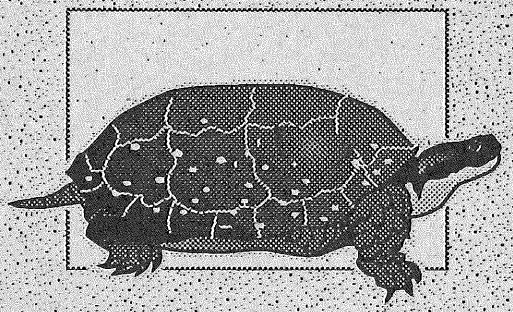
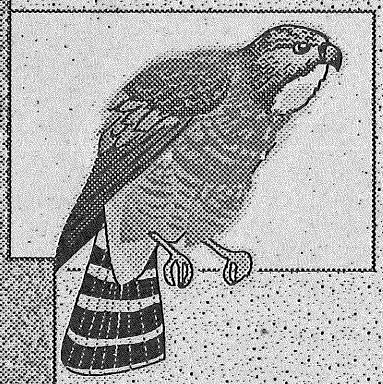
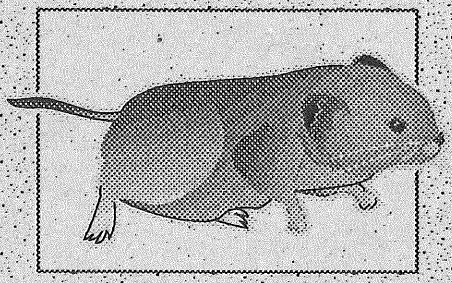


ANIMAL SURVEYS AT THE MINNESOTA ARMY NATIONAL GUARD CAMP RIPLEY TRAINING SITE 1991 - 1992



Minnesota County Biological Survey

March, 1993



SOTA DEPARTMENT OF NATURAL RESOURCES – BIOLOGICAL REPORT NO. 40

ANIMAL SURVEYS AT THE MINNESOTA ARMY NATIONAL GUARD CAMP RIPLEY TRAINING SITE 1991-1992

FINAL REPORT

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SUMMARY

The Minnesota Department of Natural Resources (DNR) agreed to conduct animal surveys at the Camp Ripley National Guard Training Site as part of a Department of Defense program designed for long-term monitoring of natural resources on military installations. The DNR's Minnesota County Biological Survey (MCBS) conducted the surveys as part of a larger effort to survey the natural features of Morrison County. During 1991 and 1992, two methodologies were employed for the animal surveys at Camp Ripley. Sixty predetermined Land Condition-Trend Analysis (LCTA) core plots were surveyed for birds and mammals using LCTA methodology designed by the U.S. Army Corps of Engineers Construction and Engineering Research Laboratory. In addition, baseline surveys were conducted using standard MCBS methodology that focused on rare animal species and included surveys for birds, mammals, herpetofauna, fish, butterflies, riverine mussels, and aquatic invertebrates. Final reports for fish, butterflies, riverine mussels, and aquatic invertebrates were completed by individual surveyors and include recommendations not mentioned within this report.

A total of 126 bird species were documented within Camp Ripley during the breeding season. This included six state-listed species consisting of the federally and state threatened Bald Eagle, and five state special concern species: Red-shouldered Hawk, Osprey, American Bittern, Yellow Rail, and Upland Sandpiper. In addition to these listed species, a Great Blue Heron nesting colony and Trumpeter Swans were documented within Camp. Eighty-four bird species were recorded on the 60 LCTA plots. Three birds most frequently surveyed on the core plots were the Red-eyed Vireo, American Redstart, and Ovenbird. Baseline surveys consisted of 67 point counts conducted at 25 sampling sites, resulting in a total of 71 species. Playback surveys were conducted for Red-shouldered Hawks and Yellow Rails.

Forty-one species of mammals were documented within Camp Ripley during the two years of surveys, including the Prairie vole, a species of special concern in Minnesota. LCTA surveys documented 18 species of small mammals on the 60 core plots, capturing a total of 1,475 individuals in 1991 and 775 in 1992. The White-footed mouse and Southern red-backed vole were the most frequently captured small mammals. Sixteen baseline sites were sampled for small mammals resulting in a total of 11 species.

