____

GPS Accuracy:_____

Site/managed area name: _____

# of individuals observed: _____ Age: _____ Sex: _____

Measurements: _____

Voucher/type of record (circle one): seen; heard; photo; specimen, other _____

Survey method (circle one): incidental; point count; drift fence; mammal grid; other _____

Habitat (vegetation, topography, soils, water, microhabitat, etc.): _____

_____

_____

Behavior: _____

_____

_____

Comments (include breeding evidence/condition, if known):_____

_____

_____

_____

Weather conditions:

Temp:		°F / °C		
Wind:	none	light breeze	mod. wind/gusts	strong wind/gusts
Cloud:	0-10%	10-50%	50-90%	90-100%
Precip:	none	drizzle/light rain	mod/intermittent	heavy/t-storm

Habitat codes

Wetland type: WP – Woodland pool SS – Shrub swamp
EM – Emergent marsh WM – Wet Meadow FF - Flooded Field
BP – Beaver pond L – Lake RS – River/stream D – Ditch
O – Other (write in wetland type)

Upland type: GRA - Grassland GOF – Old Field GNP- Native Prairie
GPA - Grazed Pasture AG - Ag fields OAS - Oak Savanna
ED - Edge DF - Deciduous Forest

Landscape: Flat Rolling Steep

Instructions for Conducting the Nightjar Survey Network
2010 Season
(see ccb-wm.org for more information)

Thank you for participating in the Nightjar Survey Network. The primary objective of this program is to determine the population distribution and trends of Nightjar species across the United States. There is a general sense that populations of these species are declining. Information on the precise scale and magnitude of population changes are necessary if we are to plot a course for conservation. However, prior to this program, there has been no widespread or long-term monitoring effort to monitor these Nightjar populations. This effort is coordinated by the **Center for Conservation Biology at the College of William and Mary and Virginia Commonwealth University.** But success of this monitoring program can only be achieved with dedicated volunteers willing to conduct Nightjar surveys.

Nightjar Surveys are standardized population counts conducted along roadside census routes at night. Each route is surveyed only one time per year but during a very specific survey window (see specific dates below). Surveys will not take much longer than one hour to complete. The only experience necessary is a familiarity with each Nightjar's characteristic song.

Determining population trends of Nightjars takes a dedicated set of volunteers willing to collect many years of data. Please consider adopting a Nightjar Survey Route only if you are able to conduct the census one time per year but for at least three consecutive years.

Please read all of the instructions carefully. Your commitment to following these instructions will ensure that data is collected in a standardized format so it may be comparable between all routes in the Nightjar Survey Network.

Visit the Nightjar Survey Network website at www.ccb-wm.org for more details

Conducting Surveys

Seasonal and Daily Timing:

1) **Begin each survey at least 30 minutes after sunset and end no later than 15 minutes before sunrise.**
2) **Surveys must only be conducted between May 20-June 4, 2010 or between June 19-July 4, 2010. Routes in southern AZ, NM, TX, and FL also have the opportunity to survey April 21-May 6, 2010 (contact coordinator to see if these dates apply to your route. High elevation sites (e.g., CO) should only be conducted June 9-July4 (contact coord.). These dates are specifically chosen to coincide with the nights of brightest moonlight and greatest Nightjar calling frequency. These are important dates to maintain consistent survey conditions across all regions of the Nightjar Survey Network.**
3) **Surveys must only be conducted when the moon is above the horizon and not obscured by clouds. It is a little known fact that Nightjars call less frequently when the moon is still below the horizon or hidden by dense cloud cover. Check your local times for moonrise at the US Naval Observatory Website (http://aa.usno.navy.mil) or newspaper. In general, the moon rises during daylight on May 20 and sets a little after midnight. Surveys should be conducted before moonset. Please note that the moon rises later each successive date. By June 3 the moon does not rise until after 11:00pm and. Surveys should only be conducted after moon rise. Please consider these times when planning surveys so the best moon conditions can be chosen.**

****SURVEY ROUTE ONLY NEEDS SURVEYED ONE TIME PER YEAR****

Route Logistics:

Each survey route consists of 10 stopping points where you count Nightjars. The starting point of your route will be named stop # 1. All other stops are sequentially numbered and spaced 1 mile apart along the route. You may vary the exact distance up to 2 tenths of a mile between stopping points to find a safe place to park. It is better to add space between points rather than shortening this distance to avoid counting the same birds twice. Not all of your stopping points need to be on the same road. Turning onto different roads may be expected. We recommend scouting your route during daylight to become familiar with the stops.

Completing the Nightjar Survey Data Sheet:

Route Name and Number – All pre-existing routes are named and numbered. See Nightjar Survey Network website at ccb-wm.org for more details. If you are creating your own route, use the county where the route begins as the name, and the last 4 digits of your phone number of the number (e.g., Henrico1649). Add an extra number (-1, -2) if multiple routes in same county.
Observer: Record your name here.
Date: Indicate the date of the survey.
Time Start: Indicate the time at which you begin listening at stop 1.
Time End: Indicate the time at which you stop listening at stop 10.

Survey Conditions at each Stop;

Wind: Do not conduct surveys during strong winds. High winds diminish your ability to hear Nightjars.

Code	Wind Speed	Description
0	Calm (<1 mph)	smoke rises vertically
1	Light (1-7 mph)	smoke drifts, weather vane inactive, leaves rustle, can feel wind on face
2	Moderate (8-18 mph)	leaves, twigs, and thin branches move around, small flags extend, raises loose papers.
3	Strong (19 mph or greater)	small trees begin to sway. **Should not conduct survey.**

Sky Condition: Do not begin a survey if the sky is completely overcast, during heavy fog, or persistent rain. All of these conditions will diminish calling rates of Nightjars and hamper your survey.

Code	Sky	Description
0	Clear	Cloudless sky, can see stars and moon clearly
1	Mostly Clear	Few clouds, less than 25% cloud cover
2	Mostly Cloudy	Many clouds, 25-50% cloud cover
3	Overcast	Dense cloud cover, entire sky covered. **Should not conduct survey.**

Background Noise: Codes indicate the level background noise impairs your ability to hear Nightjars.

Code		Description
0	None	There is no effect of background noise on your ability to hear nightjars
1	Slight	Noise slightly affects your ability to hear nightjars (e.g. distant traffic, 1-2 car passing during a stop's counting period).
2	Medium	Noise moderately affects your ability to hear nightjars (e.g. nearby traffic, 3-6 cars passing during survey period, airplane flying overhead).
3	Excessive	Noise seriously affects your ability to hear nightjars (e.g. continuous traffic nearby, construction noise, frog chorus)

Mile: Enter odometer/tripometer to nearest tenth mile at each stop. Begin with a value of 0 for first stop.

Moon Visible (**Y or N**): Enter Y for YES or N for NO to indicate if the moon can be seen above the horizon while counting nightjars at the stop. This is particularly important to register when in deep valleys because the moon may be obstructed by mountain ridges.

Instructions continue on next page

Counting Nightjars (VERY IMPOTANT TO READ):

At each point, count all Nightjars seen or heard for a period of **SIX MINUTES**. Do not include Nightjars you see or hear anytime before or after the six minute counting period. Counting nightjars and recording data should be done from a stationary position outside of your automobile. Most importantly, be consistent. Use the same technique at each stop including how you focus your listening for nearby birds and distant birds.

The counting period is broken into six 1-minute listening periods on the data sheet. Record the detection history of each individual Nightjar seen or heard from the time of their first detection through their last detection in the appropriate 1-minute block of the Data Sheet. Use a value of 1 for a detection and enter nothing for minute-columns when an individual bird was not detected. This technique will allow us to compare your data to studies that use different time periods. Birds will sometimes move during the counting period. Use your best judgment in determining new detections from those of birds that have moved during the count.

DO NOT use whistles, audio-calls, or any method of that coaxes birds to call or come closer to you. Also, **DO NOT** use a flashlight to search for reflections of Nightjars eyes. These practices will bias your survey and make it difficult to compare your data to other routes. Record birds as you hear them, rather than waiting for the end of the six minute period to avoid data omission errors.

Enter a Stop# in the appropriate column of your data sheet beginning with #1 for your first stop and sequentially numbering others as 2 through 10.

Enter the following abbreviations for each species on the Data Sheet when detected at a stop:

WHIP = Whip-poor-will	BCNI = Buff-collared Nightjar	COPO = Common Poorwill
CHUCK = Chuck-will's-widow	LENI = Lesser Nighthawk	COPA = Common Pauraque
CONI = Common Nighthawk	ANNI = Antillian Nighthawk	NONE = no birds detected

--If none of these species are detected at a stop enter **NONE** on the data sheet on the same line as that stop number

Sample Data Entry for an observer at 4 stops: Each line represents and individual bird's detection history and a value of 1 indicates that an individual bird was heard during that respective minute. Use a new line for each new bird detected at a stop.

Please Read These Instructions

		Time blocks (minutes of survey)					
Stop#	**Species**	**1**	**2**	**3**	**4**	**5**	**6**
1	WHIP	1	1	1			
1	CHUCK			1	1	1	1
2	NONE						
3	WHIP	1	1	1			
3	WHIP		1	1	1	1	1
4	NONE						

In the above example, the observer began counting at Stop#1 and initially detected 1 Whip-poor-will during each of the first three minutes of survey so a numeral 1 was placed in the each respective column. This row should only be used for observations of this one bird. The observer also detected 1 Chuck-wills Widow at Stop#1 during the third minute of survey through the sixth minute so marked the sheet with a 1 accordingly. This observer then moved on to Stop#2 and did not detect any Nightjars so NONE was entered for species. At Stop#3, the observer detected 2 Whip-poor-wills so used a separate line for data on each; 1 Whip-poor-will during each of the first three minutes of the count but did not detect this individual during the last three minutes so the numeral 1 was placed in the 1 through 3 minute columns. The second Whip-poor-will detected at Stop#3 was added on a new line and heard during the 2nd minute of survey through the remaining 6-min time. This observer used the best judgment in deciding these were two individual Whip-poor-wills and not the same bird that moved after initial detection. No additional species were detected at Stop#3. Finally, no birds were detected at Stop#4 so NONE was entered for that line..

- Please remember that surveys should be conducted during the allotted survey times (see page 1). Surveys should not be conducted under overcast or strong wind conditions, or when there is persistent rain. If conditions deteriorate after a route is started for more than 3 stopping points, we advise you to abort the survey and attempt it on another night with better conditions. **If you have questions contact Mike Wilson, e-mail: mdwils@wm.edu (preferred method), phone 757-221-1649. Include Nightjar Survey in subject of email.**

Nightjar Survey Network Data Sheet

Visit survey website at www.ccb-wm.org/nightjars.htm

State:											**Observer Name:**		
County:							**Street Address:**						
Route Name& Number:											**City:**		
Date:											**State and Zip Code:**		
Start time:				**End time:**							**Observer email:**		
Survey conditions at each stop: (fill below)											**Wind Codes**	**Sky Codes**	**Noise Codes**
Stop#:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	0 = none	0 = clear	0 = none
Wind											1 = slight	1 = mostly clear	1 = slight
Sky											2 = moderate	2 = mostly cloudy	2 = medium
Noise											3 = strong	3 = overcast	3 = excessive
Mile	**0.0**												
Moon Visible (Y or N)													

Begin filling down these columns

		Time Blocks (minutes of survey)					
Stop#	**Species**	**1**	**2**	**3**	**4**	**5**	**6**

Use these columns after others are full

		Time Blocks (minutes of survey)					
Stop#	**Species**	**1**	**2**	**3**	**4**	**5**	**6**

Mail this form to: Nightjar Survey Network, Center for Conservation Biology, College of William and Mary Williamsburg, VA 23187-8795
or email digitally completed version to: mdwils@wm.edu. Include *Nightjar Survey* on subject line of email.

U.S. Nightjar Survey Data Page 2 (if necessary)

Begin filling down these columns

		Time Blocks (minutes of survey)					
Stop#	Species	1	2	3	4	5	6

Use these columns after others are full

		Time Blocks (minutes of survey)					
Stop#	Species	1	2	3	4	5	6

Nightjar Stops Description Data

(only needed if not submitted in previous year)

Use this form if you are not able to provide a digital map of your stopping points. See Nightjar Survey Network Website at www.ccb-wm.org for more details on how to provide digital or hardcopy map data.

Observer Name	
State	
County	
Route Name and Number	
Year of Survey	

Stop#	**Latitude** e.g., dec degrees 38.43567 or deg, min, sec 38º 56´ 07´´	**Longitude** e.g., dec degrees 71.45465 or deg, min, sec 71º 25´39´´	or Location Description	# Houses Visible	Dominant 3 habitats (use codes below)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Habitat Codes:

PF = Pine/Conifer/Mixed Forest
HF = Hardwood Forest
P = Prairie
D = Developed (urban, residential area)
O = Open (fields, lawn, clear-cut)
SHR = Shrub
W = Water
M = Marsh/Wetland
AG = Agriculture

please feel free to add others if needed

Mail this form to: Nightjar Survey Network, Center for Conservation Biology, College of William and Mary Williamsburg, VA 23187-8795

or email digitally completed version to: mdwils@wm.edu. Include *Nightjar Survey* on subject line of email.

Information may have been removed from this document to protect sensitive species

Red-headed Woodpecker Recovery Project

2009 Final Report

Red-headed Woodpecker Recovery is a project
of the Audubon Chapter of Minneapolis
in cooperation with the University of Minnesota's
Cedar Creek Ecosystem Science Reserve
and the Minnesota DNR, Division of Ecological
Services, Nongame Wildlife Program

2009 Report of Red-headed Woodpecker Recovery Project

This is the second of our annual reports on the status of red-headed woodpecker (RHWO) recovery efforts in the state of Minnesota. Initiated in April of 2007 by the Audubon Chapter of Minneapolis, *Red-headed Woodpecker Recovery's* goal is to reverse the decline and promote the recovery of RHWO populations through preservation and restoration of habitat, continuing research, and public education. Red-headed woodpeckers are habitat specialists that prefer a savannah-type landscape, characterized by a large open understory, frequent burns, and small clusters of mature and dead *mast* trees. The open understory facilitates the bird's habit of swooping down from a high perch to capture grasshoppers, beetles, and other insects during spring and summer months. Small, scattered groups of mature oak trees that produce acorns (in other regions beech nuts) provide necessary food in fall and winter months for the few birds that overwinter in Minnesota. A final significant ingredient of good RHWO habitat is the presence of large dead trees, or 'snags,' with limbs large enough to accommodate cavities for nesting, roosting, and food-caching activities.

Most of our first three years have been spent getting to know the species through observation and research at the University of Minnesota's Cedar Creek Ecosystem Science Reserve (CCESR), in East Bethel, Minnesota. Cedar Creek is a jewel-like example of the type of oak savannah that RHWO historically occupied in Minnesota. We presently estimate a concentration of 50 birds in a small portion of CCESR's 5400 acres, an area that includes scattered groups of live and dead oak trees and an open understory maintained by frequent controlled burns--all keys to good RHWO habitat.

We are applying the knowledge gained in this research to educate the public to preserve and enhance existing habitat that supports clusters of RHWO in Minnesota. While there are a number of sightings and nesting reports each year, the majority of these are of *single* pairs, often found in widely separated rural telephone poles and scattered small farmsteads. The project's current focus is to locate *groups* or 'clusters' of RHWO, as a group of birds indicates a larger block of habitat that warrants preservation and potential expansion. (Note: A cluster is defined as three or more nesting pairs in a ¼-mile radius area.)

What we have learned

The precipitous drop in RHWO numbers historically has a number of causes, but housing and industrial development, intensive agriculture, and the destruction of oak savannah--one of Minnesota's rarest ecosystems--are primary causes. In addition, pruning and removal of dead trees by home owners and

public land managers have significantly reduced the species' preferred nesting habitat. This year's two main goals are (1) to continue to gather data on RHWO nesting habitat, and (2) to begin locating additional clusters throughout the state. We have no hope of finding the equivalent of CCESR's large population, but remain optimistic about locating smaller populations so that we can work with landowners to alert them to the problem of RHWO decline and provide suggestions, Best Management Practices (BMPs), to protect and even expand existing habitat. By the end of 2009 we had verified 5 additional clusters of breeding birds. Interestingly, many were located in an area of central Minnesota west and south of Lake Mille Lacs. Two clusters are located on golf courses. The new clusters range in size from 4 to 8 nesting pairs, and landowners and golf superintendents have been very cooperative in exploring means of protecting and expanding their RHWO habitat.

A summary of two years' data collection is found on the following page. Below are a few highlights. CCESR encompasses 5400 acres, of which at least 2000 are oak savanna. A surprisingly large concentration of active nests exist in a rather delimited area. In both 2008 and 2009, 95% of all active nest trees were found in the same small 200-acre section of CCESR. What distinguishes this section of CCESR's savanna habitat is that it has been regularly and frequently burned since the 1970s. The accompanying two maps illustrate the layout of CCESR and the location of nest trees in 2009. Other findings:

Nest fidelity In 2008 and 2009 the same cavity in the same tree was used 7 times. And 5 new nest trees in 2009 were found in close proximity to abandoned 2008 nest trees. We have not yet color-banded any birds, so we do not know if the same pairs are using the same nests, but our guess is that they are.

Condition of nest trees We made three distinctions for data collection purposes: *snag, dead intact,* and *living*. A *snag* is defined as a dead tree devoid of all minor limbs and the majority of major limbs. A *dead intact* tree is a recently dead tree with much of its crown and smaller limbs still present. Because most all trees have some dead limbs, we defined a *living* tree as being at least 60% alive. In both 2008 and 2009, all the nest trees that could be identified (some were mere limbless snags) were either northern pin oak, bur oak, or northern pin/red oak hybrid.

Nature of cavity Most distinctive is the incredibly clean-cut nature of the cavity. Arthur Cleveland Bent (1923) quotes Major Bendire as saying the cavity openings were "... smooth as if finished with a rasp." One sure way to identify the active cavity in a tree replete with cavities is to look for the cleanest-drilled opening.

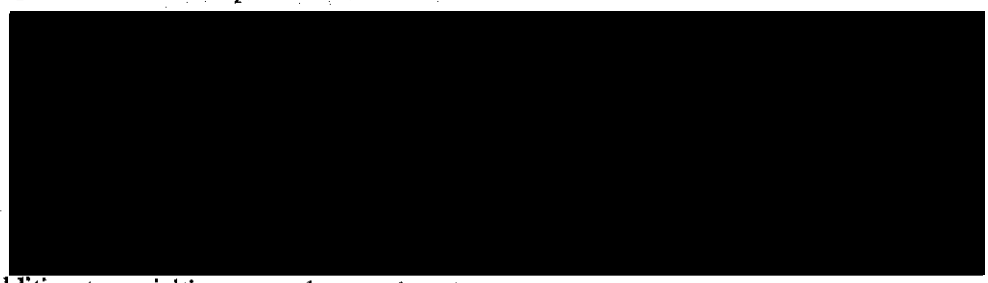
Cavity location In both 2008 and 2009 one-half the cavities were found in main trunks and the other half in primary limbs. In 2008 9 of 18 cavities were found in dead trees, while in 2009, 13 of 20 cavities were found in dead trees. When cavities were located in living trees, most often the cavity was found near the end of a dead, broken-off limb. Our data reflects previous research that has shown RHWO to generally be "high nesters." Both years the average cavity

height was a little over 27 feet. There is some thought that the height of the cavity explains in part why RHWO have a relatively high rate of productivity. Regarding the compass direction of the cavity opening, our data did not confirm any consistent direction, but the cavity did, most often, face the birds' primary feeding area.

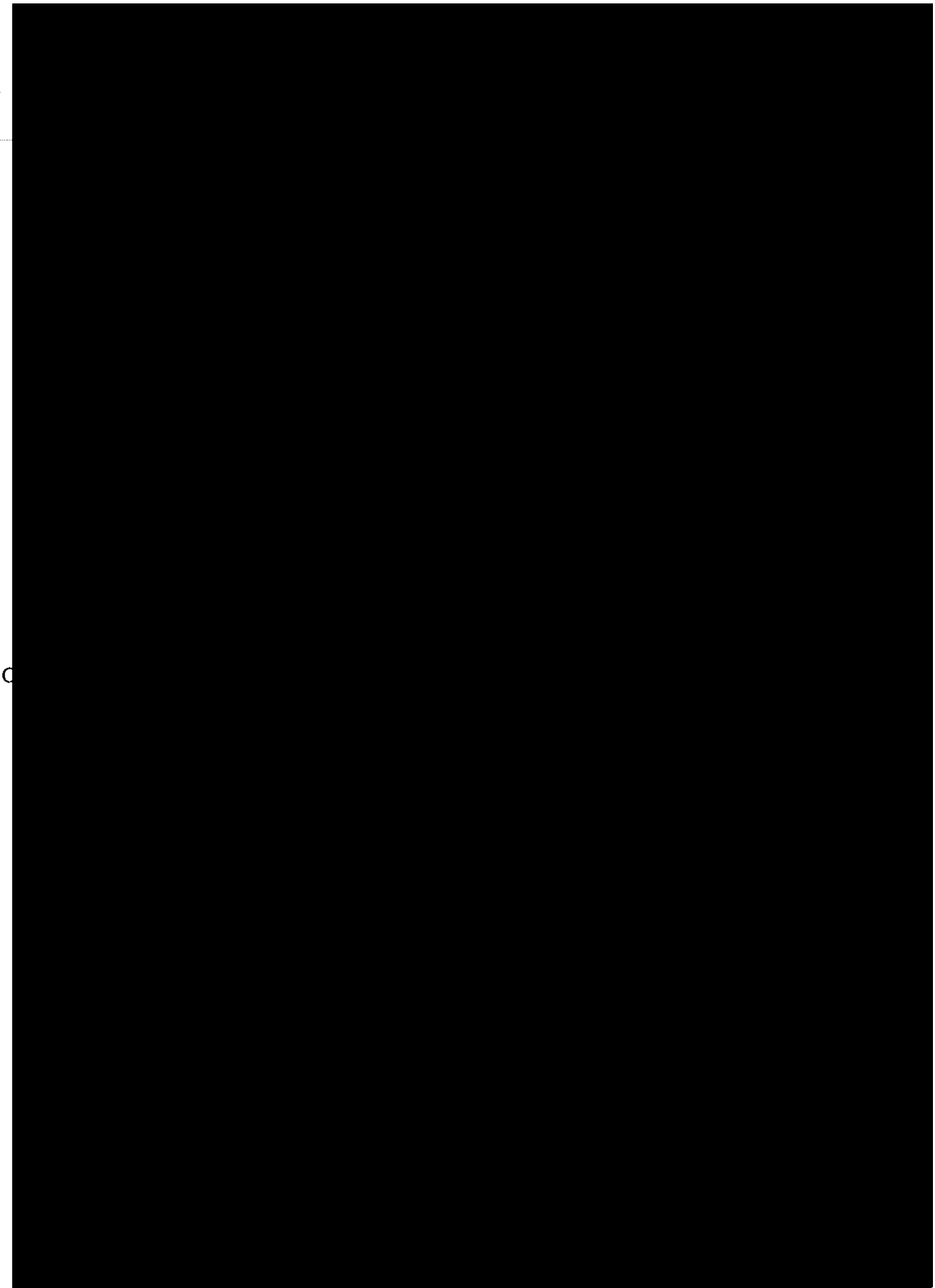
Diameter of limb at cavity height RHWO seem to have a preference for nesting in small-diameter main trunks and/or limbs. While most bird guides suggest the average size of a clutch is 4-6 eggs, the average diameter of the limb or trunk at cavity height in our study was a little over 10 inches, with some as narrow as 7 inches. This hardly seems large enough to hold a group of 4-6 nestlings. Other researchers have commented that limb/trunk diameter was "often barely large enough to accommodate a cavity." (Sedgwich & Knopf, p. 115). Next year, with the help of an intern, we will collect data on numbers of fledglings. The past two years we have typically seen adults feeding only one or two young in the vicinity of their nest.