Twenty-two species of herpetofauna were documented during the two field seasons. These consisted of 14 amphibians, and eight reptiles, including the federal candidate and state threatened Blanding's turtle, and two special concern species: Snapping turtle and Eastern hognose snake. Sampling efforts consisted of drift fences, turtle trapping, anuran surveys (frog and toad calls), and terrestrial searches. A special effort was made to locate traditional nesting sites of the Blanding's turtle.

Forty-one species of fish and 107 taxa of aquatic invertebrates were documented in lakes, rivers and streams of Camp Ripley. Sixty-five species of butterflies were documented throughout Camp Ripley. Mussel surveys conducted on the Mississippi and Crow Wing rivers documented eight species of mussels. No rare species were documented in any of these surveys.

Animal surveys conducted during 1991 and 1992 represent the initial efforts of a long-term monitoring program. The results of these two years of surveys have provided insight into areas of significant wildlife habitat at Camp Ripley, and management recommendations have been proposed to ensure the protection of rare species. Based on the presence of rare species, high priority forested areas, grasslands and wetland complexes have been designated as significant wildlife areas. Surveys are recommended to locate additional rare species and to monitor those that are known to occur within the Camp. Special use plots should be established to augment the core plots and provide data for areas currently lacking information. Management guidelines should be established to ensure the protection of rare species.

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INTRODUCTION

Military installations play a vitally important role in military field training. Additionally, by virtue of their large land area and restricted access, these installations serve as unique land preserves for natural communities of the region. Concern over potential damage to the environment from military activities has resulted in a nation-wide initiative to evaluate and monitor impacts of these activities on the natural resources contained within military bases. As part of an interdepartmental agreement between the Minnesota Army and Air National Guard Camp Ripley and the Minnesota Department of Natural Resources (DNR), the Minnesota County Biological Survey (MCBS) conducted animal surveys within the Camp Ripley Military Installation to address these concerns. Land Condition-Trend Analysis (LCTA) methodologies developed by the U.S. Army Corps of Engineers Construction and Engineering Research Laboratory (CERL) were utilized to collect data on predetermined survey sites for birds and mammals that were comparable with similar surveys on other installations. In addition, MCBS conducted baseline surveys using standard MCBS methodology that focused on rare animal species and habitats under-represented in LCTA surveys. Baseline surveys included birds, mammals and other animal groups such as herpetofauna, fish, butterflies, riverine mussels, and aquatic invertebrates. This report summarizes the results of these surveys performed during the 1991 and 1992 field seasons for birds, herps, and mammals. Sub-contractors, who conducted baseline surveys for fish, butterflies, mussels, and aquatic invertebrates, will submit separate reports and recommendations directly to Camp Ripley.

Land Condition-Trend Analysis

The LCTA program was designed by CERL to monitor impacts of military training on soil, vegetation and wildlife resources found in military installations. This program is currently in progress at approximately 50 U.S. army installations and three National Guard training sites. Objectives of the program are to 1) match training loads with land capabilities, thereby minimizing excessive soil erosion and the loss of tactical concealment cover, 2) minimize the need for expensive restoration programs, and 3) ensure long term availability of a sustainable training land resource. In addition, the LCTA program will move towards satisfying federal requirements of the National Environmental Policy Act of 1969 (P.L. 91-190, 83 Stat. 852) which requires documentation relating to the environmental effects of operations such as military training exercises, and monitoring to ensure that impacts are mitigated. The LCTA program and associated survey work will also enable Camp Ripley to meet federal and state laws regarding the protection of rare plant and animal species, and will provide data to aid in the planning of military activities and natural resource management practices to reduce impacts to such species.

Camp Ripley

Camp Ripley is located in central Minnesota in Morrison County. It was opened to Minnesota National Guard units June, 1931, and today is one of nine National Guard training sites in the United States. At 53,000 acres, it is one of the largest state-owned military installations, providing a training site for over 40,000 troops annually, including the National Guard and other branches of the Armed Services. Although Camp Ripley is utilized throughout the year, it is currently the primary winter training site in the United States. It provides diversified terrain for training in the use of a variety of weapons and equipment. Training facilities include the Miller Airfield, rappell tower, bridging site, two prisoner of war compounds, 95 training areas, two impact areas, and 45 established ranges. The ranges can handle everything from M-16's to eight-inch artillery and include an aerial gunnery range, demolition range, machine gun range, and tank range. Plans are underway to develop additional ranges in the near future.