Territoriality Most literature indicates that these birds are fiercely territorial, but also somewhat colonial in nature, like their closely related *Melanerpes* cousins, the acorn and Lewis woodpeckers. Our data indicates that for the past two years the birds have nested in a rather concentrated area of CCESR. The nesting area is classic oak savannah and is regularly burned. Nearby, however, is almost identical habitat supporting no nesting pairs. The Minnesota's Department of Natural Resource's Helen Allison Scientific and Natural Area of 80 acres is directly across the road from Cedar Creek. It has been surveyed for two years and not produced one RHWO nest. In 2008 all 18 nests were located in an area of about 200 acres. This year in 2009, 20 of 21 nests were found in the same 200-acre area. The exception is one nest which is located one-half mile from the main cluster in a more heavily wooded area.

RHWO Clusters across Minnesota - In 2010 we will continue our surveys at Cedar Creek, but will focus more energy on locating viable clusters of RHWO throughout the state. In 2009, 21 areas were surveyed in 12 counties from the southeast through central Minnesota. RHWO were found at 14 sites, but only 5 sites supported three or more nesting pairs. Of these 5 clusters, 2 are on golf courses, one is in a state park, and 2 are on private land.



In addition to revisiting several areas that showed potential last year, we will survey 15 new locations recently reported as potential cluster sites. The work we have done thus far suggests that public parks, nature centers, and golf courses are being used as RHWO nest sites. This comes as no surprise given the near non-existence of oak savanna in Minnesota. From a bird's-eye view, golf courses and parks look a lot like savanna, especially those with oak trees present. In our education work with park and golf course



Comparison of two-years data on nest trees at Cedar Creek Ecosystem Science Reserve

	2008	2009
Nest trees found*	18	20
Tree species	9 oak 9 ???	10 oak 10 ???
Tree status	9 dead 9 living	13 dead 7 living
Avg. tree height	14.87 m (r. 5.0 - 21.75 m.)	14.15 m (r. 5.7 - 19.14 m.)
Avg. diameter at breast height	41.56 cm (r. 20.0 - 84.3 m.)	41.05 cm (r.18.0 - 69.8 cm.)
Cavity height	8.2 m (r. 3.4 - 15 m.)	8.83 m (r. 4.6 - 15.0 m.)
Cavity location	9 main trunk 9 limb or main limb	10 main trunk 10 limb or main limb (9 of 9 in broken off limb)
Nearest tree	4.69 m	5.45 m

Additional Tree Status Information - In 2009 we made a distinction between trees we defined as Dead Snags (DS) basically a standing main trunk devoid of secondary and major limbs and trees defined as Dead Intact (DI), i.e., main trunk, major and minor limbs intact.

2009 totals (n = 20)

Dead snags	7
Dead Intact	6
Living < 50%	7

Compass orientation of cavity - 2009 (n = 20)

N	2
S	4
E	3
W	5
SE	3
NW	1
NE	2

Only consistent pattern was that cavity almost always faced toward main foraging area

* NOTE: In 2009 a total of 21 nest trees were verified, but we lost track of tree 105-?? due to lack of GPS reading.

C. Meyers 9-9-09

SUMMARY OF NEST TREE DATA SPRING 2009 (most recent 9/9/09)

Burn Area/nest 2009		GPS Reading	Tree Species	Tree Status	Tree Hght (m)	DBH (cm)	Top	Cavity Hgt. (m)	Cavity Location	DCH (cm)	Cavity Orientation	If Limb live/dead	Nearest Tree (m)	Nature of Understory
401	A-2	0487222 5026595	???	DS	11.6	24.8	BT	9.4	ML	16.0	W	Dead/BO	7.8	Sav. borders sedge meadow
401	B-2	0487124 5026586	???	DS	7.05	25.8	BT	5.6	MT	24.0	E	n.a.	4.4	Sav. borders open field
401	C-2	0487052 5026588	Oak	D	16.25	34.5	TI	8.5	MT	34.0	E	n.a	6.4	Sav. borders open field
401	D	0486937 5026578	Oak	L95%	15.75	27.0	MT	10.7	MT	18.0	W	n.a.	2.0	Sav. borders open field
103	E	0486853 5026346	Oak	D	11.4	21.0	TI	5.1	MT	20.0	N	n.a.	4.3	Sav. borders open field
103	W	0486558 5026306	???	DS	10.8	18.0	BT	8.8	MT	15.0	NW	n.a.	4.0	Native prairie, open slash
103	U	0486839 5026601	???	DS	11.28	35.2	BT	8.4	MT	20.0	S	n.a.	2.8	Sav. edge of sedge meadow
103	Q	0486708 5026247	Oak	L90%	14.07	26.3	TI	8.4	MT	18.0	SE	n.a.	1.0	Prairie, shrubby oaks, slash
201	T	0487237 5027015	Oak	L90%	16.8	60.0	TI	9.9	MT	30.0	S	n.a.	3.1	Sav. open, grassy,
201	0	0487054 5027053	Oak	L90%	18.6	69.8	TI	8.7	ML	30.0	NE	Dead/BO	8.0	Native prairie, shrubby oaks
104	K	0486889 5025802	Oak	L90%	16.8	52.5	TI	8.0	ML	30.0	NE	Dead/BO	6.1	Savanna
104	L	0486989 5025856	Oak	D	18.26	64.9	TI	9.7	L	35.0	S	Dead/BO	5.8	Savanna
409	S	0486308 5025809	???	DS	15.45	50.5	BT	15.0	ML	25.0	W	Dead/BO	3.2	Savanna
409	P-2	0486357 5025769	Oak	L 60%	15.36	61.8	TI	8.4	L	28.0	SE	Dead/BO	4.8	Savanna
409	N	0486476 5026093	Oak	L	19.14	35.3	TI	10.12	ML	28.0	E	Dead/BO	4.5	Savanna/woods
105	J	0486673 5026124	???	D	17.4	46.7	TI	10.2	ML	30.0	SSE	Dead/BO	22.8	Savanna

SUMMARY OF NEST TREE DATA SPRING 2009

105	??	0486506 5026010	?	?	?	?	?	?	?		?	?	?	Tree line between prairies
				Verified nesting (Meyer/Merriam)) but could not find exact tree										
101	LNC	0486986 5026946	???	DS	5.7	23.9	BT	4.6	MT	20.0	N	n.a.	5.3	Nat. prairie, slash. shrubs
102	G-2	0487177 5026271	???	DS	8.1	52.9	BT	6.3	ML	25.0	W	Dead/BOL	6.0	Sav. bordering sedge meadow
204	Z	0487155 5026076	???	D	16.59	42.0	TI	9.5	MT	30.0	W	n.a.	4.2	Sav., shrubby oaks
117 [redacted]	AJ	0484657 5026120	???	D	16.59	48.0	TI	11.3	ML	32.0	SE	Dead/BOL	2.5	Open woodland

KEY

Tree species Oak (probably Northern Pin Oak) ??? could not tell species, but probably Pin Oak

Tree status L living w/ % dead D Totally dead, but form intact DS Dead snag Basically no limbs, just trunk

Tree top condition TI top intact BT top broken off

Cavity location MT main trunk ML main limb L limb

Limb condition L living Dead dead BOL Broken-off limb

Cavity height measured in meters

DBH Diameter at breast height measured in centimeters

DCH Diameter at cavity height (note all these estimated) measured in centimeters

Distance nearest tree measured in meters

C. Meyers 9/9/09

superintendents, we have found most to be very cooperative in considering our concerns. We do need to follow up on a number of additional places where multiple sightings have been reported. Where the species has been documented breeding on private land, landowners have been very interested in BMPs. Many who now have only 1 or 2 pairs are actively managing their property to provide additional dead and dying trees to encourage population expansion.

Experiments with nest boxes for RHWO - For two years Jack Hauser has designed boxes and headed up our experiment to attract RHWO to nest boxes at CCESR. Presently the 11 nest boxes situated at Cedar Creek have been very successful in producing broods of eastern bluebirds and tree swallows. Sadly, we have had no success with nesting RHWO. There are simply too many potential nest trees and snags on the Cedar Creek property. This year we hope to place nest boxes on two golf courses that support verified clusters, but where few dead trees or snags remain.

Public Awareness - We have had a number of opportunities to inform the public of our work.

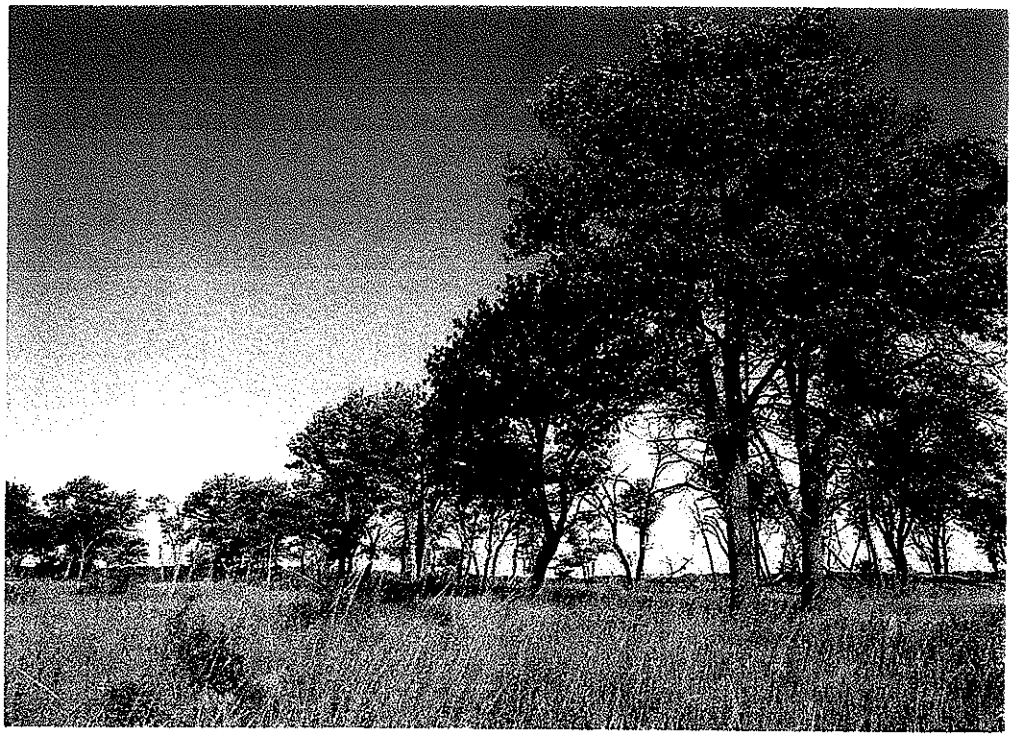
Major presentation at Minnesota Ornithologist Union Annual Paper Session

Public television special on *Venture North*

Cedar Creek Citizen Science Day presentation

Presence at Northern Green Expo, MN Audubon Annual meeting, and Wild Ones

Featured articles in *Minnesota Conservation Volunteer* and conservation column *Minnesota Birding* Quarterly newsletter, *The Redhead,* Jerry Bahls, Editor



Typical oak savanna habitat

Acknowledgments

We would especially like to thank the twenty-five individuals who serve on our committees and help with surveys. Also our gratitude to the Minnesota DNR, Division of Ecological Resources, Nongame Wildlife Program:

Liz Harper
Tim Koppleman
Hannah Texler
Carrol Henderson

Bravos and kudos for the hospitality and cooperation of the entire staff of Cedar Creek Ecosystem Science Reserve of the University of Minnesota, with special thanks to Jeff Corney, Mary Spivey, and LuAnn Marotte.

Thanks are due to Jim Williams, Stan Tekiela, and Chet Meyers for copyrighted photographs

Resources cited

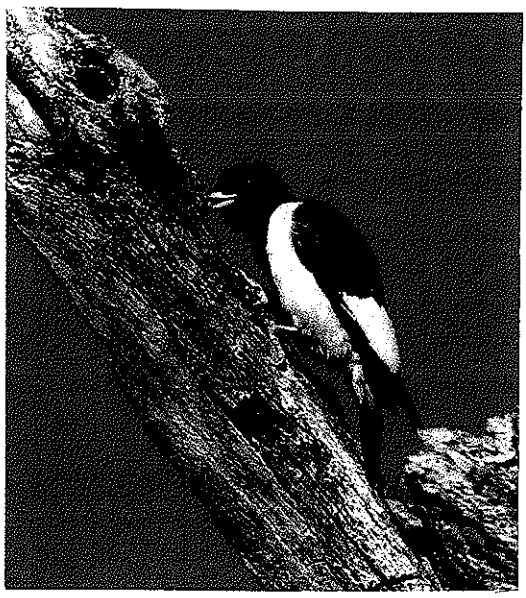
Arthur Cleveland Bent, *Life History Studies of North American Woodpeckers,* Indiana University Press, 1992. Originally published in 1923.

Sedgwick and Knopf, "Habitat relationships and nest site characteristics of cavity-nesting birds in cottonwood floodplains," *Journal of Wildlife Management,* 54, pp. 112-124, 1990.

Various sources noting height of RHWO cavities; for example see:
King, Brashear, Reiman, "Red-headed woodpecker nest-habitat thresholds in restored savannas," *Journal of Wildlife Management, 71,* pp. 30-35, 2005.

* * * * * * *

Report prepared by Chet Meyers, chair of *Red-headed Woodpecker Recovery 1-29-10*
Web site <www.redheadrecovery.org>



Caching acorns for a long Minnesota winter

LOGGERHEAD SHRIKE

Field Identification:
Robin-size, slate-gray with black wings and tail (which show white in flight) and distinctive black mask. Commonly perches on telephone wires or fence posts.

Sightings:
Please report consistent sightings and/or evidence of breeding or nesting attempts, such as male territorial behavior (singing), eggshell fragments near sightings of adults, nest with eggs or young, etc. Include precise location (to 1/4 1/4 section or distance and direction from nearest town or other conspicuous landmark): dates of sightings; description of habitat; observer's name and address; and a written description(s) including as many other details as possible.

HAVE YOU SEEN THIS BIRD?

Report sightings to:

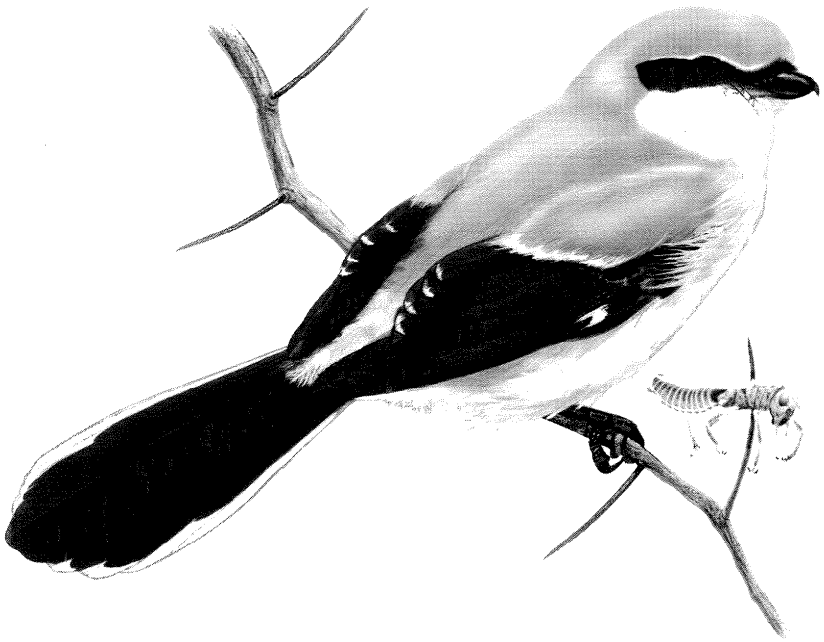
Nongame Wildlife Program
Box 7, 500 Lafayette Road
St. Paul, Minnesota 55155

Phone: 612-297-4966; or
800-766-6000 Minn. toll free

Landowners Guide for Maintaining and Encouraging

Loggerhead Shrikes

Loggerhead shrikes are in trouble – ***but you may be able to help***. Throughout the United States, and particularly in the Midwest, loggerhead shrikes are disappearing at an alarming rate. So serious is the decline that the loggerhead shrike is one of six bird species considered threatened in Minnesota.

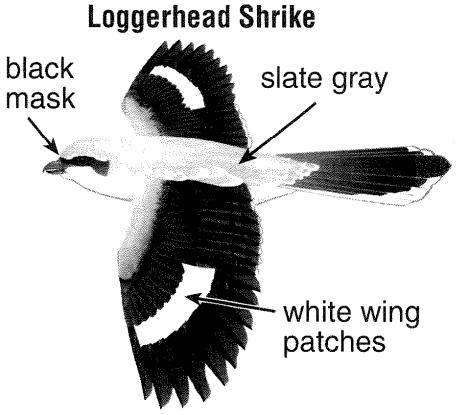


What is a loggerhead shrike?

Loggerhead shrikes are special birds – an interesting cross between songbird and hawk. They feed on large insects such as grasshoppers and beetles, mice, small birds, frogs and toads. Shrikes spend much of their time perched on powerlines, fences or the top-most branches of trees and shrubs, scouting for prey and then swooping down to catch it. Then the bird either eats its prey, impales it on a nearby thorn or barbed wire fence or wedges it into the fork of a branch. Because shrikes lack the strong, sharp claws and feet of hawks, impaling food holds it in place as the bird tears at it with its bill. Your first clue that loggerhead shrikes are on your property may be finding an animal impaled on a fence barb or a thorn. This habit has earned the loggerhead shrike the nickname "butcher bird."

What do loggerhead shrikes look like?

The robin-sized loggerhead shrike has a slate-gray back with a light breast. The most distinguishing markings of this bird are the black mask, which extends across the eye, and the black and white wing and tail patches which flash when the bird flies. Males and females are similar in size and color.



In Minnesota, loggerhead shrikes are most easily confused with eastern kingbirds and northern shrikes. However, eastern kingbirds have no mask, their heads are entirely dark, and they do not have white patches on their wings. The northern shrike looks very similar to the loggerhead shrike, but occurs in Minnesota from October through April, whereas the loggerhead shrike is here from March to October. During the early spring and fall, when both shrikes are in the state, they can be told apart by the loggerhead shrike's completely black bill and its mask which extends across the top of the bill.

Where do they live?

Loggerhead shrikes were once found throughout much of the unforested region of the state. Today, their numbers are very low. Recent surveys have located fewer than 30 nests in the state (Fig. 1). It is very important that we try to maintain habitat for the few shrikes that still breed in Minnesota.

Shrikes use grassy, open areas with scattered trees and shrubs such as pastures, prairie patches and grassy roadsides. A few trees and shrubs, along with fences and powerlines provide nesting sites and perches from

continued on back

which to hunt. Red cedar, hawthorn and plum trees are often used for nesting. A pair may range over 2.5 - 3.0 acres.

Loggerhead shrikes are early nesters, arriving in Minnesota from their wintering areas in the southern U.S. and Mexico in early spring. Shrikes lay 4-6 eggs that hatch after about 16 days. The young birds remain with their parents for about 4 weeks after leaving the nest. It is at this time that the birds are most conspicuous. Shrikes tend to nest in the same general areas from year to year, although they may be absent for a year or two and then return again, as long as the habitat remains.