Camp Ripley is located in the Pine Moraine ecological landscape region and is bordered by the Mississippi River to the east and the Crow Wing River to the north. The most striking geomorphic

feature of Camp Ripley is the northeast-southwest trending zone of the knob and kettle topography of the St. Croix Moraine (Sheridan 1991). Characteristic of this topography are irregular steep-sided knobs and ridges which typically rise 50 to 100 feet above adjacent lowlands. The greatest elevation in Morrison County exceeds 1,500 feet and occurs in the knob and kettle topography of Camp Ripley. The moraine is also characterized by having numerous small to medium-sized lakes, wet meadows, and fens. In contrast to the rugged moraine topography, the eastern edge of the Camp is primarily a level terrace of alluvial deposits of the Crow Wing and Mississippi rivers. The southwest portion of Camp Ripley consists of a complex of low lying, scoured channels and lakebeds with very low relief and high water table.

According to the original public land surveyor's records from the mid-1800's, the presettlement vegetation of Camp Ripley contained a high diversity of plant communities, including coniferous and deciduous forest, oak woodland and brushland, oak openings, upland prairie, wet prairie and marshes, conifer bog, and river-bottom forest. Mixed pine-hardwood forest dominated the area, with large tracts of white pine, red pine and red oak. Natural communities present today include large contiguous tracts of mixed oak forest with inclusions of aspen and pine; and a variety of wetland types including floodplain forest, black ash swamp, tamarack swamp, poor fen, wet meadow, and mixed emergent marsh. The most significant tracts of high quality, unfragmented, native vegetation are found at the north end of the Camp. Steep terrain and difficult accessibility have contributed to the low level of disturbance in this area. Through the years these natural communities have been greatly altered by human activities. Prior to the establishment of Camp Ripley the land was farmed, grazed, and logged. Military training activities and current timber management practices continue to alter the natural communities and landscape within the Camp. As a result, present day vegetation types in Camp Ripley also include large tracts of old field including non-native grasses, aspen regeneration, pine plantations, and second-growth hardwood forests.

In 1987, the Minnesota Department of Military Affairs and the Minnesota DNR established a cooperative agreement for the management of timber, minerals, fish, and wildlife within Camp Ripley. Currently, the Division of Forestry maintains tree plantations and manages timber resources within Camp. In addition, the Section of Fisheries utilizes lakes for muskie and walleye rearing and minnow production. Camp Ripley is a State Wildlife Management Area managed by the Section of Wildlife. The major wildlife management activity consists of an annual bow hunt which includes over 2,000 hunters with an average of 200-250 deer removed each year (4,500 hunters taking over 400 deer in 1992). Other wildlife management activities include scent post stations to monitor coyote populations, occasional beaver trapping, and management of nuisance animals. Nongame species, such as Bald Eagles and Osprey, have been monitored through a cooperative effort between the DNR Region 3 Nongame Program and Camp Ripley Environmental Staff.

The Minnesota County Biological Survey

The State of Minnesota initiated the MCBS in 1987 in recognition of the need to assess the status of the state's biological diversity and its unique natural resources. It is a systematic, county-by-county survey conducted by the Natural Heritage and Nongame Wildlife programs of DNR's Section of Wildlife, Division of Fish and Wildlife. The objectives of the MCBS are to collect biological information on the distribution and status of rare animals, rare plants, and natural communities.

Natural areas, representative of the Minnesota landscape prior to European settlement in the 1850's, are identified by MCBS plant ecologists. Such areas are made up of natural communities--distinctive groups of native plants and animals living together under similar environmental conditions (Minnesota Natural Heritage Program 1992a). MCBS also identifies locations of selected rare animals and rare plants. In

1991, surveys were conducted in Morrison County for natural communities, rare plants, and rare animals. Survey work conducted at Camp Ripley was part of the larger effort to survey the entire county. MCBS plant ecologists conducted natural area surveys in Morrison County. Camp Ripley was included within the survey and significant natural features were identified in a 1991 report (Sheridan 1991). The DNR Natural Heritage Program botanist prepared a collection of plant species found at Camp Ripley, including rare plants targeted by the MCBS. Rare animal surveys focused on species that are officially listed under the Federal Endangered Species Act of 1973, Public Law 93-205 or Minnesota Statute 84.0895. Listed species include federally and state endangered and threatened species and state special concern species (Coffin and Pfannmuller 1988). Endangered and threatened species are provided the highest level of legal protection under federal and state laws. In addition, MCBS targets species that are not legally listed or protected, including species proposed to be listed and species needing further documentation. A summary of animal survey staff and survey activities at Camp Ripley for 1991 and 1992 are presented in Table 1.