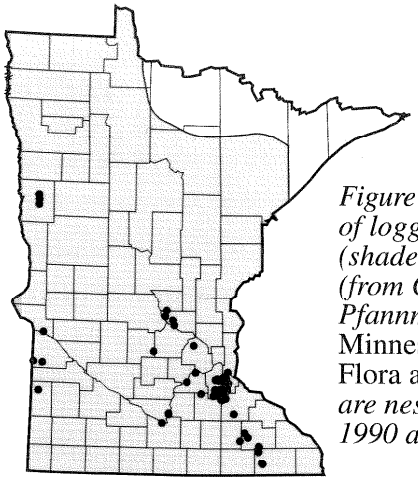


Figure 1. Historical range of loggerhead shrikes (shaded) in Minnesota. (from Coffin and Pfannmuller. 1988. Minnesota's Endangered Flora and Fauna). *Dots are nests found between 1990 and 1996.*

Why is the loggerhead shrike population declining?

The decline of the loggerhead shrike is likely the result a combination of factors, including loss of habitat resulting from the conversion of pasture and grasslands to houses or cropland and the encroachment of forest and brush on pastures and grasslands. In addition, changes in farming practices have resulted in larger fields and fewer trees, shrubs and fences scattered about. The increasing use of pesticides may also play a role in the decline of shrikes because these chemicals affect many animals that shrikes eat.

WHAT CAN YOU DO TO HELP LOGGERHEAD SHRIKES?

If there are shrikes nesting on your property, congratulations! You are one of a very few Minnesotans fortunate to share your property with such a unique bird. We hope you will want to help this bird continue its presence in your neighborhood. Obviously your land management practices and land use are already compatible if the birds have selected your land for nesting. While biologists continue to investigate the decline of the shrike there are things you can do on your property to encourage shrikes.

1. Leave fences standing for shrikes to use for perching and impaling food. If a fence must be removed, or if there are no fences near your grassland or pasture, you can create perch and impaling posts. To do this, wrap barbed wire near the top of a post. Place these posts along the edges of pastures and fields for shrikes to use. Your local nongame wildlife biologist can help you select the best locations for the posts.

2. Keep brush from encroaching upon grasslands by removal or burning, but only to the extent that the shrubs and trees don't dominate the grassland. A few scattered shrubs and trees are necessary to maintain the best shrike habitat.

3. Maintain existing pastures and grasslands. Pastures and grasslands are more attractive to shrikes than are row crops. Investigate the Conservation Reserve Program (CRP) which pays farmers to retire highly erodible farmlands from production and to establish permanent grassland. Contact your local Natural Resources Conservation Service office (formerly the Soil Conservation Service) for more information about this program.

4. Take advantage of financial incentives for maintaining compatible land uses. In many counties, the Agricultural Preserve Program and/or the Green Acres Program provide tax adjustments and/or deferments to farmers to help them maintain their land for agricultural use. Contact your county assessor's office for more information about these programs.

5. Minimize use of pesticides. Pesticides can reduce the supply of large insects and other animals that shrikes need. Also, because shrikes feed on animals at which pesticides are directed, these chemicals can build up in the birds and impair their ability to reproduce and reduce the survival of their young.

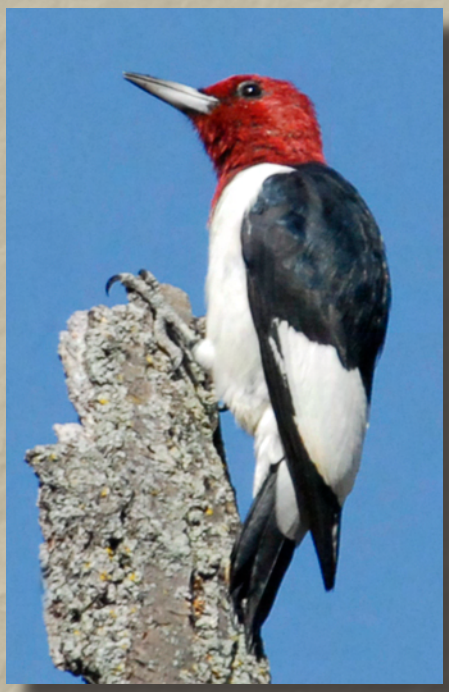
For more information about shrikes or to report loggerhead shrikes on your property please contact:

Liz Harper - Central Region Nongame Wildlife Specialist
Nongame Wildlife Program, Division of Ecological Resources, MNDNR
1200 Warner Road, Box 28
St. Paul, MN 55106
651-259-5764
Elizabeth.Harper@dnr.state.mn.us

WANTED

More Red-headed Woodpeckers

- **Rapidly disappearing from their former range**
- **Nest in dead trees and dead limbs**
- **Prefer open parkland and golf courses**



Please report sightings of four or more Red-headed woodpeckers to:

marygracm@aol.com

Please do not report individual sightings.

NOT this one!

Red-bellied Woodpecker

Red cap and back of head

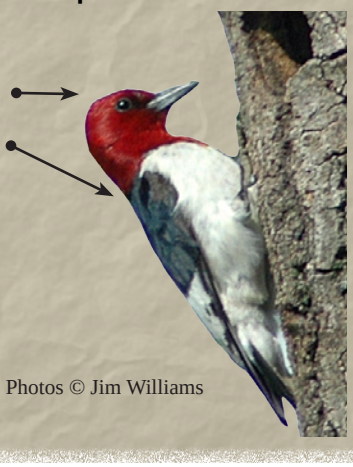
White and black striped back

This one!

Red-headed Woodpecker

Solid red head and neck

Black back



Visit **redheadrecovery.org** to learn more about the Red-headed Woodpecker Recovery Project.

REPORT SNAKE SIGHTINGS:

Several of Minnesota's 17 species of snakes have declined due to loss of habitat. The following species are rarely observed, so if you see one or recall seeing one in the past, please report your sightings to the Minnesota DNR (See contact info below).

Western Hognose Snake

Eastern Hognose Snake

Hognose Snake Defenses: If threatened, both species of hognose snakes may resort to an unusual display. They may flatten their necks exposing dark markings and appearing larger. They may hiss loudly. In addition, they often perform a death-feigning act, rolling over on their back with their mouth open. They may remain like this until the disturbance has passed.

Gophersnake (Bullsnake)

Western Foxsnake

If you observe any of these snakes in Minnesota:

- Contact: Liz Harper, Central Region Nongame Wildlife Specialist
Nongame Wildlife Program, Division of Ecological Resources, MNDNR
1200 Warner Road, Box 28, St. Paul, MN 55106. Ph. 651-259-5764, or email Liz.Harper@dnr.state.mn.us

- Take photographs if possible of back, belly and head.
- Include identifying features of the snake in your report, either make sure you describe them, or your pictures show them (see back of page for descriptions of identifying features).
- Report date, location, time of day, and estimated length of snake.
- Please use caution, these snakes are NOT venomous, but may bite and cause skin irritation.

-SEE OTHER SIDE FOR MORE INFORMATION ON THESE SPECIES-

WESTERN HOGNOSE SNAKE

(*Heterodon nasicus*)

State Status: Species of Special Concern

Belly scales and underside of the tail of adult and juvenile western hognose are generally black with scattered, light flecks. The large scales between the eyes and on the nose are separated by a cluster of very small scales, which help distinguish it from the eastern hognose. Adults rarely exceed 2 feet in length.

Adults

Head:

Large scales on face separated by a cluster of small scales

Sharply up-turned nose

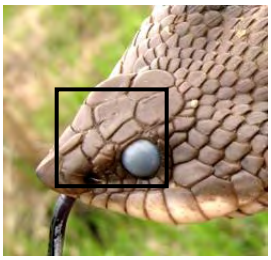
EASTERN HOGNOSE SNAKE

(*Heterodon platirhinos*)

State Status: Not listed, but tracked

Belly scales of adult eastern hognose snakes are often creamy, light yellow. Belly scales of juveniles are black, but lighter under the tail. The large scales of the head and face are touching, unlike the western hognose. Adults may reach 3 feet in length.

Adults



Head:

Large scales on face touching

Slightly up-turned nose

Adults

GOPHERSNAKE (Bullsnake)

(*Pituophis catenifer*)

State Status: Species of Special Concern

Adult and juvenile Gophersnakes are tan or cream-colored with dark markings. Adults can reach over 5 feet in length. If threatened a Gophersnake will hiss and may vibrate its tail or strike with a closed mouth. Dark markings on the top of the head and on the face help distinguish it from the western foxsnake. An adult w. foxsnake has a copper-colored head.

WESTERN FOXSNAKE

(*Elaphe vulpina*)

State Status: Not listed, but tracked

Adult western foxsnakes have a narrow copper-colored head (which distinguishes it from the Gophersnake), and a tan body with dark blotches. Juveniles have dark markings on the head. Western Foxsnakes can reach 5 feet in length. If threatened, they may vibrate their tail.

Juvenile: pre-shed

Adult head

Microhabitat Components of Key Habitat Types in the Anoka Sand Plain that Influence Habitat Selection among Species in Greatest Conservation Need

Grant Proposal

MN T-24-R-1 REVISED

March 31, 2010 (or date of approval, whichever is earliest)

– December 31, 2011

Submitted by the State of Minnesota
Department of Natural Resources
Division of Ecological Resources

Prepared by: Liz Harper, Regional Nongame Specialist and Erica Hoaglund, Natural Resource Specialist

Need:
The upland habitats (including oak savanna, prairie, grassland, and dune) in the Anoka Sand Plain subsection are being developed at an alarming rate. The main portion of this subsection stretches across the northern portion of the Twin Cities metropolitan area, west to the St. Cloud area, and north to the North Branch area. Human population growth in the Anoka Sand Plain is the second fastest of any subsection in the state, and more than 90% of the land is in private ownership (MNDNR 2006 pg. 70). Loss and degradation of habitat are the most significant challenges facing Species in Greatest Conservation Need (SGCN) populations in this subsection (MNDNR 2006 pg. 71). Oak savanna, prairie, grasslands and dunes are designated as a key habitat in the State Wildlife Action Plan (SWAP) (MNDNR 2006 pg. 73) for the Anoka Sand Plain Subsection, and the oak savannas and dunes remaining in this subsection are some of the highest quality examples of these habitat types remaining in the state. Most of the remaining savannas occur on public lands.

Surveys of rare animals in this subsection were completed by the Minnesota County Biological Survey (MCBS) in 1990. Due to the high number of counties surveyed during that field season, many portions of this subsection were not surveyed. Additionally, these surveys did not include invertebrate species. Thus, the MCBS data are 19 years old, incomplete, and do not include information on invertebrate SGCN as defined by the State Wildlife Action Plan.

To address this issue, as well as others, a State Wildlife Grant project T-13-R-1, entitled “Rare Wildlife and Habitat Surveys in Oak Savannas of the Anoka Sand Plain Subsection” (hereafter ASP1) was undertaken in 2008 and 2009 (Harper and Hoaglund 2009). While ASP1 was highly successful in identifying the persistence of many SGCN on this landscape, it also brought to light gaps in understanding of SGCN and their habitats that clearly need to be filled by a more detailed study.

An example of this gap in knowledge is the lack of information on the western hognose snake (*Heterodon nasicus*). Little is understood about the habits and requirements of this SGCN throughout much of its range, and thus no informed management decisions can be made in Minnesota with this species in mind (Edgren 1955, Wright and Didiuk 1998, Eckerman unpublished). Several other SGCN were also identified in ASP1 as requiring more study (Table 1).

Trends anecdotally observed during ASP1 appear to be wholly unstudied in the Anoka Sand Plain and may greatly influence the management strategies used on this landscape. For example, during ASP1 it was anecdotally observed that certain patches of habitat on the landscape contain large concentrations of rare biota of diverse taxon. The question of why such large numbers of rare species congregate in discrete patches of habitat, leaving other, nearby patches, more sparsely inhabited or uninhabited was raised, and no previous studies were found that address this issue. Several habitat characteristics were observed across these “hot spots” such as abundant loose soil, but these have not been studied sufficiently to draw conclusions about what makes a certain location a “hot spot.”

The major goal of this proposed project is to better understand the requirements and habitat preferences demonstrated by the SGCN that occur in this rapidly vanishing landscape. This project will thus address Goal II of SWAP (improve knowledge about SGCN) (MNDNR 2006 pgs.74-75) by implementing Strategy IIA, surveying SGCN populations and habitats. This will be done by implementing the priority conservation actions of 1) surveying SGCN populations related to the key habitats, 2) surveying wildlife taxa underrepresented by MCBS animal surveys (invertebrate and reptile species), and 3) collecting habitat information needed to support the effective conservation of the rapidly changing Anoka Sand Plain habitat (MNDNR 2006 pg. 75).

This project will consist of SGCN surveys and detailed habitat surveys within Sherburne National Wildlife Refuge and Sand Dunes State Forest in Sherburne County. The surveys will be confined to these managed areas because 1) these lands contain a representative sample of all of the major types of habitat that are found in the Anoka Sand Plain in close proximity allowing for efficiency of work, 2) they exist on the fringe of the massive development threatening the Anoka Sand Plain and thus represent the greatest hope for successful large scale restoration activities, and 3) most of the SGCN species that were identified in ASP1 as requiring more study (Table 1) were observed within these managed areas, and 4) they provide the best potential for locating Uncas Skippers (*Hesperia uncas*) which were not found during ASP1.

Ideally all SCGN taxa would be tracked and studied remotely throughout the expansive ASP1 study area. However because of time and funding constraints it is necessary focus our remote sensing survey efforts on a “flag-ship” species. It was observed during the ASP1 surveys that frequently when western hognose snakes were observed, SGCNs from several other taxa were also observed. Therefore they appear to be an excellent indicator of the type of habitat used by many other target SGCNs.

The western hognose’s secretive behavior and small size, which has prevented researchers from studying this species using traditional telemetry, has resulted in little information about this species movements and habitat needs. Traditional radio transmitters are rarely less than five grams, thus the animals they are used to track must be at least 100 grams in order to restrict the transmitters to 5% or less of that animal’s weight (the recommended percent). Of the western hognose snakes captured and weighed during the ASP1 study, 70% weighed less than that required for a conventional transmitter.

In the last 20 years a pioneering technology has emerged for the remote tracking of very small study subjects (Lovei et al. 1997, Engelstoft et al. 1999, Greene et al. 2003, Boyarski et al. 2007). Harmonic radar was first used as a means to track insects (Lovei et al. 1997) and subsequently expanded to use with vertebrates (Lovei and Sunderland 1996, Webb and Shine 1997a, Webb and Shine 1997b, Webb and Shine 1998, Langkilde and Alford 2002, Greene et al. 2003, Boyarski et al. 2007). The major benefit to the use of this technology is that the tag that is used is tiny and does not require a battery which drastically reduces its weight. These reductions in weight and size beyond those possible with radio telemetry transmitters make the

tag appropriate for attachment or implantation into virtually any vertebrate species regardless of that animal's weight and size.

The use of harmonic radar technology will allow us to gather more detailed information on this species, including micro habitat components, use of surrounding marginal habitats, range, territory and daily habits, and possibly lead to the discovery of hibernacula for this species. Without the use of harmonic radar technology the challenges faced by scientists in monitoring the status of the western hognose snake will continue, leaving this SGCN poorly understood. This lack of information is a common thread among rare species, and should this technology prove effective the techniques we pioneer in this project could be used to study and monitor many other SGCN.

The results of this project will also address Goal I of SWAP (stabilize and increase SGCN populations) by identifying habitats within the Anoka Sand Plain that support and may be critical to SGCN, and using this information to provide technical assistance to individuals and/or agencies responsible for the management of key habitats. Without more detailed and updated information on the microhabitat components that influence habitat selection among SGCN within the Anoka Sand Plain, management decisions in this rapidly developing region will continue to be made without concern for these species and any remaining populations may be lost.

Objectives:

Work will be completed in 2010 and 2011 to meet the following objectives:

1. Conduct occurrence surveys within Sherburne National Wildlife Refuge and Sand Dunes State Forest, Sherburne County, focusing on target SGCN identified in ASP1 as requiring more study (Table 1)
2. Identify the key microhabitat components selected by target SGCN within survey areas

Expected Results and Benefits:

This study will help to achieve Goals I and II of SWAP as outlined in the Anoka Sand Plain Subsection (MNDNR 2006 pgs. 74-75). The results of this survey will be summarized in a report that will be distributed to all partners. This report will explain all habitat trends observed and of statistical significance, and the management implications of these results. All new or updated occurrences of species tracked in the Natural Heritage Information System (NHIS) will be submitted for entry into Biotics, and all data will be submitted to the NHIS Observation Database. As a result of this survey and distribution of the results, there will be an increase in knowledge of the status of SGCNs found in lower frequency in ASP1 as well as a refinement and further development of our understanding of the microhabitats that are being selected by the SGCN present. These results will help to determine which habitat features within the key habitats (oak savanna, prairie, grassland, and dune) are required for SGCN to persist and flourish. This increased knowledge will lead to more informed development and management decisions, and hence increased conservation and better restoration of SGCN and Sand Plain habitats. Data collection during this survey will be done in such a way that it may be used to develop a longer-term monitoring study to track selected SGCN populations over time as

management, climate change, and other factors exert influences over key habitats on the Anoka Sand Plain.

Results of this study will help the managing partners of these lands to achieve more efficient and effective management for SGCN. When sufficiently detailed habitat use and preference trends are observed during this study, the managers may delineate "hot spots" of conservation priority within their managed lands. With this knowledge the active management, which is on-going on this landscape, may result in more effective, timely results for both conservation and preservation.

With improved conservation strategies, these rare habitats can be preserved as a functioning ecosystem for years to come. This will offer SGCN populations refuges in a rapidly developing landscape and will preserve the human enjoyment of these healthy ecosystems. The results of the surveys will also inform future status updates/list revisions.

Approach:

1) Review of existing information and preparation for field work:

Much of the information review took place before ASP1, but any new information available about rare species, habitats, and habitat management within each of the study areas will be reviewed prior to site selection and surveys. Sources reviewed for information may include recent aerial photos, spatial data relating to current habitats and soil conditions, MCBS sites of biodiversity significance and mapped native plant communities, management plans submitted by partners, and the NHIS rare species information.

Preparation for field work will consist of purchasing, assembling and organizing equipment, purchasing supplies, training hired personnel/contractors, and acquiring all necessary permits. The harmonic radar tracking system which will be used in this study will need to be purchased in March 2010 to ensure delivery and allow time for the construction of the diodes for implantation, as well as time to test and become familiar with this emerging technology. Passive Integrated Transponder (PIT) tags and PIT tag implanters will also need to be purchased during this time frame. We are requesting that these expenses be allowed as preagreement costs.

Contractors and temporary hires will be sought and trained in any necessary skills prior to, and during the first few weeks of field work in 2010 and 2011.

2) Site Selection:

Study sites will be selected prior to field work. In order to maintain the feasibility of this study, 10 to 15 discrete 2500m^2 study sites will be chosen within the target managed areas of Sherburne National Wildlife Refuge and Sand Dunes State Forest. The study sites will be selected based on locations of western hognose snakes detected during ASP1. The presence of western hognose snakes will be used as a factor in site selection, as results from ASP1 indicated that SGCN of all taxa surveyed were frequently present where western hognose snakes were observed. This selection criterion also lends itself to objective 3 (see below).

Current quality of the surrounding habitat and current management of the study sites will also guide site selection.

3) Surveys of selected sites:
To meet Objective 1 (Conduct occurrence surveys within Sherburne National wildlife Refuge and Sand Dunes State Forest, Sherburne County, focusing on target SGCN identified in ASP1 as requiring more study) occurrence surveys will target SGCN identified in the ASP1 survey as being particularly rare, difficult to find, or underrepresented (Table 1). Occurrence surveys will be conducted April-October 2010 and 2011, with each species being surveyed at times when they are easiest to locate. Surveys will focus on target SGCN, but all species found will be documented. Surveys will involve a number of taxon-specific methods modeled after those outlined in the ASP1 interim report (Harper and Hoaglund 2009). Small mammals will be surveyed using Sherman live traps in study sites where no plains pocket mice (*Perognathus flavescens*) were located in ASP1, breeding-season birds will be surveyed by conducting point counts at the center of each study site and conducting targeted searches within the study sites, reptiles will be surveyed using timed terrestrial searches within the study sites, and invertebrates will be surveyed in the study sites using terrestrial searches and possibly night-time surveys and/ or sweep net surveys if time and funding allow. Detailed remote monitoring of habitat use by the western hognose snake will be carried out due to its position as a "flag-ship" species for this project (see objective 3 below).

We do not intend to collect voucher specimens of any species during our survey work, however whenever feasible and safe for the animal, tissue samples will be collected from western hognose snakes during surgery and deposited in the Minnesota Bell Museum of Natural History.

Objective 2 (Identify the key microhabitat components selected by target SGCN within survey areas) will be accomplished through the detailed study of the habitat components of each selected study site. A vegetation survey contractor or temporary hire will conduct detailed surveys of the plant communities within each pre-determined study site, under the guidance of the regional plant ecologist, Hannah Texler. Natural resource specialists, volunteers and Minnesota Conservation Corps will assist as needed. In addition to the detailed habitat surveys, several simple habitat and geological parameters (minimally including information on predominant growth forms, terrain, soil texture and moisture, and rock, water, litter and debris type and distribution) will be collected at each survey site, and microhabitat variables will be collected every time a western hognose snake is located via harmonic radar (see objective 3 below). During this work any incidental observations of state listed plants will be noted.

For a more detailed study of habitat components one 20 x 20 m releve will be placed in the center of each of the10-15 study sites and analyzed by a plant ecologist in mid-summer, when plant identification is easiest. In releves, all vascular plant species are recorded and listed in height classes, and percent cover of each species within each height class is recorded within cover classes. A vegetation quality rank (from A to D) is assigned each releve. In addition, a visual search will be made of the remainder of the site outside of the releve, and any additional vascular plant species in the site will be recorded on the releve form as "outside of plot". Finally,

for a select number of plant species of special interest to SGCN, the number of plants in each species in the site will be recorded. These species include large-flowered penstemon *(Penstemon grandiflorus)* (important to *Metaphidippus arizonensis* and *Tutelina formicaria*), hairy grama *(Bouteloua hirsuta)* (important to Uncas skipper), round-headed bush clover *(Lespedeza capitata)* (important to *Metaphidippus arizonensis*) *and* blazing stars (*Liatris* spp.) (important to Leonard's skipper (*H. leonardus leonardus*)).
Detailed habitat surveys will chiefly occur in the first field season (2010), but may be completed during the second (2011).

To meet objective 2 for the hognose snake we will utilize the emerging technology, harmonic radar, to track the movements of western hognose snakes. Harmonic radar tracking requires two main pieces of equipment: the receiver and the tags. The receiver is the device that will translate the location of the tag into an auditory signal for triangulation. Tags are assembled around a central diode by researchers to best fit the needs of their study.

Targeted searches for western hognose snakes will occur in the spring of 2010. We will attempt to implant tags in at least one snake per study site. The tags will be surgically implanted into snakes by a certified veterinarian following established protocols informed by previously published work (Reinert 1982) and the protocols used by the nongame wildlife specialist, Jamie Edwards, to implant transmitters into timber rattlesnakes. Each snake will retain its harmonic radar tag indefinitely unless removal becomes necessary. Each implanted snake will then be injected with a PIT tag for identification purposes in the field. These will remain in the snakes indefinitely. If loss of implanted western hognose snakes is too high in 2010, additional snakes may be implanted in the spring 2011. (Loss may occur to natural death, road mortality, predation, collection for the pet trade, etc.)

These snakes will then be tracked throughout the duration of the study. Each snake will be tracked as often as possible during both field seasons (2010 and 2011) from implantation until hibernation begins in September or October, and 2 to 3 times during the winter (November 2010 to March 2011). Attempts will be made to locate each snake at least 3 times a week with no more than 3 days between attempts to locate individuals to prevent signal loss.

Each time an implanted western hognose snake is located via harmonic radar, microhabitat data will be collected in a one square meter plot centered on the snake's location. The snake's PIT tag will also be read if possible to uniquely identify the animal. The microhabitat data collected will include information on variables such as canopy, open soil, dead plant matter, dominant soil type, presence of standing water, woody debris, slope, aspect, distance to nearest open soil if none present in plot, and characteristics of vegetation within the plots. The same microhabitat variables will be collected at neighboring random plots for comparison.

Tracking will cease in the fall of 2011 when the second field season ends, but PIT tag and harmonic radar information will be available to land managers if they want to continue tracking these snakes on the land they manage.

4) Data entry and analyses:
Data will be collected, entered and analyzed in such a way that observable trends in habitat use by target SGCN, particularly western hognose snakes, will be identified. This will allow us to provide a report to managers, which augments the previously produced habitat management recommendations by providing details on the types of microhabitat most important for target SGCN persistence. This will serve to deepen the usefulness of the more large scale habitat management recommendations that were produced after the ASP1 survey work, allowing management to progress on both the micro and macro scales and increase the effectiveness of SGCN habitat conservation and restoration.

All element occurrence records for all state-listed animals and plants will be submitted for entry into Biotics.

Location:
Sherburne National Wildlife Refuge and Sand Dunes State Forest, Sherburne County, Minnesota.

Personnel:
Field work will be conducted primarily by MN DNR Ecological Resources staff, volunteers, the Minnesota Conservation Corps, several contractors, and other MN DNR staff.

The donation of effort by volunteers will be crucial in maintaining the feasibility of this project. Volunteers can aid in ground searches of herpetofauna as well as assist in the tracking of marked western hognose snakes using the new innovative technology of harmonic radar. We will seek volunteer involvement from the Minnesota Herpetological Society, Friends of the Sherburne National Wildlife Refuge, and Great River Greening over the next 2 field seasons. We will track volunteer time with daily time logs completed by each volunteer. Volunteer hours will be valued at the level of an entry level Natural Resources Technician salary ($14.61/hr).

Project Leaders:

1. **Liz Harper**, MN DNR Ecological Resources, 1200 Warner Rd. Saint Paul, MN 55106 651-259-5764, Elizabeth.harper@state.mn.us,
2. **Hannah Texler** MN DNR Ecological Resources, 1200 Warner Rd. Saint Paul, MN 55106 651-259-5811, Hannah.texler@state.mn.us, and
3. **Erica Hoaglund** MN DNR Ecological Resources, 1200 Warner Rd. Saint Paul, MN 55106 612-730-2156, Erica.hoaglund@state.mn.us,)

Partners involved in this project:

- Minnesota Herpetological Society - provided this project with a grant which will be used to match Federal funds, and will be providing volunteers for survey and tracking work
- U.S. Fish and Wildlife Service - Sherburne National Wildlife Refuge staff are in support of this project being completed on lands they manage and will provide us with access to the Refuge

- DNR Divisions of Ecological Resources (County Biological Survey, Natural Resources and Nongame Research, and Nongame programs) and Forestry
- Minnesota Conservation Corps – will provide 350 hours of labor for this project, which will be used as match for Federal funds
- Great River Greening – is currently collaborating with the Nongame Program on several projects within the Anoka Sand Plain including habitat restoration and bird monitoring and may provide volunteers for field work
- Audubon Chapter of Minneapolis Red-Headed Woodpecker Recovery group – will collaborate on Red-headed Woodpecker sightings

Estimated Costs

The Minnesota Department of Natural Resources uses a detailed cost coding system to identify all costs associated with this grant. The costs associated with grant activities include labor, direct and indirect costs, travel, materials, supplies, equipment, contracts, engineering, archeological contracts, training and fleet charges necessary to accomplish the objectives of this project.

Total Expenditures:	$170,000
State Share* (50%):	$85,000
Federal Share (50%):	$85,000

* In-kind match valued at up to $5,000 may be used to meet the state share match for this grant.

Preagreement costs

The harmonic radar tracking system which will be used in this study will need to be purchased in March 2010 to ensure delivery and allow time for the construction of the diodes for implantation, as well as time to test and become familiar with this emerging technology. Passive Integrated Transponder (PIT) tags and PIT tag implanters will also need to be purchased during this time frame. We are requesting that these expenses be allowed as preagreement costs. The estimated cost for this equipment is $10,000.

Program Income

No activities included in this project generate program income incidental to their purpose.

Reports

An interim report will be submitted to the SWG coordinator by March 31, 2011. This report will summarize work completed during the 2010 field season. Data will undergo final analysis in September-November 2011, and a final report will be submitted to SWG coordinator by December 31, 2011. This report will summarize methods and results of the animal and vegetation surveys, including any insights gained on the home range size, behavior, habitat selection, reproduction and seasonal habitat use of the western hognose snake. There will also be a list of animals species located compiled for each of the management units. The interim

and final reports will include comparisons of actual accomplishments to the planned accomplishments for the grant period and explanations for any deviations.

Compliance:

National Environmental Policy Act

The Minnesota Department of Natural Resources' Division of Ecological Resources believes that this grant complies with the Department of the Interior – Final Revised Implementation Procedures for the Fish & Wildlife Service as published in the Federal Register on January 16, 1997 (Vol. 62, No. 11). The emphasis of this grant is on survey efforts. The Division of Ecological Resources believes that this grant will have no significant impact on the human environment and activities included in the grant are covered by categorical exclusions 1.4 B(1). See attached NEPA checklist. Compliance was done at the grant level.

Protection of Historic Properties

Section 106 of the National Historic Preservation Act of 1966 (NHPA) requires federal agencies to consider the effects of their actions on historic properties. The Divisions of Fish and Wildlife and Ecological Resources contract with a licensed archeologist to administer compliance with Section 106. None of the activities proposed have the potential to impact historical or archeological resources.

Floodplain Management, Executive Order 11988

The project will be in full compliance with this Executive Order.

Protection of Wetlands, Executive Order 11990

This grant will be in full compliance with this Executive Order.

Pesticides

The application of pesticides will not take place under this project.

Protection of Threatened and Endangered Species

The MN DNR believes that this grant will be in full compliance with the Endangered Species Act of 1973. A Section 7 Phase 1 review has been completed and is attached. Implementation of this grant will not jeopardize the continued existence of any federally listed, threatened, endangered, or candidate species or result in the destruction or adverse modification of critical habitat of these species.

Literature Cited:

Boyarski, V. L., G. H. Rodda, and J. A. Savidge. 2007. Evaluation of harmonic direction-finding systems for detecting locomotor activity. Journal of Wildlife Management 71(5): 1704-1707.

Eckerman, C. M. Finding a needle in a haystack: Identifying suitable habitat for the Western Hognose Snake (*Heterodon nasicus*). Unpublished report, Des Moines Area Community College.

Edgren, R. A. 1955. The natural history of the hog-nosed snakes, Genus Heterodon: A Review. Herpetologica 11(2): 105-117.

Engelstoft, C., K. Ovaska, and N. Honkanen. 1999. The harmonic direction finder: a new method for tracking movements of small snakes. Herpetologcal Review 30(2): 84-87

Greene, J. K., G. O'Neal, C.D. Capps, and R.G. Luttrell. 2003. The use of directional radar for tracking pentatomids. University of Arkansas and Arkansas soybean promotion board research results.

Harper, L., and E. Hoaglund. 2009. Rare wildlife and habitat surveys in oak savannas of the Anoka Sand Plain subsection. Interim Report. 7pp.

Langkilde, T. and R. A. Alford. 2002. The tail wags the frog: harmonic radar transponders affect movement behavior in *Litoria lesueuri.* Journal of Herpetology, 36(4): 711-715.

Lovei, G. L., I. A. N. Stringer, C. D. Devine and M. Certellieri. 1997. Harmonic radar – A method using inexpensive tags to study invertebrate movement on land. New Zealand Journal of Ecology 21(2): 187-193.

Lovei, G. L. and K. D. Sunderland. 1996. Ecology and behavior of ground beetles. Annual Review of Entomology 41: 231-256.

Minnesota Department of Natural Resources. 2006. Tomorrow's habitat for the wild and rare: an action plan for Minnesota wildlife. Comprehensive Wildlife Conservation Strategy. Division of Ecological Resources, Minnesota Department of Natural Resources.

Reinert, H. K. and D. Cundall. 1982. An improved surgical implantation method for radio-tracking snakes. Copeia 1982(3): 702-705.

Webb, J. K. and R. Shine. 1997a. A field study of spatial ecology and movements of a threatened snake species, *Hoplocephalus bungaroides.* Biological Conservation, 82: 203-217.

Webb, J. K. and R. Shine. 1997b. Out on a limb: conservation implications of tree-hollow use by a threatened snake species. Biological Conservation 81: 21-33.

Webb, J. K. and R. Shine. 1998. Ecological characteristics of a threatened snake species *Hoplocephalus bungaroides* (Serpentes, Elapidae). Animal Conservation 1, 185-193.

Wright, J. and A. Didiuk. 1998. Status of the plains hognose snake (*Heterodon nasicus nasicus*) in Ablerta. Alberta Environmental Protection, Fisheries and Wildlife Management Division, and Alberta Conservation Association, Wildlife status Report No. 15, Edmonton, AB.

Table 1. Target Species of Greatest Conservation Need *				
Taxa	**Scientific Name**	**Common Name**	**State Status**	**Federal Status**
Birds	Ammodramus savannarum	Grasshopper Sparrow	NL	NL
Birds	Caprimulgus vociferus	Whip-poor-will	NL	NL
Birds	Chordeiles minor	Common Nighthawk	NL	NL
Birds	Dolichonyx oryzivorus	Bobolink	NL	NL
Birds	Lanius ludovicianus	Loggerhead Shrike	THR	NL
Birds	Melanerpes erythrocephalus	Red-headed Woodpecker	NL	NL
Birds	Sturnella magna	Eastern Meadowlark	NL	NL
Insects	Cicindela lepida	Little White Tiger Beetle	THR	NL
Insects	Cicindela patruela patruela	Northern Barrens Tiger Beetle	SPC	NL
Insects	Hesperia leonardus leonardus	Leonard's Skipper	SPC	NL
Insects	Hesperia uncas	Uncas Skipper	END	NL
Mammals	Perognathus flavescens	Plains Pocket Mouse	SPC	NL
Reptiles	Heterodon nasicus	Western Hognose Snake	SPC	NL
Spiders	Metaphidippus arizonensis	A Jumping Spider	SPC	NL
Spiders	Tutelina formicaria	A Jumping Spider	SPC	NL
*Lark Sparrow is proposed to become a state listed special concern species so will be recorded when observed				

An Evaluation of the Ecological Significance of the

Sand Dunes State Forest

Sherburne County, Minnesota

Tiger beetle *(Cicindela patruela patruela)*

Prepared by:
Division of Ecological Resources, Central Region
Department of Natural Resources
1200 Warner Road
St. Paul, Minnesota 55106

April 15, 2009

SITE INFORMATION

SITE NAME: **SAND DUNES STATE FOREST**

DATE: **MARCH 4, 2009**

AUTHORS: **HANNAH TEXLER, REGIONAL PLANT ECOLOIGST**
ELIZABETH HARPER, REGIONAL NONGAME SPECIALIST

AFFILIATION: **CENTRAL REGION, MINNESOTA DNR**

MINNESOTA COUNTY BIOLOGICAL SURVEY SITE NUMBER: **158, 160, 161, 162, 164, 170, 171, 172, 173, 174, 175, 176, 177, 190,**

COUNTY: **SHERBURNE**

ECOLOGICAL CLASSIFICATION SYSTEM REGION: **ANOKA SAND PLAIN**

USGS 7.5 MINUTE QUAD MAP (DNR QUAD CODE): **Q15b**

LEGAL DESCRIPTION: **T34N, R27W, SECTION 15, 16, 17, 20, 21, 22, 24, 25, 26, 27, 28, 29**

APPROXIMATE ACREAGE: **2,600**

OWNERSHIP: **MINNESOTA DNR, DIVISION OF FORESTRY**

STATEWIDE BIODIVERSITY SIGNIFICANCE RANK:
OUTSTANDING/HIGH/MODERATE

ECOLOGICAL SIGNIFICANCE

Overview

This site is part of the Anoka Sand Plain ecological subsection, a landscape characterized by broad, mostly flat outwash sands and numerous wetlands. In a few places on the Anoka Sand Plain, over 5,000 years ago the sand was shaped into dunes (Keen and Shane 1990). The largest remaining area of dunes on the Anoka Sand Plain occurs in Sand Dunes State Forest and adjacent private and federal lands. Most of the rest of the dunes on the Anoka Sand Plain have been destroyed by reshaping and disturbance associated with housing development. The remaining dunes support a rich array of native plant communities, some of them unique to dune systems. The Dry Barrens Oak Savanna in particular is one of the most rare plant communities in the state, as most oak savannas have been converted to agricultural or development uses or have succeeded to oak forest in the absence of natural disturbance. Five state-listed rare plant species and nine state-listed rare animal species that require open dry oak savanna habitats occur in the dunes in Sand Dunes State Forest. In addition, diverse wetland communities occur here that support a state-threatened plant species *(Viola lanceolata)* and provide habitat for the state-threatened Blanding's turtle *(Emydoidea blandingii)*. Oak woodlands and associated wetlands provide habitat for red-shouldered hawks *(Buteo lineatus)*, a state special concern bird. Mesic Prairie and Pin Oak – Bur Oak Woodland native plant communities are other important parts of the dune ecosystems that occur in this site.

Pines and other evergreens, including white pine, Norway (red) pine, jack pine, and spruce, have been planted throughout the dunes in Sand Dunes State Forest since the 1930's, originally for the purpose of stabilizing the shifting dunes during a time of drought. These pines did not occur in the Anoka Sand Plain dunes prior to European settlement, and have resulted in conversion of portions of the site to forests that consist of a mix of large oak trees, pines, tall shrubs, and understory plants adapted to shady environments. However, there are savanna remnants throughout the dunes on drier slopes with rare species still surviving. Intensive management could be applied to most dune areas to restore native plant communities, though this effort will become more difficult the longer the pines and spruce trees are allowed to dominate. Most of the site is managed by the DNR Forestry Division as a forest with logging, soil disturbance, seeding in of pines, and planting of pine seedlings. The 745-acre Uncas Dunes Scientific and Natural Area (SNA) was established in 1989 (north unit) and 1997 (south unit) in two portions of the state forest and some adjacent acquired private land to protect some of the areas with important rare features. The SNA is being managed with logging of pines and controlled burning to restore and protect dune ecosystems for the natural features they support, with an emphasis on habitat for the state-endangered Uncas skipper *(Hesperia uncas)*. In the rest of this report, the phrase Sand Dunes State Forest will refer to the non-SNA portions of the state forest.

Geologic Features

Sand dunes are rare geologic features in Minnesota. About 7% of the Anoka Sand Plain was covered by sand dunes in the 1930's (Cooper 1935). These dunes formed during times of severe drought in the mid-Holocene, between 8000 and 4000 years before present (Keen 1985). Northwest winds created parabolic dunes and dune blandest, and south and west winds later modified them into asymmetrical parabolic shapes. By 4,000 years B.P., dune activity had decreased to minor levels. Northwest winds dominate the area today, indicating that the

paleowind regime that formed the dunes was similar to today's pattern.
The dune fields on the Anoka Sand Plain are the largest in the state, and have the best formed dunes in the state, according to Carrie Jennings, Minnesota Geological Survey (personal communication). The largest dunes on the Anoka Sand Plain are in eastern Sherburne County, including those in Sand Dunes State Forest and the Uncas Dunes SNA (Keen 1985). Over one half of these dunes have been reshaped and/or disturbed in recent years by housing developments. The only Anoka Sand Plain dunes that remain in a more or less natural condition today are those in the Sand Dunes State Forest and Uncas Dunes SNA, together with a small dune ridge in the northwest portion of Sherburne National Wildlife Refuge, a small dune ridge in Carlos Avery Wildlife Management Area, a small portion of Bunker Hills County Park, and a few small private tracts. Figure 1 shows the approximate locations of the dune formations in the vicinity of the Sand Dunes State Forest and Sherburne National Wildlife Refuge. The dunes in the south unit are particularly high and well-formed, characterized by a variety of dune ridges of various shapes and including excellent examples of asymmetric parabolic dunes. The dunes of the north unit are smaller and more typical of other Sherburne County dunes.

Historic Vegetation

Pollen analyses from Lake Ann indicates that spruce parkland occurred in the area in the late glacial period >10,000 years B.P. (Keen and Shane 1990). This was followed by a short-lived mixed coniferous-hardwood forest with an increase in red and jack pine around 10,000 to 9100 years B.P. The period 9100-4000 years B.P. is interpreted as open prairie vegetation, with small but fluctuating percentages of pine, oak, elm, and other trees. The period 4000-800 years B.P. had 20-30% oak pollen, 25-40% pine pollen, and 40% herbaceous pollen, and was interpreted as "open woodland, perhaps a mixture of oak savanna with prairie openings" (Keen and Shane 1990). A surface core from Lake Ann had similar pollen percentages (Keen and Shane 1990).

The mid-1800s Public Land Survey records from the area that is now Sand Dunes State Forest describe upland areas as possessing "scattering oak and scattering timber" (U.S. Surveyor General 1847-1908). Bearing trees recorded included tamarack, aspen, bur oak and "black oak," which was the term used by the surveyors for northern pin oak in this part of the state (Figure 2). Of the 169 survey corners in the state forest, one corner was forested, while the rest were in openings or wetlands, inferred from the vegetation descriptions and the distance between bearing trees (Table 1). From the descriptions and bearing trees, Marschner (1974) mapped the presettlement vegetation in the area as "oak openings and barrens" and "brush prairie" in uplands, and "wet prairie" and "conifer bogs and swamps" in wetlands (Figure 2). There were no pines recorded in the area that is now Sand Dunes State Forest (Figure 2). Pines occurred rarely in the Anoka Sand Plain in the 1800s, and they were limited to places where lakes or wetlands prevented most fires from burning (Wovcha et al. 1995).

Table 1. Summary of Vegetation Types for Sand Dunes State Forest Based Upon the Public Land Survey Line Notes
(table compiled by John Almendinger, Forest Ecologist, Minnesota DNR)

Vegetation Type	Primary ECS System	N	Percent of Landscape	Percent Treed		Means When Treed	
				open	treed	Distance in links	Diameter in inches
Forest	FDs	1	1	0%	100%	33	5.3
Swamp	FPs, FPn	15	9%	27%	73%	71	8.1
Thicket	UPs, FDs?	1	1%	0%	100%	34	10.0
Bottoms	FFs, UPs?	24	14%	42%	58%	522	10.2
Openings	UPs, FDs?	88	52%	9%	91%	163	8.1
Prairie	UPs	26	15%	27%	73%	339	9.2
Dry Meadow	WMs, WMn	2	1%	0%	100%	256	6.5
Marsh	MRn	1	1%	100%	0%	N/A	N/A
Lake	Aquatic	2	1%	100%	0%	N/A	N/A
Creek	Aquatic	2	1%	100%	0%	N/A	N/A
River	Aquatic	7	4%	100%	0%	N/A	N/A

Native Plant Communities

Upland Native Plant Communities

The "oak openings and barrens" described by Marschner would today be classified as oak savannas and dry prairies on the south to west-facing dune slopes, oak woodlands on the north to east-facing dune slopes, and mesic prairie in shallow depressions. These communities once occurred naturally in the area in a changing mosaic affected by the slope and aspect of the dunes, annual rainfall, and fire patterns.

Applying the current native plant community classification (Minnesota DNR 1995) to uplands on the dunes, native plant communities consist of Pin Oak – Bur Oak Woodland, Dry Barrens Oak Savanna, Dry Barrens Prairie, and Mesic Prairie (Table 3). Pine plantations have had a major impact on these communities. In some cases pines have formed dense plantations that have displaced oak savanna vegetation, and in other cases, the pines are interspersed with oak savanna vegetation. There are still excellent examples of native plant communities occurring throughout the state forest in places where pines have failed or have not been planted.