Data collected from MCBS surveys, including those from Camp Ripley, are maintained in the Natural Heritage Information System. Rare features and natural communities data are entered into the Rare Features Database. Presently over 14,000 locations (or records) are documented for the state in this database. Other databases, including plant releve' and county check-lists, Bald Eagle nests, and MCBS site logs, are maintained in the Natural Heritage Information System. Additional information on these databases or the rare features tracked by this system are available upon request (Minnesota Natural Heritage Program 1992b).

METHODS

Site Selection

Prior to initiation of the LCTA surveys, CERL identified permanent plots using an automated GIS site selection process (Tazik et al. 1991) that combined satellite imagery of vegetation cover with digitized soil maps to identify 20 landcover categories within Camp Ripley. Eighty-one core plots were chosen from these categories, proportional to the landcover types represented within Camp Ripley. From these 81 core plots, a subset of 60 plots were identified as LCTA wildlife plots (Fig. 1). Each wildlife plot was surveyed for birds and mammals for two consecutive years.

For purposes of analyzing the LCTA animal survey data reported in this document, seven broad habitat types were established based on dominant cover extracted from 1991 belt-transect vegetation surveys. Each of the 60 wildlife core plots were assigned to a habitat type (Table 2). A Plant Community Classification System (PCC), established by CERL for use at all military installations, was not available until 1993. PCC Codes (PCCC) specific to Camp Ripley were based on data obtained from the 1991 line-transect vegetation surveys. This resulted in nine different PCCC's assigned to the 60 wildlife core plots. A comparison of the seven habitat types and the nine PCCC's shows that the two systems are fairly compatible, although a few plots may need to be re-evaluated (Table 2).

Selection of baseline sites was based primarily on the targeted animal species and their preferred habitats. A list of target species was developed that included federally- or state-protected species (i.e. endangered, threatened, or special concern), non-listed rare species, and non-listed species lacking county documentation. Local resource managers were consulted for information regarding recent observations of target species or the presence of potential habitat in the area. Locations of specific habitat types, for example, sedge fens for Yellow Rails, were obtained from a review of available maps and photography, recommendations from MCBS plant ecologists, and ground reconnaissance to confirm suitability of the

sites. LCTA plots excluded wetland habitats and sites smaller than two hectares, however, these areas are part of the total complement of habitats represented at Camp Ripley and often are important to rare animal species. Thus, examples of these habitats were surveyed and smaller sites were considered for baseline surveys. Baseline sites containing important conditions or species were subsequently recommended as permanent special-use plots for future LCTA surveys.

Animal Surveys

LCTA methodology for bird and mammal surveys was adopted for all LCTA wildlife plots. These methods are described briefly below (refer to U.S. Army Field Methods for further details on LCTA survey design and data sheets (Tazik et al. 1991)). MCBS methods were used for all baseline plots and are described below.

Bird Surveys: Most of the bird surveys were conducted during the breeding season, late May through June. For LCTA plots, birds were censused using a modified point-count transect technique (Blondel et al. 1981). Plots were censused once in the morning and once in the evening by slowly walking the 100-meter transect, stopping at the end, and returning to the starting point. All birds seen or heard within 100 meters were recorded during the 20-minute survey. For each segment of the census, care was taken not to record the same individuals more than once. Depending on the weather and accessibility to the core plots, three to five plots were completed during one morning and evening period.

Baseline bird surveys incorporated several techniques, including point counts and playbacks. The primary technique employed was a modified fixed-radius point count method (Stucker 1992). At several points within a given habitat, all birds heard or seen during a six-minute interval were identified and evidence of breeding behavior or nesting was recorded. Points were spaced 200-250 meters apart and the exact number of points surveyed was determined by the size of the site. Playback surveys were utilized to locate particular species that respond to this technique. Taped hawk recordings were played between 0900 hours and 1400 hours to elicit responses from territorial pairs of breeding Red-shouldered Hawks. Large tracts of floodplain and upland forests were targeted for hawk playbacks. Yellow Rails were surveyed after sunset to document calling. Rocks were struck against each other to simulate the call of this secretive bird. Wet meadows and sedge fens were the focus of these efforts. In addition to directed survey efforts, incidental sightings were recorded for all species when encountered, including migrants.