The most important of these communities, Dry Barrens Oak Savanna, is considered the most imperiled native plant community in the Midwest, today occupying only about .02% of its presettlement extent (Nuzzo, 1986). Oak woodlands are more prevalent than savannas, but even they have been greatly reduced from their original extent (Wovcha et al 1995). High quality examples of all of these communities are rare in the present-day Anoka Sandplain, where only about 6% of the landscape supports native plant communities of high enough quality to be mapped by the Minnesota County Biological Survey (MCBS). In Sherburne County, 5% of the landscape was mapped as native plant communities by MCBS (Delaney and Epp, 1993).

The oak savanna in Sand Dunes State Forest is classified as Dry Barrens Oak Savanna (Southern) Oak Subtype, referred to here as Dry Barrens Oak Savanna. This type of savanna occurs on sand on landforms varying from level to steeply sloping dune formations. It is

dominated by northern pin oak *(Quercus ellipsoidalis)* and bur oak *(Quercus macrocarpa)*, generally with open-grown forms, occurring individually or in groves. Dune crests, south to southwest-facing slopes, and sand blowouts are generally open and sparsely vegetated by grasses and forbs. Some common and characteristic herbaceous species include porcupine grass *(Stipa spartea)*, June-grass *(Koeleria pyramidata)*, sand reed-grass *(Calamovilfa longifolia)*, gray goldenrod *(Solidago nemoralis)*, tall wormwood *(Artemisia campestris)*, hoary frostweed *(Helianthemum bicknellii)*, and prairie golden aster *(Chrysopsis villosa)*. Eighty-five native plant species have been recorded in Dry Barrens Oak Savannas in Sand Dunes State Forest and Uncas Dunes SNA in recent years (Appendix). Fourteen state-listed rare species occur in Dry Barrens Oak Savanna in this site (Table 2). There are five state-listed rare plant species: annual skeletonweed *(Lygodesmia rostrata)*, small-leaved pussytoes *(Antennaria parvifolia)*, sea-beach needlegrass *(Aristida tuberculosa)*, beach-heather *(Hudsonia tomentosa)*, and creeping juniper *(Juniperus horizontalis)*. Two plant species tracked by the Natural Heritage Information System but not state-listed also occur in Dry Barrens Oak Savanna in this site: long-bearded hawkweed *(Hieracium longipilum)* and old field toadflax *(Linaria Canadensis)*. In addition, nine state-listed rare animal species have been documented in Dry Barrens Oak Savanna in this site: Uncas skipper *(Hesperia uncas)*, plains pocket mouse *(Perognathus flavescens)*, Blanding's turtle *(Emydoidea blandingii)*, gophersnake *(Pituophis catenifer*), western hognose snake (*Heterodon nasicus*), a species of jumping spider *(Metaphidippus arizonensis)*, Leonard's skipper *(Hesperia leonardus leonardus*), regal fritillary *(Speyeria idalia)*, and a species of tiger beetle *(Cicindela patruela patruela)*.

Dry Barrens Oak Savannas mapped by MCBS in the site (Figure 3) range from excellent quality, A-ranked occurrences to lower quality occurrences. The best quality areas are on south- to southwest-facing slopes where planted pines have failed or where pines were not planted. Lower quality areas include planted pines, dense growth of young deciduous trees and shrubs, dense thatch, and/or recent disturbance by machinery to prepare sites for seeding of pines.

Some of the most open south-facing oak savanna slopes were mapped as Dry Barrens Prairie (Southern) by MCBS (Figure 3). As the rare species and the management needs of these open slopes are the same as for oak savanna, the rest of this report considers the prairies part of the oak savannas.

Pin Oak – Bur Oak Woodlands in this site (Figure 3) are native plant communities dominated by northern pin oak and/or bur oak. They often have dense to patchy tall brush cover of American hazel, red raspberry, smooth sumac, prickly ash, and/or red cedar. Groundlayers contain a mix of savanna species in openings and species more typical of dry oak forest in denser areas such as poison ivy *(Toxicodendron rydbergii)*, Canada mayflower *(Maianthemum canadensis)*, woodbine *(Parthenocissus quinquefolia*, and sun-loving sedge *(Carex pensylvanica)*. Quality of these communities in the site is highly variable, ranging from high quality areas to lower quality areas; characteristics of the latter include dense European buckthorn *(Rhamnus cathartica)*, disturbed groundlayers, presence of planted pines, and presence of dense saplings of shade-tolerant deciduous forest trees such as basswood *(Tilia americana)* and elm *(Ulmus spp.)*.

Mesic Prairie occurs in one place in Sand Dunes State Forest, in the east half of the northeast quarter of Section 20 (Figure 3). This area was not mapped by MCBS, as it was discovered in

more recent years. Mesic prairies are characterized by the presence of tall prairie grasses and plant species adapted to mesic soil conditions. Common species in this prairie include prairie cordgrass *(Spartina pectinata)*, big bluestem *(Andropogon gerardii)*, little bluestem *(Schizachyrium scoparium)*, Indian grass *(Sorghastrum nutans)*, leadplant *(Amorpha canescens)*, prairie willow *(Salix humilis)*, rough blazing star *(Liatris aspera)*, and prairie sage *(Artemisia ludoviciana)*.

Wetland Native Plant Communities

Wetlands in the Sand Dunes State Forest occur in lowland swales and basins between upland dune formations. The larger wetlands include zones or patches of different native plant communities that occur where they do because of the depth and duration of standing water. Wetland native plant communities in this area include Tamarack Swamp (Southern), Northern Very Wet Ash Swamp (or Northern Wet Ash Swamp), Alder (Maple-Loosestrife) Swamp, Low Shrub Poor Fen, Graminoid Rich Fen (Basin), Sedge Meadow, and Northern Mixed Cattail Marsh (Table 3, Figure 3).

There are small areas of Tamarack Swamp (Southern) in the wetland complex in the east portion of the South Unit of Sand Dunes State Forest. The canopy is dominated by tamarack *(Larix laricina)*, with the woody understory consisting of elm, alder *(Alnus incana)*, bog birch *(Betula pumila)*, black ash *(Fraxinus nigra)*, yellow birch *(Betula allegheniensis)*, red maple *(Acer rubrum)*, and poison sumac *(Rhus vernix)*. The diverse ground layer includes sphagnum moss and two species rare in the area, as they are more characteristic of northern swamps: Labrador tea *(Ledum groenlandicum)* and buckbean *(Menyanthes trifoliata)*. Hardwood-dominated swamps occur in the same wetland complex. These were not field surveyed, but are either Northern Very Wet Ash Swamps or Northern Wet Ash Swamps.

Alder (Maple – Loosestrife) Swamps occur in several wetland basins in the South Unit of Sand Dunes State Forest, often as a narrow zone around other wetland plant communities. They are dominated by alder *(Alnus rugosa)*, and also include red-osier dogwood *(Cornus racemosa)* and bog birch *(Betula pumila)*.

There is one Low Shrub Poor Fen in the southeast portion of the South Unit of Sand Dunes State forest, in a small basin surrounded by uplands. The center is dominated by wiregrass sedge *(Carex lasiocarpa)* and sphagnum moss under scattered tamaracks. The outer zone is dominated by tussock sedge *(Carex stricta)*, with scattered tamarack, bog birch, and balsam willow *(Salix pyrifolia)*. Poor fens are relatively uncommon in the Anoka Sand Plain, and occur in areas of low acidity that are fed primarily by groundwater.

Graminoid Rich Fen (Basin) occurs in a narrow zone around open water in Larsen Slough. It is a floating sedge mat on peat soil dominated by wiregrass sedge *(Carex lasiocarpa)*, with bluejoint grass *(Calamagrostis canadensis)* and wild rice *(Zizania aquatilis)* among the associated species.

Sedge Meadows occur in small to large basins throughout the South Unit of Sand Dunes State Forest as well as in one small area in the North Unit. Their composition varies, but common species include tussock sedge *(Carex stricta)*, lake sedge *(Carex lacustris)*, wiregrass sedge *(Carex lasiocarpa)*, bluejoint grass *(Calamagrostis canadensis)*, Hayden's sedge *(Carex*

haydenii), and Canada anemone *(Anemone canadensis).* Several sedge meadows in the site support populations of the state threatened rare plant species lance-leaved violet *(Viola canadensis).*

Northern Mixed Cattail Marsh occurs rarely in basins with standing water year-around, and as narrow zones around open water in wetland complexes. They have not been surveyed in the field, but in general are dominated by cattails, including broad-leaved cattail *(Typha latifolia),* narrow-leaved cattail *(Typha angustifolia),* and hybrid cattail *(Typha x glauca).*

Rare Plants

Eight rare plant species have been documented in the project area, including two state threatened species, four state special concern species, and two species tracked in the Natural Heritage Information System but with no official state listing. Table 2 lists all the plant species, the number of statewide occurrences, the number of occurrences in the Anoka Sand Plain, the number of occurrences in Sand Dunes State Forest, and the number of occurrences in the Uncas Dunes SNA. Figure 3 shows the location of each rare plant population occurrence. Figure 4 shows those rare plant occurrences that have been verified in the year 2000 or later.

The lance-leaved violet *(Viola lanceolata)* is a state-threatened plant species that occurs in Sedge Meadows, generally near the outer rim. It is a perennial species of violet with spring-blooming white flowers. Two occurrences are in the Uncas Dunes SNA. Two others occur on Sand Dunes State Forest land outside the SNA: one occurrence of thousands of plants in a shallow Sedge Meadow, and another occurrence with thousands of plants in a small wet depression at the base of a dry dune ridge.

The annual skeletonweed *(Lygodesmia rostrata)* is a state-threatened species that has been found in one area of Sand Dunes State Forest, in a blowout area [redacted]. This species occurs only in sand dunes in the Great Plains and is local or uncommon throughout its range. In Minnesota it has been documented in two sand dune areas in northwestern Minnesota, in the Sand Dunes State Forest, and in the Sherburne National Wildlife Refuge. It is not known if the species was introduced into Sherburne County from western Minnesota-origin seeds, or if it occurs there naturally.

The small-leaved pussytoes *(Antennaria parvifolia)* is a state special concern species. A mat-forming perennial plant, it occurs on sandy to gravelly soil in dry prairies, and is most common where there are few to no other plants. There is one occurrence in the north unit of Uncas Dunes SNA, and two occurrences in Sand Dunes State Forest outside the SNA. All of these occur on open dunes, and are small populations of only a few square meters. It is likely that there are more small populations of this species in Sand Dunes State Forest in suitable habitat that has not been carefully searched.

Sea-beach needlegrass *(Aristida tuberculosa)* is an annual grass and a state special concern species. It occurs more commonly along the Gulf Coast of the U.S., but it has a secondary range in the Midwest in sand dunes of the Upper Mississippi River and a few tributaries. It colonizes areas of open sand in savanna and prairie areas, especially on dunes. It has been found in four places in Sand Dunes State Forest in oak savanna openings with exposed sand. There are likely

other populations in open sand areas in other portions of the Sand Dunes State Forest.

Beach heather (*Hudsonia tomentosa)* is a low-lying evergreen shrub, and is a state special concern species. It occurs only in sand prairie and savanna in active sand dunes. It has been documented in six places in Sand Dunes State Forest, in oak savanna openings with exposed sand in dunes in both the north and south units, and one place in the Uncas Dunes SNA.

Creeping juniper (*Juniperus horizontalis)* is a prostrate, evergreen shrub, and is a state special concern species. Its range is throughout the state, but it occurs rarely and in habitats limited to sand dunes, open sand prairies, and rock outcrops. It has been found in three places in the north unit of Sand Dunes State Forest and one in Uncas Dunes SNA, in sunny openings surrounded by overgrown oak savanna.

Two plant species tracked in the Natural Heritage Information System but with no official state status are old field toadflax *(Linaria canadensis)*, a small annual plant, and long-bearded hawkweed *(Hieracium longipilum),* a tall perennial plant. These two species occur in open sand in sand dunes and other sand prairie areas. They are both uncommon in the Sand Dunes State Forest, but likely occur in more places than they have been mapped.

Rare Animals

Ten rare animals have been documented in the project area, including one state endangered, one state threatened, and eight state special concern species (Table 2). Table 2 lists all of the animal species, the number of statewide occurrences, the number of occurrences in the Anoka Sand Plain, the number of occurrences in the Sand Dunes State Forest, and the number of occurrences in the SNA. Figure 3 shows the location of each rare animal occurrence. Figure 4 shows rare animal occurrences that were documented in 2008, as well as animal species of greatest conservation need documented in 2008.

The plains pocket mouse *(Perognathus flavescens)* is the only rare mammal documented in Sand Dunes State Forest. This state special concern species was documented in the North Unit near the [redacted] Recent surveys have not located any individuals of this species within the Sand Dunes State Forest, but this species was located less than 1.5 miles north of the state forest boundary in 2008, so it is possible that they still persist within the Sand Dunes State Forest. This species requires open areas in sand prairie and sand savanna habitats. It is uncommon throughout its range and appears to be limited to discrete, isolated populations where it does occur. While 23 occurrences have been documented in the state, some of these have been destroyed by housing development.

The red-shouldered hawk *(Buteo lineatus)* is the only rare bird documented as breeding within Sand Dunes State Forest. This state special concern bird requires relatively large tracts of mature deciduous forest habitat with scattered wetland openings.

Three rare reptiles occur in the Sand Dunes State Forest: the state-threatened Blanding's turtle *(Emydoidea blandingii),* the state special concern gophersnake *(Pituophis catenifer*), and the state special concern western hognose snake (*Heterodon nasicus*). Blanding's turtles have been documented on the west [redacted] several times, most recently in 1989. Blanding's turtles were also documented in a small wetland within Sand Dunes State Forest in 2008, and

near the [redacted] in 1990. They are regularly observed along the [redacted] in the Sherburne National Wildlife Refuge between the [redacted] most recently in 2008. Blanding's turtles nest in open sandy grassland areas such as the oak savanna in the dunes, use emergent vegetation and wetlands for other parts of their life cycles, and travel along rivers when dispersing to new sites. Gophersnakes also use open sandy grassland areas. Gophersnakes have been recorded on [redacted] on several occasions, most recently in 2008. In 2008, gophersnakes were also observed within the [redacted] and at 2 locations near the eastern and southern [redacted]. Western hognose snakes are habitat specialists that occur in dry prairie habitats and oak savannas. Two western hognose snakes were found along the border of Sand Dunes State Forest in 2008: [redacted]

Three rare butterfly species have been documented in the Sand Dunes State Forest/Uncas Dunes SNA area. The state-endangered Uncas skipper *(Hesperia uncas)* was last observed in 1987 in the Uncas Dunes SNA[redacted], and in the Sand Dunes State Forest in[redacted]. Surveys were completed for this species in 2008, but all areas where it may persist were not searched. The species has only been documented in one other place in Minnesota, and it is unknown whether any still survive. Uncas skippers are limited to sites with dry prairie or barrens prairie on sand dune forms where the native grass species hairy grama or blue grama serve as the larval hosts. In the Sand Dunes State Forest, they were documented for many years through 1972 as occurring [redacted] They were also observed in Site 176 on a south-facing dune slope in 1987 about [redacted] the eastern unit of the SNA.

Leonard's skipper *(Hesperia leonardus leonardus)* is a state-special concern butterfly that is also restricted to open sand prairie and savanna habitats. It occurs rarely in the Anoka Sand Plain and in similar barrens habitats in southeastern and central Minnesota. It was documented in Sand Dunes State Forest in "dry open oak wooded hillsides" with no specific location given in 1966 and 1967. This species was re-located in several areas of Sand Dunes State Forest and Uncas Dunes SNA in 2008. All locations of this species within the Sand Dunes State Forest were limited to small prairie openings within the forest or along the roadsides.

The regal fritillary was documented in Sand Dunes State Forest in 1966, but the exact location is unknown. Subsequent attempts to find the butterfly in the Sand Dunes State Forest and the Uncase Dunes SNA have not been successful.

One state special-concern species of tiger beetle *(Cicindela patruela patruela)* was documented in Sand Dunes State Forest in 1989, 2002, and 2008. It was first observed in Uncas Dunes SNA in 1989. In 2002, entomologist Ron Huber observed 1000 individuals in the State Forest[redacted] He has never seen this species in numbers this high, and noted that this is probably the best location in the state for this species. This is one of only three known breeding colonies of this species in the state. In 2008, seven *Cicindela patruela patruela* were found at three locations within the State Forest. All were limited to small prairie openings within the

forest or along the trails.

One state special-concern species of jumping spider, (***Metaphidippus arizonensis)***, occurs in Sand Dunes State Forest. It was documented in the south unit in Site 176 in 1987, in the main unit of Uncas Dunes SNA in 1996, in [redacted] of Sand Dunes State Forest in 2001, and in the south unit of Uncas Dunes SNA in 2008. This species reaches its northernmost range limit in Minnesota, and is restricted to sand prairie and savanna sites.

SITE BY SITE SUMMARIES OF RARE NATURAL FEATURES

The following descriptions refer to Minnesota County Biological Survey sites that occur in the project area. The site locations are shown in Figure 5. The Biodiversity Significance Rankings for each site, assigned by MCBS ecologists, are shown in Figure 5 and explained in Management Considerations/Conservation Recommendations below.

North Unit

Site 158 [redacted]

This site was found to be one of the best Dry Barrens Oak Savanna areas in the Sand Dunes State Forest in 1989, and was given a ranking of outstanding biodiversity significance (Figure 5). It contains gently rolling dune topography with scattered wet meadow depressions. The oak savanna was ranked B, and it includes a population of small-leaved pussytoes as well as long-bearded hawkweed and old-field toadflax. There were young Norway pine seedlings in the site at that time. This area is surrounded by pine plantations on all sides. This site was field surveyed in 2003. Many of the planted pines had survived and grown larger since 1989, but overall the site retained the same quality as it had in 1989. Kentucky blue grass was dense throughout and thatch accumulation was high, indicating a need for prescribed burning. Animal surveys were not conducted here during 2008 surveys.

Site 160 [redacted]

This site includes the north portion of the [redacted], and has hiking trails, multi-purpose trails, and a picnic area within it. This area is Pin Oak – Bur Oak Woodland, with a few scattered Dry Barrens Oak Savanna and Dry Barrens Prairie openings and a fairly large white pine plantation in the north portion. In 1989, the open areas had populations of lance-leaved violet in wetlands, and sea-beach needlegrass and creeping juniper in open savanna; the site was given a ranking of high biodiversity significance (Figure 5). Gophersnakes and red-shouldered hawks have been documented in this site. This site was visited in 2003. In the north portion of the site, where rare plants had been observed previously, south-facing slopes supported excellent savanna habitat, with sea-beach needlegrass and hairy grama grass common. The south portion of the site was more disturbed; open areas included few native species and the forested areas had many young, multiple-stemmed oaks with a disturbed groundlayer.

North Portion Site 161 [redacted]

Site 161 includes the south portion of the [redacted] This description will only address the north portion of Site 161, outside of the SNA. This area has hiking trails, multi-purpose trails, a campground, and a portion of a picnic area within it. [redacted] its eastern boundary, and [redacted]

[redacted]. This site was field surveyed in 2001. Several very high quality Dry Barrens Prairie openings occur in this site. Three rare plant species were documented in these openings in 2001. The prairies contain a diverse array of native species and excellent potential habitat for Uncas skippers, which were found here in 1987. The plains pocket mouse occurred here in 1949. Portions of the area were re-surveyed in 2008, but no plains pocket mice were found. It is not known if this species still survives in the site. Blanding's turtles were found here in 1989, and *Cicindela patruela patruela* were found here in 2008. Gophersnakes, western hognose snakes, and Leonard's skippers were all found within this site at Uncase Dunes SNA in 2008, and are likely to occur within this site in the State Forest. There is a population of the rarely seen native plant prickly pear cactus *(Opuntia fragilis)* in this site that most likely has persisted from a planting many years ago. There are some large white pine, Norway pine, and jack pine plantations in this site. The prairie openings are high priority for protection. This site was given an outstanding biodiversity significance ranking (Figure 5).

Mesic Prairie (not an MCBS site; [redacted]

This area was not originally surveyed by MCBS. In 2001, Forestry and Ecological Services DNR staff visited this area and marked its boundaries for inclusion in a protected area. Parts of this area were disturbed by an old dump. The area consists of about 40 acres of wet to mesic prairie, a very rare community type on the Anoka Sand Plain, and a small area of Dry Barrens Prairie. The wet to mesic prairie has moderate diversity and is in good condition. The dry prairie still had quite a bit of trash on it in 2001 and had relatively low native species diversity, but supported a population of beach-heather. The Mesic Prairie is shown in Figure 3.

South Unit

Site 170 ([redacted]

Most of this site is part of the Uncas Dunes SNA. It was described as high to moderate quality Dry Barrens Oak Savanna during the 1989 MCBS survey, when a population of small-leaved pussytoes was documented there and the site was ranked high in biodiversity significance (Figure 5). The site was visited again in 2008. Conditions were similar, and the need for prescribed burning to reduce woody encroachment and brush was noted. There has also been illegal use by ATVs. *Metaphidippus arizonensis* and Leonard's skipper were located at this site in 2008. The portions of the site outside the SNA on the north, west, and south edges are privately owned and now have been converted to housing.

Site 171 [redacted]

This site is composed of Dry Barrens Oak Savanna and Pin Oak – Bur Oak Woodland. Much of the north portion has been heavily planted to Norway and white pine plantations, and much of the oak woodland consists of recently cut and coppiced oaks. The oak savanna in the west part of the south portion of this site, on a south-facing dune slope[redacted], was field surveyed in 2001 and 2003. This savanna has large, scattered, open-grown bur oaks throughout and scattered areas of prairie vegetation beneath, including populations of beach-heather and creeping juniper. However, there is dense young jack pine growth throughout this area that is quickly shading out the prairie species, and a parking area has been established in one area that was formerly prairie/savanna. Leonard's skipper were found in the SE corner of this site in 2008 in a small, sandy opening along the roadside. The Uncas Dunes SNA is immediately west of this area. The eastern portion of this site has been planted to rows of the exotic invasive

species amur maple and scattered pine and spruce trees. There is a large Sedge Meadow of moderate quality in this site, as well as several intact smaller Sedge Meadows. The site's proximity to the SNA and the persistence of oak savanna species makes it a high priority for protection and restoration work, particularly the western portion. The site was given a moderate biodiversity significance ranking (Figure 5).

Site 172 [redacted]

Most of the upland portions of this site are Pin Oak – Bur Oak Woodland that has been logged in the past, with only a few small pine plantations. Little open savanna vegetation was seen here during the MCBS survey, and the area was not visited in recent years. The wetlands around Larsen Slough consist of open water, Rich Fen, and Sedge Meadow native plant communities, with scattered tamaracks. The area appeared to be diverse and of moderate quality during the MCBS survey and a field check in 2008. Purple loosestrife was dense in some parts of the marsh in 1989. Animal surveys were not conducted here for all taxa during 2008 surveys.

Site 173 [redacted]

This site consists of disturbed oak savanna surrounded by pine plantations on state forest land in the west portion, and disturbed oak savanna with houses in it on private land in the east portion. The portion on state land was visited in 2008. Several small Dry Barrens Oak Savanna openings were visited and found to be diverse and of high quality, though one has been impacted by recent pine planting activities and both are in need of prescribed burning. This site was ranked high in biodiversity significance (Figure 5). Animal surveys were not conducted here during 2008 surveys.

Site 174 [redacted]

This site consists of Dry Barrens Oak Savanna in the north portion, and Pin Oak – Bur Oak Woodland and two large Dry Barrens Prairies in the south portion, all on scenic old dunes. These plant communities were ranked C in 1989 because of disturbance from planted pines, logging equipment, and lack of prescribed fire, but still had good species diversity. Although potential rare plant habitat exists here, no listed species were documented in this site. This site has not been field surveyed in recent years, but prairies and savanna openings appear intact in 2008 air photos. This site was ranked outstanding in biodiversity significance (Figure 5), primarily because of the high dune formations and the intact savanna and prairie openings. *Cicindela patruela patruela* was found at this site in 2008.

Site 175 [redacted]

This site contains scenic old dune topography supporting a large expanse of Dry Barrens Oak Savanna grading to Pin Oak – Bur Oak Woodland, with some oak forest in the north portion of the site. There are extensive Norway pine plantations throughout the east portion of this site. Portions of the site were visited in 2001 and other portions in 2008. Several large diverse Dry Barrens Prairies and Dry Barrens Oak Savannas with potential habitat for Uncas skippers and other rare species occur on south-facing slopes. Several of these had been recently disturbed by machinery to prepare for aerial pine seeding in 2001, while others were intact. Some of the Pin Oak – Bur Oak Woodlands in the west portion of the site were intact communities with few to no pines and diverse native groundlayers. No listed plant species were documented in this site, but *Cicindela patruela patruela* and Leonard's skippers were found here in 2008. This site was

ranked outstanding in biodiversity significance (Figure 5), primarily because of the high dune formations and the intact savanna and prairie openings.

Site 176 [redacted]

Much of this site is Dry Barrens Oak Savanna with patchy pine plantations, and there was recent heavy logging activity that has disturbed soils in some places in 2001. However, there were several high quality Dry Barrens Prairie and Dry Barrens Oak Savanna openings described in 1989 that were still intact in 2001. There was a small population of Uncas skippers here in 1987, along with rare jumping spiders (*Metaphidippus arizonensis*). There have been no recent comprehensive surveys for these species to determine whether they are still present in this site. One small population of pussytoes was observed in prairie in this site in 2001; it needs to be revisited to determine whether it is the rare small-leaved pussytoes. The lance-leaved violet occurs in Sedge Meadow in this site. This site was ranked outstanding biodiversity significance (Figure 5). The historic skipper population together with the persistent high quality prairie and savanna patches make this site a high priority for protection.

Site 190 [redacted]

Most of this site supports wetland communities, though there is Pin Oak – Bur Oak Woodland on uplands in the south portion of the site. The west part of the site is on state forest land, and consists of a mosaic of Tamarack Swamp, Ash Swamp, Alder (Maple - Loosestrife) Swamp, Sedge Meadow, and Poor Fen communities. These communities continue to the east onto private land, but looked more disturbed there to MCBS ecologists who saw them from a distance in 1989. A brief visit to hardwood and tamarack swamp areas in 2003 confirmed that these communities are good to moderate in quality, with disturbed edges dominated by reed canary grass, but with relatively diverse interiors. The forest was not surveyed by MCBS in 1989 or in recent years. No rare species have been documented in this site. Animal surveys were not conducted here during 2008 surveys.

MANAGEMENT CONSIDERATIONS/CONSERVATION RECOMMENDATIONS

Overall Recommendations

There are many factors to be taken into account in deciding relative protection priority. One is the overall biodiversity significance of a site. The MCBS program assigns biodiversity significance ranks to sites based on the size, rarity, and quality of native plant communities and the rarity and population size of rare species. Those ranks, which range from outstanding to high to moderate (and "below minimum standards" for lower quality sites), are shown in Figure 5.

Another important factor is habitat continuity for rare animals and other wildlife species. Small, isolated habitat will not generally be sufficient to ensure the survival of animals into the future. Places for animals to travel from one part of their habitat to another, and to disperse to new habitats, must be protected and managed appropriately.

Protection of intact ecosystems is generally believed to be the most effective way to manage and protect rare features. In the case of Sand Dunes State Forest, the natural landscape and continuum of native plant communities consists of the dunes, the upland continuum of oak savanna to woodland to forest, and a diversity of wetland communities from forested swamps to fens, wet meadows, and marshes. Connectivity between wetlands, upland savanna habitat, and

the [redacted] is important for Blanding's turtles and other native turtles.

The presence of natural processes is also important to protecting rare features. Regular fires were an important natural process in oak savannas and associated communities. However, some rare species, such as creeping juniper and Leonard's skipper may be harmed by intensive fires, so it is important to manage fire carefully. The dune topography, wetlands, lakes, and rivers in the area may have resulted in a pattern of frequent, relatively small, low intensity fires much of the time, with hotter and more expansive fires burning during periods of drought. The shifting of dunes over time as wind and climate varied was a natural process that maintained the open sand habitats of many of the rare plants and animals that occurred here.

Taking all of these considerations into account, a proposed Rare Natural Features Management Area is shown in Figure 6. Management of this area to protect and maintain the plant communities and associated rare species, together with the protection afforded in the Uncas Dunes SNA, would address the needs of the rare features detailed in this report. Management considerations for the areas in the two State Forest units are described below.

Management Considerations for the North Unit

The areas north of the Uncas Dunes SNA that possess native plant communities and rare species habitat include the [redacted], the Mesic Prairie area, the wetlands in which Blanding's turtles occur, and land adjacent to [redacted] It is recommended that the 777 acre area shown as "Rare Natural Features Management Area" in Figure 6 be managed with clearing and controlled burning to improve the quality of the native plant communities, protect the excellent prairie and savanna habitat that exists in Site 161, provide continuity with the SNA, the mesic prairie, and the wetlands, and provide an area next to the county road that is managed similarly to the Sherburne National Wildlife Refuge north of the road. The Bob Dunn Recreation Area is partially managed by DNR Parks, and natural features management is in keeping with Parks policy. Management will have to take aesthetics and visitor uses into account in the picnic and camping areas. Where possible, native species should be used for visual screening. Pine plantations should be phased out of this area. With tall pines, this could be accomplished gradually as it is economically feasible to cut them. Pine seedlings should be removed as soon as possible to avoid destroying prairies and savanna habitats.

Management Considerations for the South Unit

The South Unit contains a very large expanse of dunes with a mosaic of Pin Oak – Bur Oak Woodland, Dry Barrens Oak Savanna, prairie openings, pine plantations, and areas recently scarified and seeded to pines. There are several multi-purpose trails that run through this area (used for snowmobiling, hiking, and horseback riding) and a few non-motorized trails (used for skiing and hiking).

At a minimum, those areas that still contain open prairie and savanna vegetation should be managed to enhance those communities and the rare species that occur in them, and the savanna to the east of the Uncas Dunes SNA should be managed to remove the young jack pines and improve the savanna habitat.

The remaining areas would require intensive management to restore native plant communities

and eliminate pines, but this could be done. The 1,832-acre area in the South Unit mapped as "Rare Natural Features Management Area" in Figure 6 could be restored and managed for native plant communities and rare species. This would create the largest expanse of dune communities on the Anoka Sand Plain, and greatly increase the chances that there would be sufficient natural habitat for the rare animals that survive here.

ELEMENT SUMMARY

Table 2. Rare Species in Sand Dunes State Forest and Uncas Dunes SNA (summarized from the Natural Heritage Information System and 2008 field records)

Common name	Scientific name	[1]Status	Year of last observation in SDSF or Uncas Dunes SNA	# occur. in SDSF	# occur. in Uncas Dunes SNA	# Anoka Sand Plain Subsection ocurrences	# state-wide occurences
Mammals							
Plains pocket mouse	*Perognathus flavescens*	SC	1949	1	0	8	23
Birds							
Red-shouldered hawk	*Buteo lineatus*	SC	2008	2	0	36	541
Amphibians and Reptiles							
Blanding's turtle	*Emydoidea blandingii*	T	2008	3	0	408	1113
Gophersnake	*Pituophis catenifer*	SC	2008	2	2	33	128
Western hognose snake	*Heterodon nasicus*	SC	2008	1	1	13	35
Jumping Spiders							
A species of jumping spider	*Metaphidippus arizonensis*	SC	2008	2	2	9	15
Butterflies							
Uncas skipper	*Hesperia uncas*	E	1987	3	2	7	7
Leonard's skipper	*Hesperia leonardus leonardus*	SC	2008	2	2	10	22
Regal fritillary	*Speyeria idalia*	SC	1966	?	?	2	258
Tiger Beetles							
A species of tiger beetle	*Cicindela patruela patruela*	SC	2008	3	1	5	32

[1] State Rarity Status for Rare Species
E = endangered
T = threatened
SC = special concern
NON = no legal status but tracked in the Natural Heritage Information System
Proposed = proposed status in newly revised list as of December 2008

Table 2 (continued)

Common name	Scientific name	[1]Status	Year of last observation in SDSF or Uncas Dunes SNA	# occur. in SDSF	# occur. in Uncas Dunes SNA	# Anoka Sand Plain Subsection ocurrences	# state-wide occurences
Vascular Plants							
Annual skeletonweed	*Lygodesmia rostrata*	T	1986	1	0	2	6
Lance-leaved violet	*Viola lanceolata*	T	1989	2	2	78	88
Small-leaved pussytoes	*Antennaria parvifolia*	SC	1987	1	1	6	21
Sea-beach needlegrass	*Aristida tuberculosa*	SC (Proposed T)	2003	4	0	31	46
Beach-heather	*Hudsonia tomentosa*	SC (Proposed T)	2008	6	1	16	36
Creeping juniper	*Juniperus horizontalis*	SC	2003	3	1	7	49
Long-bearded hawkweed	*Hieracium longipilum*	NON	2008	3	0	27	89
Old field toadflax	*Linaria candadensis*	NON	1990	1	1	9	36

[1] State Rarity Status for Rare Species
E = endangered
T = threatened
SC = special concern
NON = no legal status but tracked in the Natural Heritage Information System
Proposed = proposed status in newly revised list as of December 2008

Table 3. Native Plant Communities in Sand Dunes State Forest and Uncas Dunes SNA

[1]Native Plant Community (new classification)	Classification Code	[2]Natural Community (old classification)	[3]Status (State Rarity Status)	[4]Global Rarity Status
Dry Barrens Oak Savanna (Southern) Oak Subtype	UPs14a2	Dry Oak Savanna (Central) Barrens Subtype	S1S2	G2
Dry Barrens Prairie (Southern)	UPs13a	Dry Prairie (Central) Barrens Subtype	S2	G2G3
Mesic Prairie (Southern)	UPs23a	Mesic Prairie (Central)	S2	G1G2-G2G3
Pin Oak – Bur Oak Woodland	FDs37b	Oak Woodland Brushland (Central); Oak Forest (Central) Dry Subtype	S3	GNR
Northern Very Wet Ash Swamp or Northern Wet Ash Swamp	WFn64b (or) WFn55b	Mixed hardwood swamp	S3	GNR
Tamarack Swamp (Southern)	FPs63a	Tamarack swamp	S3	G2G3
Alder (Maple – Loosestrife) Swamp	FPn73a	Alder Swamp	S5	GNR
Low Shrub Poor Fen	Apn91a	Poor Fen	S5	GNR
Rich Fen (Basin)	Opn92	Rich Fen	S4	GNR
Sedge Meadow	WMn82b	Wet Meadow	S4/5	GNR
Northern Mixed Cattail Marsh	MRn83	Cattail Marsh	S2	GNR

[1] New native plant community classification (Minnesota DNR 2005)
[2] Older natural community classification (Minnesota DNR 1993)
[3] State Status – Ranks for native plant communities are program-defined; no legal status)
S1=critically endangered
S2=endangered
S3=threatened
S4=special concern
S5 = demonstrably secure
[4] Global Rarity Status (as defined by Natureserve):
G1 – Critically imperiled
G2 - Imperiled
G3 - Vulnerable
GNR - Unranked (not yet assessed)

INFORMATION SOURCES

Field Surveys

Information for this report came from data and field notes of Minnesota County Biological survey staff, who visited the site in 1989; reports on the sand dunes of the area (Keen 1985); aerial photos, GIS data and personal information provided by DNR Forestry staff knowledgeable about the area; and field evaluations by the Hannah Texler in 2001, 2002, 2003, and 2008. A survey of animal species of greatest conservation need was conducted in the Sand Dunes State Forest during the field season of 2008 to obtain updated information.

Literature

Cooper, W.S. 1935. The history of the upper Mississippi River in Late Wisconsin and post-glacial time. University of Minnesota Press, Minneapolis. 116 pages.

Delaney, B.C. and A. Epp. 1993. Natural communities and rare species of Sherburne County, Minnesota. Minnesota County Biological Survey Map Series No. 4.

Keen, K.L. 1985. Sand dunes on the Anoka Sand Plain. M.S. thesis. Minneapolis, Minnesota, University of Minnesota. 191 pages.

Keen, K.L. and L.C.K. Shane. 1990. A continuous record of Holocene eolian activity and vegetation change at Lake Ann, east-central Minnesota. Geological Society of American Bulletin, 102: 1646-1657.

Marschner, F.J. 1974. The original vegetation of Minnesota (map scale 1:500,000). USDA Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota (redraft of the original 1930 edition).

Minnesota DNR, 1993. Minnesota's Native Vegetation, A Key to Natural Communities, Version 1.5. Minnesota DNR Biological Report No. 20.

Minnesota Department of Natural Resources. 2005. Field Guide to the Native Plant Communities of Minnesota: the Eastern Broadleaf Forest Province. Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program. Minnesota Department of Natural Resources, St. Paul.

Nuzzo, V.A. 1986. Extent and status of Midwest oak savanna: presettlement and 1985. Natural Areas Journal 6(2):6-36

U.S. Surveyor General. 1847-1908. Field notes: Township exterior and subdivision lines. Minnesota State Archives, 57.J.5.9B-57.J.8.8F, Minnesota Historical Society, St. Paul.

Wovcha, et al. 1985. Minnesota's St. Croix River Valley and Anoka Sandplain; A Guide to Native Habitats. University of Minnesota Press, Minneapolis.

Figure 1. Sand Dune Formations In the Vicinity of Sand Dunes State Forest and Sherburne National Wildlife Refuge (redrawn from Keen 1985)