Small Mammal Surveys: Small mammal surveys were conducted during late summer, July through August, when population levels are high. Small mammals were surveyed on LCTA plots by setting two rows of 20 Museum Special traps and five Victor rat traps parallel to the long axis of each LCTA plot. Traps were baited with a mixture of rolled oats and peanut butter. Traps were set during the late afternoon of the first day, checked and reset in early morning and late afternoon and run for two nights for a total of 100 trapnights per plot. Mammals collected were recorded on the LCTA Small Mammal Summary Data Form. Depending on the accessibility of the core plots, six to ten plots could be completed per team each week.

The baseline small mammal survey technique established 4x10-station trap grids, with one trap per station. The forty traps per grid included 16 Sherman live traps, 16 Museum Special traps, 4 cone pit-fall traps and 4 Victor rat traps. Traps were baited with peanut butter and oatmeal, set for four days and checked twice a day, for a total of 120 trapnights per grid. Data obtained from each specimen included species identification, sex, reproductive condition, age, and molt. After processing live mammals in the field they were marked and released. Other specimens were processed in the lab and selected captures were prepared as voucher specimens for Camp Ripley and the Bell Museum of Natural History at the

University of Minnesota. A very limited effort was made to identify bats at Camp Ripley. Mist nets were set along stream corridors at dusk and removed before dawn the following morning.

Herpetofauna Surveys: Herpetofauna surveys were conducted throughout the field season, May through September. LCTA methods were not used for surveying amphibians and reptiles. Based on discussions with CERL concerning the amount of effort involved and the effectiveness of the methods as described, it was agreed that MCBS survey methods would be employed. These methods included anuran call surveys, turtle searches and trapping, drift fences, and terrestrial searches. Incidental records of herpetofauna, such as snakes basking along roads, were recorded when encountered. Voucher specimens were collected and preserved for permanent storage at the Bell Museum of Natural History.

Anuran call surveys, which documented breeding frogs and toads, were conducted at night after 2200 hours during chorusing periods in May. Wetland locations were surveyed for five minutes, where all species calling were identified and the intensity of calls (an index of the number of calling individuals) were recorded.

Turtles were surveyed using visual searches and turtle traps in wetlands having suitable habitat. Spotting scopes and binoculars enabled surveyors to identify and document basking turtles. Turtle traps consisted of hoop nets which were baited with smelt, set in shallow wetlands, and checked every other day for one week. In addition, searches were conducted in early June for nesting females or turtle nests.

Drift fences were set in several habitat types to capture more secretive herpetofauna, such as salamanders, and to record seasonal movements of a variety of species. Drift fences, consisting of one to three 50-foot rolls of aluminum flashing, were set into the ground and oriented in linear configurations, depending on the topography of the site. Along the length of the flashing, eight to twelve five-gallon buckets were buried flush with the ground on either side of the flashing and funnel traps were set on the surface. Fences were installed in May, the buckets were open May through June and again in September. During these times, the buckets and traps were checked every other day and all herpetofauna captured were identified and removed. Buckets were closed during July and August when herpetofauna are generally inactive, and all drift fences were removed at the end of September.

Terrestrial searches involved actively searching a particular habitat or area, and hand-capturing all herpetofauna found. Logs and ground debris were turned over to check for concealed herps. This technique was useful for documenting snakes and skinks that might not be found using the other methods.

Blanding's Turtle Project: Several Blanding's turtles were documented at Camp Ripley during the 1991 herpetofauna surveys. This species is threatened in Minnesota and is a candidate for federal listing. Largely due to its protected status, a radio-telemetry project was conducted in 1992 to monitor the movements of female Blanding's turtles and to determine travel corridors and locate traditional nesting sites within Camp Ripley. Turtles were captured by hand or with the use of turtle traps, weighed, measured, photographed and marked prior to being released at the point of capture. Transmitters were placed on the rear marginal scutes of female Blanding's turtles. Turtles were monitored as frequently as time permitted throughout the field season, typically 1-2 times per week. Gravid females (females carrying eggs) were monitored more frequently during the nesting period, late-May through mid-June, in an attempt to locate nesting sites. At the end of the field season, all transmitters were removed.