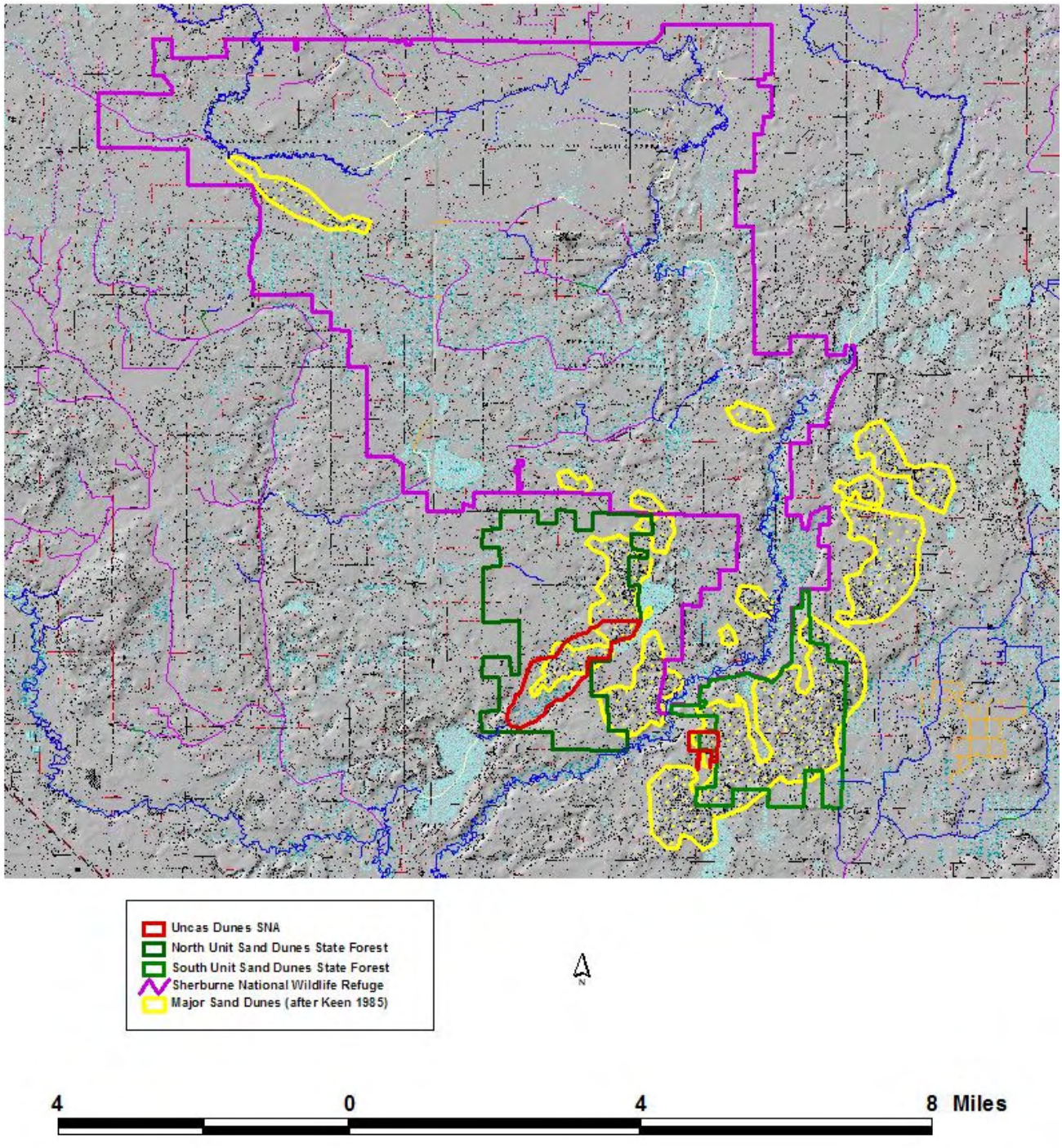
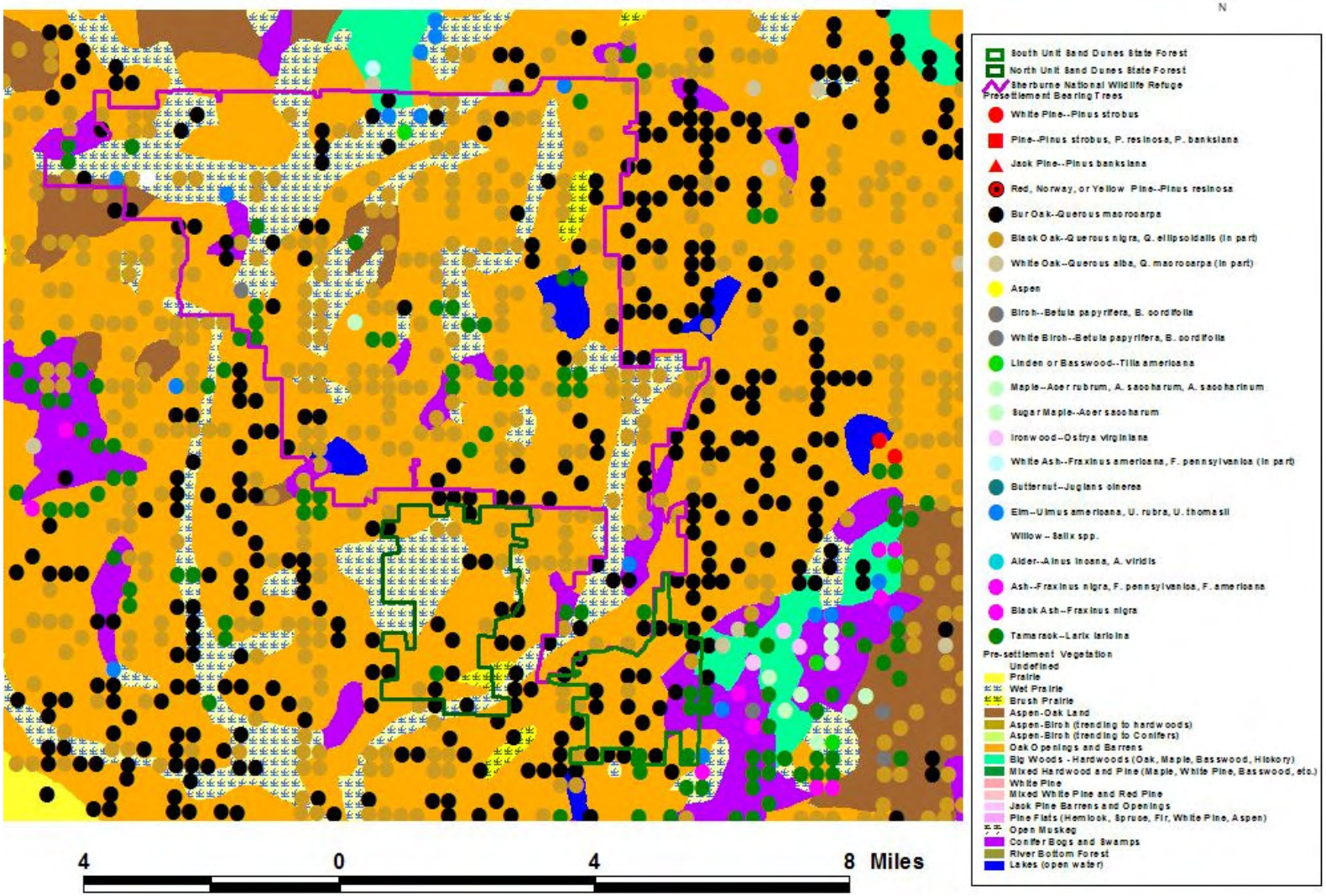
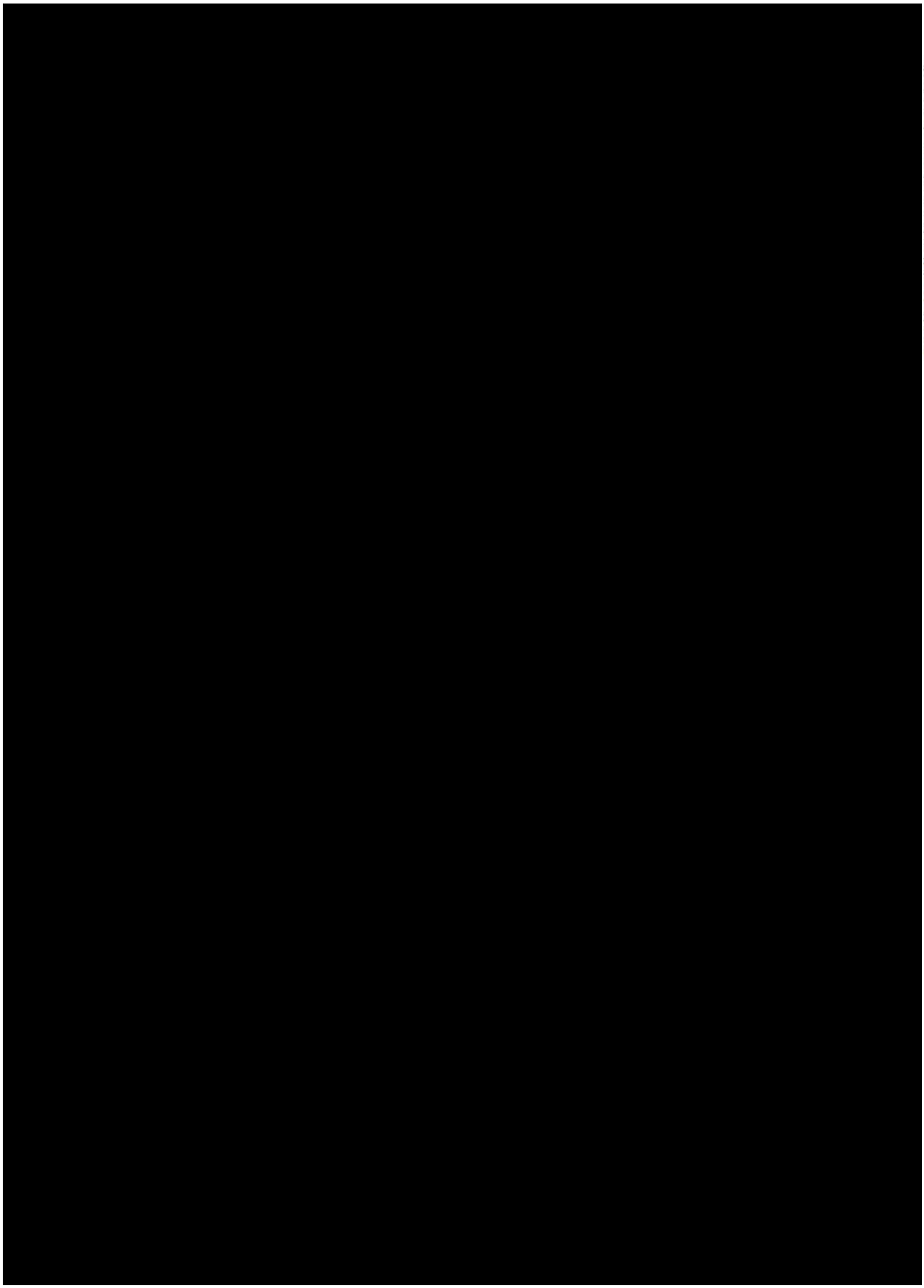
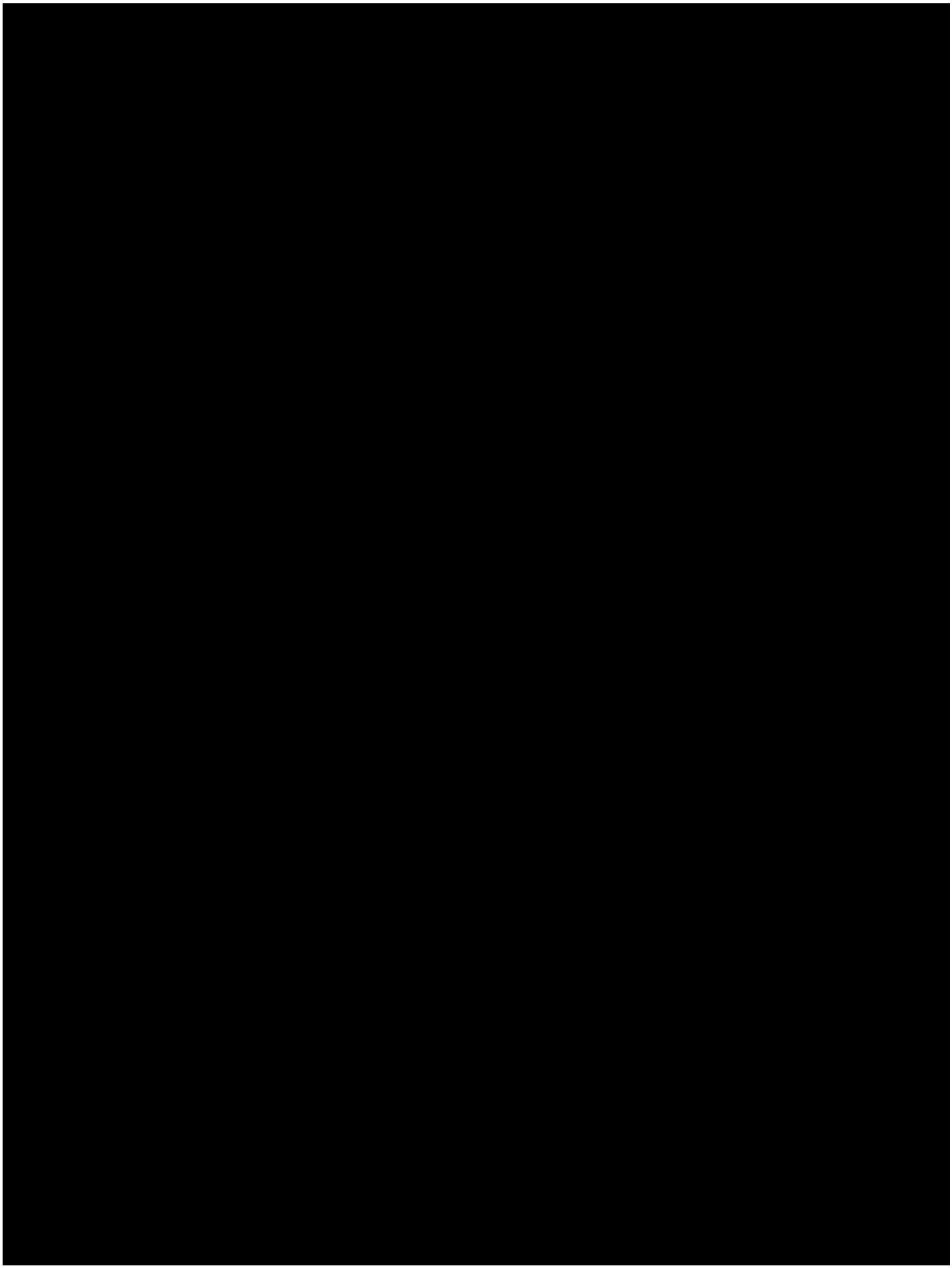
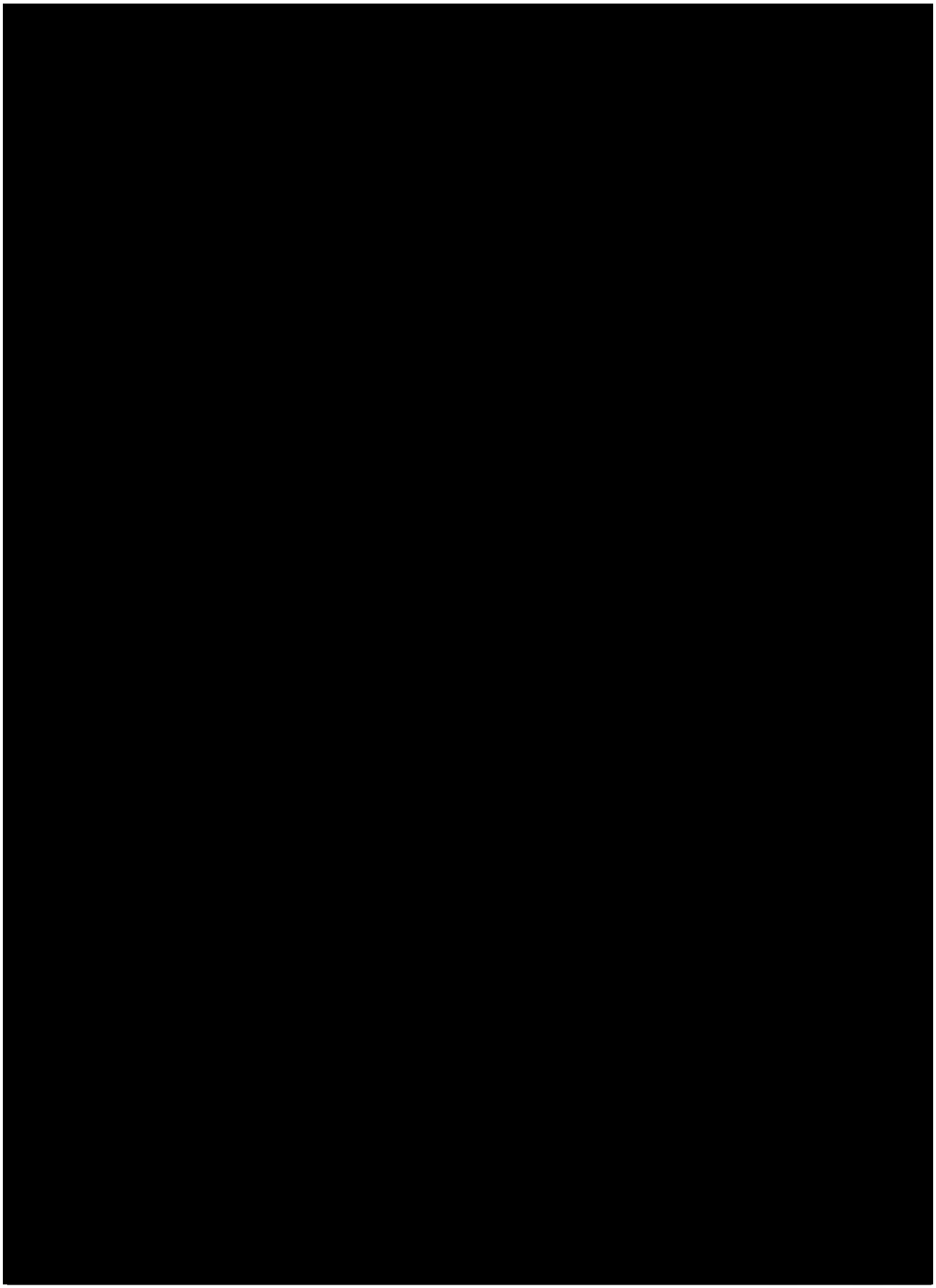


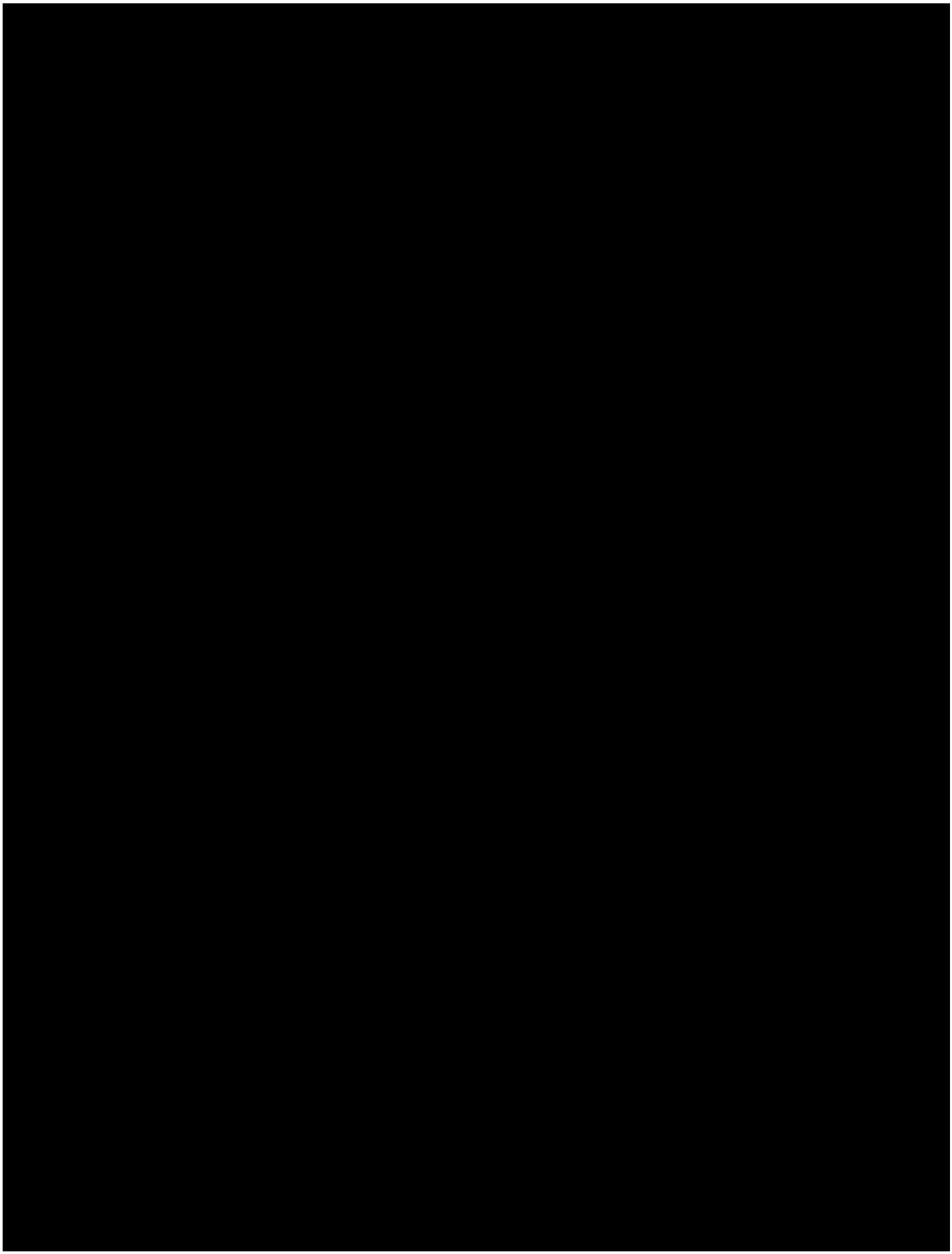
Figure 2. Presettlement Vegetation in the Sand Dunes State Forest and Sherburne National Wildlife Refuge











APPENDIX

Native Plant Species List for Dry Barrens Oak Savannas in Sand Dunes State Forest and Uncas Dunes SNA (compiled from relevés and field notes taken by Ecological Resources Division plant ecologists)

Scientific Name	Common Name
Woody Plants	
Amorpha canescens	Lead-plant
Arctostaphylos uva-ursi	Bearberry
Celastrus scandens	Climbing bittersweet
Corylus americana	American hazelnut
Juniperus communis	Bush juniper
Juniperus horizontalis	Creeping juniper
Juniperus virginiana	Eastern red cedar
Prunus serotina	Black cherry
Prunus virginiana	Chokecherry
Quercus ellipsoidalis	Northern pin oak
Quercus macrocarpa	Bur oak
Rosa arkansana	Prairie rose
Salix humilis	Priaire willow
Toxicodendron rydbergii	Western poison ivy
Zanthoxylum americanum	Prickly ash
Forbs	
Ambrosia artemisiifolia	Common ragweed
Ambrosia psilostachya	Western ragweed
Anemone cylindrica	Long-headed thimbleweed
Anemone patens var. *multifida*	Pasqueflower
Antennaria parvifolia	small-leaved pussytoes
Apocynum androsaemifolium	Spreading dogbane
Apocynum cannabinum	American hemp
Anemone cylindrica	Long-headed thimbleweed
Arenaria lateriflora.	Side-flowering sandwort
Artemisia campestris	Tall wormwood
Artemisia ludoviciana	Prairie sage
Aster ericoides	Heath aster
Aster sericeus	Silky aster
Chrysopsis villosa	Prairie golden aster
Conyza canadensis	Horseweed
Cycloloma atriplicifolium	Winged pigweed
Dalea purpurea var. *purpurea*	Purple prairie clover
Dalea villosa	Silky prairie-clover
Equisetum sp.	Horsetail
Euphorbia geyeri	Geyer's spurge
Froelichia floridana	Prairie cottonweed
Geum triflorum	Prairie smoke
Hedeoma hispidum	Mock pennyroyal
Helianthemum bicknellii	Hoary frostweed

Helianthus occidentalis	Western sunflower
Helianthus strumosus ssp. *pauciflorus*	Woodland sunflower
Hieracium longipilum	Long-bearded hawkweed
Hudsonia tomentosa	Beach-heather
Lechea stricta	Prairie pinweed
Liatris aspera	Rough blazing star
Linaria canadensis	Old field toadflax
Linum sulcatum	Grooved yellow flax
Lithospermum carolinense	Hairy puccoon
Lygodesmia rostrata	Annual skeleton weed
Mirabilis hirsuta	Hairy four o'clock
Oenothera biennis	Common evening primrose
Oenothera clelandii	Cleland's evening primrose
Penstemon grandiflorus	Large-flowered beard tongue
Physalis virginiana	Ground-cherry
Polygonella articulata	Coast jointweed
Potentilla arguta	Tall cinquefoil
Pteridium aquilinum	Bracken fern
Ranunculus rhomboideus	Early buttercup
Selaginella rupestris	Rock spikemoss
Silene sp.	
Solidago missouriensis	Missouri goldenrod
Solidago nemoralis	Gray goldenrod
Viola pedatifida	Bearded bird-foot violet

Graminoids

Andropogon gerardii	Big bluestem
Aristida basiramea	Base-branched three-awn
Aristida tuberculosa	Sea-beach needle-grass
Bouteloua curtipendula	Side-oats grama
Bouteloua hirsuta	Hairy grama
Calamovilfa longifolia	Sand reedgrass
Carex pensylvanica var. *digyna*	Sun-loving sedge
Cenchrus longispinus	Sandbur
Cyperus schweinitzii	Schweinitz's nut sedge
Eragrostis spectabilis	Purple love grass
Koeleria pyramidata	Junegrass
Leptoloma cognatum	Fall witch grass
Panicum commonsianum	White-haired panic grass
Panicum oligosanthes	Scribner's panic grass
Panicum perlongum	Long-leaved panic grass
Poa compressa	Canada bluegrass
Schizachyrium scoparium	Little bluestem
Sporobolus cryptandrus	Sand dropseed
Stipa spartea	Porcupine grass

Report on the targeted surveys for invertebrate species on the Anoka Sand Plain

Excerpted from "Surveys for Target Invertebrate Species on Selected Sites on the Anoka Sand Plain, 2008 and 2009". Dean C. Hansen, 2009

Edited by Erica P. Hoaglund, MN DNR

Introduction

Ten rare species of insects, and three rare species of jumping spiders, are presently, or were previously, found on the Anoka Sand Plain, and these species have been listed by the MN DNR as Species of Greatest Conservation Need. Because of their spotty known distribution, and their dependence on plant communities that have been greatly reduced in extent and quality since settlement, a survey to document their present occurrence and abundance was undertaken in 2008 and 2009. Surveys were done on specific known oak savannas and prairies on dune areas in Sherburne, Anoka, and Chisago counties.