RESULTS

Bird Surveys

A total of 126 bird species were documented within Camp Ripley during the breeding season (Appendix 1). Another 15 breeding species were documented in other areas of Morrison County and may also be present at Camp Ripley. Limited data collected on birds outside the breeding season recorded an additional 27 bird species considered migrants at Camp Ripley. Six state-listed bird species were documented as breeding within Camp Ripley, including the federally and state threatened Bald Eagle and five state special concern species: Red-shouldered Hawk, Osprey, American Bittern, Yellow Rail, and Upland Sandpiper (Table 3, Fig. 2). In addition to these listed species, a Trumpeter Swan was regularly observed in a wetland north of Normandy Road. This species was extirpated in Minnesota but currently is being reintroduced into the state. A Great Blue Heron nesting colony was found along the Mississippi River in the northeast portion of Camp.

Eighty-four species were recorded on the 60 LCTA wildlife plots during the two field seasons (Table 4). Two listed species were documented, Bald Eagle (plot# 32) and Red-shouldered Hawk (plot# 16). Species richness ranged from no species in an upland grass plot in 1991 (plot# 30) up to a maximum of 18 in another upland grass plot (plot# 37) that same year. In 1992, 67 baseline point counts were conducted at 25 sampling sites, documenting a total of 71 species, including two state-listed species, the Osprey and Red-shouldered Hawk (Fig. 3, Table 5). Habitats surveyed included coniferous-deciduous forest, deciduous forest, oak savanna, forest-grassland edge, grassland, emergent marsh, shrub swamp, tamarack swamp, floodplain forest, and black ash swamp. Red-shouldered Hawks responded to playback at four of 13 sites surveyed in 1991, and 13 of 33 sites surveyed in 1992. Yellow Rails were detected at three of four sites surveyed in 1991 and at both sites surveyed in 1992.

Mammal Surveys

A total of 41 species of mammals were documented within Camp Ripley during the two years of surveys, including the Prairie vole, a state special concern species (Table 3, Appendix 2). Survey efforts focused on small mammals, however, medium and large mammals were recorded when observed or other evidence of their presence was noted. Bats were under-represented because standard small mammal techniques are not suitable and a more intensive effort was required to document them. Other mammals have been reported as occurring at Camp Ripley but were not verified during the surveys in 1991 and 1992. These include Virginia opossum, Gray wolf, Gray fox, Lynx, and Moose. Red bat, Water shrew, and Norway rat were recorded from surveys conducted in other areas of Morrison County and, although not documented at Camp Ripley, are likely to occur there.

LCTA trapping efforts documented a total of 18 small mammal species, 14 species (1,475 individuals) in 1991 and 16 species (775 individuals) in 1992 (Table 6). Prairie voles were found on four grassland core plots over the two years of surveys (plot# 4,6,30,33; Fig. 4). Species richness ranged from one species in an oak forest (plot# 77) up to seven species in aspen regeneration (plot# 72). The highest number of captures was from a mature maple-basswood forest (66 individuals, plot# 16) in 1991, while no small mammals were taken from a mixed hardwood stand (plot# 78) in 1992. These illustrate the wide range in variation between individual plots, but do not indicate trends for particular habitat types. In fact, wide variation existed among plots of similar habitat. For example, while aspen regeneration plot #72 contained the highest number of species, another aspen regeneration plot (# 19) had only two, ranking among the lowest in species richness.

Baseline surveys censused a total of 21 additional areas. Habitat types sampled included grasslands (10

sites), sedge meadow, chamaedaphne bog, floodplain forest, black ash swamp, tamarack swamp (2 sites), oak savanna and coniferous(pine)-deciduous forests (3 sites) (Table 7, Fig. 5). A total of eleven species were documented among all baseline grids over the two survey seasons. All species, with the exception of a House mouse captured in a tamarack swamp, were also documented from the LCTA core plots. Prairie voles were captured from two grassland grids in 1991 (Fig. 4). Special effort was made in 1992 to locate additional grassland sites with Prairie voles, however, no new locations were found.