Both years proved to be years of low butterfly numbers in the upper Midwest. Wisconsin workers described the 2009 season thus: "The disturbing trend of decreasing Lepidoptera numbers noted the past several years continues. Jim Ebner experienced his worst season since 1940, with butterflies—including many usually common species--found in low numbers….Many common species were scarce or not observed at all. ….Ann and Scott Swengel reported [that]….*Hesperia ottoe* has declined precipitously, being seen in only one of its traditional sites…" Much the same was observed in Minnesota. Time and again I noted in my field notes "no leps [Lepidoptera] seen."

Only one of the target butterflies was seen: *Hesperia leonardus.* But it was seen in very good numbers. One of the two target species of tiger beetle was seen: *Cicindela patruela patruela.* While never seen in numbers, it was seen in several new locations. One of the two target species of jumping spiders, *Pelegrina (Metaphidippus) (Metaphidippus) arizonensis*, was found in good numbers in some spots, and at least present in some others.

The remaining species looked for, but not seen in either 2008 or 2009, were *Hesperia uncas*, *Lycaeides melissa samuelis*, *Speyeria idalia*, *Cicindela lepida*, and *Tutelina formicaria.* A decent possibility of eventually finding *C. lepida* and *T. formicaria* on one or more of these sites still exists, but *L. melissa samuelis*, and *S. idalia* are far less likely to be found.

Site Summaries

Oak Savanna Park Reserve

Oak Savanna Park Reserve was visited once (18 Sept.) in 2008, and no target species were noted. Noted, however, were two spots with fair amounts of hairy grama, significant because of its suspected status of obligate host plant for the Uncas skipper (*Hesperia uncas)*. The area was visited three times in 2009: 17 June, 8 July, and 26 August. On the June visit, over a dozen silk nesting retreats were found in the previous year's seed capsules of showy Penstemon on the northwest part of the Park, indicating the presence of jumping spiders. While not vouchered, a female *Pelegrina (Metaphidippus) arizonensis* was removed from her silk nest, identified, and released. Similar nests in the near vicinity were also examined, but the nests were not opened nor were the female spiders removed from the nests. While spider species than *P. arizonensis* build silk retreats in old Penstemon seed capsules, the very close resemblance of all the nests examined on this date suggest that unopened nests were also *P. arizonensis*.

On a visit on 8 July several more locations of hairy grama were noted, however, no adult *Hesperia uncas* were seen although this visit was during the expected flight period. Also found was one of only two spots with blue grama seen during survey activities; this species was likely planted as part of a prairie restoration along an old road or cut on the north edge of the Park. Three female *P. arizonensis* were also found, again in last year's Penstemon seed capsules.

The 8 August visit turned up the first C*icindela patruela* for the site; this specimen was vouchered.

Impressions on habitat, threats, and management needs and recommendations:

A pair of aerial photos from 1938 (BJL-5-39, 40) show extensive agriculture to the west and northwest of the park, mixed woods to the north, and a dry Clitty Lake being farmed or cut for hay. Also remarkable in the photos are the faint patterns of former stream braiding from the center to the northwest corner of the photo. Under a stereo viewer, the entire dune area rises gently from the southeast to the northwest. The sloping western edge of the dunes runs almost north-south. The northern dune edge is quite steep, running east-west just to the south of the bottomlands of the Elk River. The forest on the western part of the dunes looks fairly open, unlike its solid canopy today; 71 years after the

photos were taken. There are also areas of what appears to be open sand, with no trees and possibly no vegetation at all.

Several areas of habitat have changed such since these aerial photos as to provide limited open sand habitat for *C. lepida*. However, both the native and planted showy Penstemon appears to be providing suitable nesting habitat for *Pelegrina (Metaphidippus) arizonensis*, thus this plant should be encouraged in order to continue to provide habitat in a rapidly changing area.

Most non-wooded areas here are a mix of disturbance and naturalized non-native plants (e.g., smooth brome) with native prairie plants present as well. A main potential threat to the persistence of these openings is the invasion of eastern red cedar. It is likely that if these cedar were controlled original prairie vegetation could persist.

Future monitoring:

The open sand sites should be monitored for *C. lepida,* particularly in the last week of June and all of July. With the good numbers of showy Penstemon, silk nesting retreats should be examined for both *P. arizonensis* and for *Tutilina formicaria.* Areas with hairy grama should also be watched for the Uncas Skipper from mid-June to mid-July.

Bunker Hills Regional Park

The Park was visited twice in 2008, on 9 June and 31 August, and then only on the dune/savanna region [redacted] While not target species, the Dusted Skipper (*Atrytonopsis hianna)*, a species of some interest was found there on 9 June. This is a prairie/barrens obligate, using little and big bluestem for larval host plants. On 31 August 10 *H. leonardus* were found on or near blazing star in bloom, [redacted]

The Park was visited on nine days in 2009: 20 May; 3, 23 June; 2, 22, 28 July; 17 August; and 2, 10 September. Three target invertebrate species were found in the Park in 2009: *Pelegrina (Metaphidippus) arizonensis*, *Cicindela patruela*, and, for the second year, *Hesperia leonardus*. The latter species was seen in very good numbers on blazing star. Other non-target species of note were the butterflies *Euchloe olympia* and *Atrytonopsis hianna.* There were also several areas of hairy grama noted, and blue grama was noted in a small prairie restoration area.

Impressions on habitat, threats, and management needs and recommendations:

It appears that the remaining natural areas at Bunker Hills Regional Park offer the best possibility of having suitable habitat for several listed invertebrate species. Historically there may have been a larger amount of dune habitat available to these species and thus monitoring is needed to observe the effects of decreased habitat availability on species diversity and abundance. Any emphasis on maintaining natural type dune and prairie openings will likely lessen the pressure of decreasing habitat availability on these rare species. Invasive species control could also be considered as a counter measure to the loss of native habitat.

Future monitoring:

There seems a decent potential of future Uncas skipper observations in this area due to the presence of open areas and hairy grama. The Uncas Skipper should be sought again where this grass is present, from mid-June to mid-July.

Cicindela patruela should also be sought again to assess its current habitat preferences and get a better idea of its numbers. Several areas of open sand were noted and these should be looked at again for *C. lepida.*

More sweep netting, and checking bush clover for nesting retreats, to find habitat preferences for *Pelegrina (Metaphidippus) arizonensis* would also be desirable. *Tutelina formicaria,* although not found in either year, should also be looked for again.

Hesperia leonardus was found to be doing quite well wherever blazing star (either rough or dotted) was present. This population should be monitored, and management of prairie areas should include encouraging both the larval host plant for the species and the preferred adult nectar sources, rough and dotted blazing star.

Prescribed burning should also be monitored in the future along with the invertebrate species as fires can impact the populations of many.

Noted were some sites in open sand having the pits for an ant lion larva (Neuroptera). This group of insects is known from only a handful of sites in Minnesota and should be sought again.

Two butterfly species, the Dusted Skipper (*Atrytonopsis hianna*) and the Olympia (or Rosy) Marble (*Euchloe olympia*), were also found in the Park. These are both species of interest and should be monitored.

There is a very slight possibility that this park could support the Regal Fritillary. This species was found in two different years on the [redacted] which is less than 10 miles away. The species was also found decades ago on the former Fridley Dunes (UMN specimen), so it was once present in the region on habitat much like that remaining in a portion of the Park. Another slight possibility would be the presence of the Cobweb Skipper (*Hesperia metea*) and the Ottoe Skipper (*Hesperia ottoe*). The nearest known population of *H. metea* is in the barrens east of Danbury, WI, while the nearest known populations of *H. ottoe* are in Winona and Wabasha counties. The Mottled Dusky Winged Skipper, *Erynnis martialis,* would be a more likely possibility; 2009, unfortunately, proved to be a bad year for finding any species of *Erynnis* in this area although it was present in good numbers in the pine barrens east of Danbury, WI, in 2009. *Erynnis brizo,* the Banded Oak Dusky Winged Skipper, whose larval host plant is bur oak, has been found in the Park (UMN insect collection, 1942). It should be sought again. The UMN's only specimen of *E. horatius*, the Brown Dusky Winged Skipper, was found in 1932 on the Fridley Sand Dunes (these are now nearly all lost to suburban development). Again, the location of this old record is fewer than ten miles away, so the species should be looked for in the Park. Its larval host plant is red oak, of which the Park has plenty.

It would be exciting to locate a viable population of any of these butterfly species in the Park.

Cedar Creek Natural History Area

Cedar Creek Natural History Area was visited on 17 September, 2008, and 25 June, 2009.

Pelegrina (Metaphidippus) arizonensis was observed at two locations here in 2008 and again at one site in 2009. Although one site visited in 2008 is in the same area where Bruce Cutler took *Tutelina formicaria* years ago none were found during this survey. Historical locations of Karner blue butterflies were also visited with no success.

Future monitoring:

The old field to the east of the [redacted] between Sections [redacted] should be checked for *Pelegrina (Metaphidippus) arizonensis*—there was considerable bush clover there. *Hesperia leonardus* was previously reported from this field, and it should also be sought here again. The

two small dry prairies in the [redacted] where *Tutelina formicaria* had been previously found, should be checked again for this species and for both *P. arizonensis* and *H. leonardus.* It would seem that *C. patruela* could turn up on any of the trails through the oak woodlands and oak savannas. The dry prairie in the [redacted] where *P. arizonensis* was found in 2008, should be checked for this species and for *H. leonardus.*

Helen Allison Savanna Scientific and Natural Area

The site was visited on five dates in 2008 (4, 17 June; 15 July; 31 August; and 9, 17 September) and four dates in 2009 (3, 25 June; 23 July; and 13 August). *Pelegrina (Metaphidippus) arizonensis* was found there on nearly every visit, in silk nesting retreats in the previous year's Penstemon seed pods, in similar retreats in the previous year's seed heads of bush clover, or in sweep samples from open areas. *P. arizonensis* was also found in moderate numbers when sweeping goldenrod, dotted mint, and sage (*Artemesia*) plants; they were even found sweeping short (1-2 meters high) Scotch pine trees and grasses with no forbs.

On a visit on 31 August, 2008, with *Liatris* in full bloom with hundreds noted in a single field, however, no *H. leonardus* were seen. On 13 August, 2009, however 6 *H. leonardus* were observed at *Liatris* on the site; these were the first sightings of the species for the year.

Two cast skins of *Tutelina* were found in last year's Penstemon seed capsules; whether they were *T. formicaria* or *T. elegans* could not be determined.

Hairy grama was noted at four spots, and several spots with open sand were noted and watched, without success, for *C. lepida*.

Impressions on habitat, threats, and management needs and recommendations:

The very high quality of the habitat at this site was the overarching impression during surveys. Very little encroaching exotic species or trees were observed.

Future monitoring:

This site should certainly be monitored for the presence of *Tutelina formicaria.* The status of *Pelegrina (Metaphidippus) arizonensis* appears quite healthy at this site, but continued periodic monitoring is suggested.

The open sand blows should be looked at again the last week of June through July for *C. lepida*.

Orrock Dunes, in Sherburne National Wildlife Area

This small site, a part of the much larger Sherburne National Wildlife Refuge, was visited later in the 2009 season: 31 July; 12, 24 August; and 10 September. The more open dune area is just north of the highway and has some open sand. Despite the impressive abundance of hairy grama at this site, no Uncas skippers were observed. On 10 September 2009 *Pelegrina (Metaphidippus) arizonensis* was however, found. 11 specimens were netted sweeping in both the sand prairie and in the former cultivated field.

Impressions on habitat, threats, and management needs and recommendations:

Fire and prescribed burns should be monitored as their effects on invertebrate populations can be severe if no refugia of unburned habitat are left.

Future monitoring:

The extreme abundance of hairy grama suggests that surveys for the Uncas Skipper should be continued in the area.

Rice Lake Scientific and Natural Area

This site was visited on 2 June and 18 September, 2008, and on 8 July, 2009. Several blazing star plants were noted but no target butterflies. Sweeping for jumping spiders on these visits was unsuccessful, and the only butterfly noted was a Coral Hairstreak on butterfly milkweed on 8 July, 2009.

Future monitoring:

Pelegrina (Metaphidippus) arizonensis should be sought on the site in bush clover on the small remnant prairie. *H. leonardus* could also be sought at the few blazing star plants.

Sand Dunes State Forest

The highest quality habitat in this area is the southwest-facing hillsides where there is the most open prairie vegetation. They are easily accessible by hiking north along the [redacted] Another hill prairie just under a mile to the west on this main group, was also visited in 2009, as were an old field, a prairie remnant, and an overgrown dune area just to the north.

The hill prairies were visited twice in 2008: 24 June and 30 August. They were visited seven times in 2009: 28 May; 12, 26 June; 20 July; 12, 18 August; and 10 September. *Cicindela patruela* was found here on 24 June, 2008 and 30 August, 2008. *Hesperia leonardus* was found here on 30 August, 2008, and 18 August and 10 September, 2009. No other target invertebrates were seen. While both hairy grama and open sand blows where observed neither the Uncas Skipper nor *C. lepida* were found.The [redacted] portion of the dunes was visited only in 2009, on 12 June, 7 July, and 24 August. While the 7 July date would have been during the flight period of *H. uncas*, and the species had been found here previously, no specimens were seen on this (or any other) visit. *Hesperia leonardus* was found on roadside *Liatris* on 24 August, as was an ant lion adult.

Impressions on habitat, threats, and management needs and recommendations:

The many habitat changes that have occurred in this area in the last decades are the most likely cause for the absence of several of the more rare and previously documented species. The loss of open sand blows and open sand prairies have left little viable habitat for these species to persist in

A few of the more hardy species such as *H. leonardus* have persisted despite this habitat loss, but those more sensitive species have either been extirpated or have such low abundances as to make them very difficult to document.

Open prairie and dune habitat should be promoted whenever possible for the potential recovery of these species.

Future monitoring:

Continued monitoring for *Hesperia uncas* is recomended. *H. leonardus* should also be looked for and documented from additional sites.

Cicindela patruela should be sought again, particularly on the [redacted] portion of the dunes. There were some areas of open sand noted on both the main and [redacted], and these should be watched from roughly 25 June through July for *C. lepida*.

Showy Penstemon and bush clover should be examined for the two target jumping spiders, *Pelegrina (Metaphidippus) arizonensis* and *Tutelina formicaria.*

Sherburne National Wildlife Refuge

This site was visited five times in 2008: 2 June, 22 August, and 5, 9, and 18 September. Several of the target tiger beetle, *Cicindela patruela,* were seen on 9 September, and the Dusted Skipper (not a target species but one of interest), *Atrytonopsis hianna*, was seen on 2 June.

The site was visited on six days in 2009: 2, 15, 17 June; 13, 31 July; and 26 August. An extensive area with lupine in bloom was searched for the Karner Blue and *Erynnis persius* during the June dates, when both species would have been in flight, but neither was seen. *Cicindela patruela*, true to its "spring-fall" life cycle, was seen on 17 June and again on 26 August, but not during the July visits. *Pelegrina (Metaphidippus) arizonensis* was found sweeping showy Penstemon and bush clover stands, and what appeared to be the silk nesting retreats for the species were also seen in showy Penstemon seed capsules. A mature female *Tutelina elegans* was taken from a silk nesting retreat in a showy Penstemon seed capsule. Two cast skins of some species of Tutelina were also taken prying open last year's seed capsules of showy Penstemon. While the striped forelegs showed they were clearly *Tutelina*, diagnostic genitalic features were not yet developed. They could have been from either *T. elegans* or *T. formicaria*.

The most extensive stands of hairy grama observed in any survey site were noted, but no Uncas Skipper where observed.

Despite spending some time looking for *Hesperia leonardus* on the numerous stalks of rough blazing star in bloom on 26 August, 2009, none were seen, although the species was out in numbers elsewhere that day.

Impressions on habitat, threats, and management needs and recommendations:

Prescribed burns should be monitored here as well as in the other survey sites. As mentioned before burns can decrease invertebrate abundance if consideration is not given to providing refugia for them.

Future monitoring:

The extensive stand of lupine in the savanna should definitely be monitored for the Karner Blue Butterflies and the extensive stands of hairy grama for *Hesperia uncas* . The species should be looked for from mid-June through mid-July, and then again in mid-August (if, indeed, a second brood ever occurred in this population).

Cicindela patruela should be looked for in other spots on the savanna and even in the oak woods; they often are found on small trails or two-track roads.

Both *Pelegrina (Metaphidippus) arizonensis* and *Tutelina formicaria* should be looked for again, both in their silk nesting retreats in showy Penstemon, and the former in similar silk retreats in bush clover. *T. formicaria,* because it is an ant mimic, should also be looked for near ant hills.

Uncas Dunes Scientific and Natural Area,

Southeast Unit

The site was visited twice in 2008: 18 June and 4 September. *Pelegrina (Metaphidippus) arizonensis* was found on the June visit, and, despite poor (overcast, cool) weather, 5 *Hesperia leonardus* were found on the September visit.

2009 saw seven visits: 28 May; 12 June; 7 July; 18, 24, 26 August; and 10 September. The 7 July visit was during the expected flight period of the Uncas Skipper, but none were seen. The Rosy Marble butterfly, *Euchloe olympia*, while not a target species, was seen on 28 May. Two specimens of *Cicindela patruela* were seen on 12 June. Several locations of hairy grama were noted on 7 July, as were larval ant lion traps and an adult ant lion. In late August, *Hesperia leonardus* appeared and over 140 adults were observed nectaring on rough blazing star or perching on the ground on the three late August visits. A few were still in flight two weeks later, on 10 September, when another *C. patruela* was seen.

Impressions on habitat, threats, and management needs and recommendations:

Habitat in this area was of generally high quality. The control of the encroaching cedar trees would be recommended, along with the maintenance of some of the open sand blows.

Future monitoring:

Uncas Skipper should be sought as they have been historically found in similar dune habitats in the area. *C. lepida* should be sought in the open sand blows. *Pelegrina (Metaphidippus) arizonensis* and *Tutelina formicaria* should also be sought in Penstemon seed capsules.

Uncas Dunes Scientific and Natural Area, Main Unit

The site was visited four times in 2008: 18 June and 4, 9, and 18 September. The Dusted Skipper, *Atrytonopsis hianna*, was seen on the SNA on the June visit, and was an Eastern Pine Elfin, *Callophrys niphon* was seen near the [redacted] Spots with hairy grama were noted on 4 September, and *Hesperia leonardus* was seen nectaring on *Liatris* on 9 September.

The site was visited four times in 2009: 2 and 26 June; 10 July; and 24 August. *Pelegrina (Metaphidippus) arizonensis* was found here on a showy Penstemon seed capsule on 26 June. Several sites with hairy grama were noted on 10 July. A female *Tutelina* was disturbed from her nest in a 2008 showy Penstemon seed capsule; unfortunately, she dropped to the ground and escaped so it was not determined whether she was *T. formicaria* or *T. elegans*. Five *Hesperia leonardus* were seen nectaring on *Liatris* on 24 August.

Judging from the collection or observation dates Ron Huber (pers. comm.) put together from the known records of *H. uncas* in the state, the 26 June visit would, in a normal year, have been at the peak of the flight period of *H. uncas*, and the 10 July visit would have been towards the end. 2009 was a dry year, however, and possibly the flight period of *H. uncas* was delayed. Despite this timing however, the species was not seen.

While open sand blows are present, I did not see *C. lepida* on the site. *C. patruela* was also not seen here.

Impressions on habitat, threats, and management needs and recommendations:

Much of the orginal habitat that supported the Uncas Skipper in this area is no longer suitable because of its conversion to less open habitat. That is likely the chief cause for their apparent rarity in this area in the present day.

Future monitoring:

Despite the recent failures to find it, the Uncas Skipper should still be sought in this area.

Both target jumping spiders, *Pelegrina (Metaphidippus) arizonensis* and *Tutelina formicaria*, should be sought again, either in showy Penstemon seed capsules, bush clover seed heads, or sweeping vegetation.

Both target tiger beetles, *Cicindela lepida* and *C. patruela*, should be looked for again.

Wild River State Park

The Park was visited four times in 2008: 16 and 19 June; 21 August; and 16 September. Because of the limited amount of target habitat surveying was confined to two small sections of suitable habitat in the park,

One target invertebrate, *Pelegrina (Metaphidippus) arizonensis*, was found throughout all survey activity. Lupine, in bloom, was checked for Karner Blue adults or ant activity on 16 June; neither were seen. A south-facing hillside was checked on 19 June. Plants seen included a puccoon (in low numbers), spiderwort, showy Penstemon, bush clover, and *Stipa*. The four stalks of 2007 showy Penstemon found were checked for spider nesting retreats, but none were seen.

P. arizonensis was found, however, fairly commonly in 2007's showy Penstemon stalks, particularly just north of [redacted]

The Park was visited once, on 11 June, in 2009. The lupine in the oak savanna was checked, without success, for the Karner Blue. A few nesting retreats for *P. arizonensis* were noticed in the remaining stalks, and one specimen was taken.

Impressions on habitat, threats, and management needs and recommendations:

While the oak savanna habitat in the park is limited, much of it that is there is of decent quality. As stated before burns should be done carefully in these areas so as not to trap feeling invertebrates with no place to flee. Another consideration is when seed collecting some Penstemon seed heads should be left for use by both *P. arizonensis* and two *Tutelina* species.

Future monitoring:

Pelegrina (Metaphidippus) arizonensis is undoubtedly secure in open areas, given showy Penstemon or bush clover for nesting retreats. While not seen in either year, both *Tutelina* species should be looked for again.

The Karner Blue butterfly has been found in the barrens area east of [redacted] to the southwest of [redacted] is about 16 miles to the northeast, [redacted] is about twenty-five miles to the northeast, and the [redacted] is about forty miles to the northeast. Because of this proximity some monitoring should be conducted.

While not seen on any of the visits, *Cicindela patruela* could be present and should be looked for, especially on trails through a more open woods. Any open sand blows should checked for *C. lepida*.