Bat nets were set over water corridors, as time and opportunity permitted, however, no bats were captured. At one set, several bats, one of which was identified on the wing as a Hoary bat, were observed flying through a forest opening along the Mississippi River. Bats became entangled in the net, but managed to free themselves before the field crew arrived to check the net. During a second set, several bats were observed flying repeatedly over and around the net without being captured. Their call frequencies suggested that they might be Little brown bats, however, a positive identification was not made. A desiccated specimen of a Big brown bat was found at the base of the Range Control building. Based on casual observation, bats were clearly more numerous and more species were present on the base than this report documents.

Herpetofauna Surveys

Twenty-two species of herpetofauna, including 14 amphibians and eight reptiles, were located within Camp Ripley during the 1991 and 1992 field seasons (Appendix 3). Listed species include the federal candidate and state threatened Blanding's turtle, and two state special concern species: Snapping turtle and Eastern hognose snake (Table 3, Fig. 6). The state-listed Western hognose snake was documented within Morrison County, but not in Camp Ripley.

Anuran call surveys were conducted at ten sites in 1991 and four sites in 1992, documenting seven of the nine anuran species in Camp Ripley (Table 8, Fig. 7). Both Cope's gray treefrog and the Eastern gray treefrog were documented at Camp Ripley based on their calls, since they cannot be separated visually in the field. Call surveys were conducted during May. This was too late to document early breeders, such as Wood frogs that breed in April. Late breeders, such as Leopard frogs, Green frogs, and Mink frogs were under-represented in numbers because their peak chorus period is in June. The primary objective of these call surveys was to document the presence of anurans at Camp Ripley. The same methodology can be used for long-term monitoring of breeding anuran populations, however, surveys should be repeated during early, middle, and late summer to ensure that all species are adequately censused.

During the 1991 and 1992 field seasons, hoop-nets were set in 20 wetlands, capturing ten Blanding's turtles, seven Snapping turtles, and numerous Painted turtles (Fig. 7). Six Blanding's turtles and six Snapping turtles were also documented traveling or actively digging nest cavities during the nesting season.

Drift fences, set in five different habitats, documented 12 species of herpetofauna (Table 9, Fig. 7). Habitats sampled were deciduous forest, floodplain forest, forest edge, lakeshore edge and grassland. Species richness ranged from a high of ten species in the deciduous forest to a low of five species in the edge habitats. The greatest number of captures occurred in the deciduous forest habitat where a total of 190 animals were recorded. The fewest captures were from the forest edge habitat where only 15 animals were captured. The American toad, Wood frog, and Leopard frog were present in all five habitats, although their abundance varied greatly. For example, only two Leopard frogs were captured in the deciduous forest habitat compared to 146 captured in the grassland. The Central newt, a relatively rare

species in this area, was taken from the deciduous forest drift fence. The drift fences provided valuable data on presence of secretive species, seasonal movements of emerging froglets and relative abundances of herpetofauna among the different habitats. However, they were a biased sample of the total herpetofauna in the area. Species-specific behavior and morphology greatly influence their susceptibility to being captured by this technique. For example, the two treefrogs, Spring peepers, and Chorus frogs were documented from the Camp by anuran call surveys. However, due to their ability to climb out of the plastic buckets, they were poorly represented in the drift fences.

Terrestrial herp searches were conducted in deciduous forest, upland shrub, savanna and grassland habitats. Red-bellied snakes, Eastern garter snakes, Blue-spotted salamanders and several species of frogs were documented from these habitats. Several incidental sightings of Eastern hognose snakes were made while traveling on gravel roads throughout Camp.

Blanding's Turtle Project: Ten Blanding's turtles, seven males and three females, were captured at Camp Ripley in 1992 (Table 10). Nine were captured in hoop-nets from mid- to late May and one was hand-captured in early June. Although hoop-nets were set in 13 different wetlands, Blanding's turtles were captured in only three. The females were radio-tagged and tracked intensively during early June and intermittently during the remainder of the summer. Blanding's turtles were concentrated at the wetland south of Normandy Road during mid-May, when seven individuals were captured. This was also the only site were females were captured in hoop nets.

During late May, two female Blanding's turtles (#2000, 2007) were frequently found basking among the sedges and willows on the western edge of the wetland. The turtles were underneath the dead standing vegetation and hidden from view. On one occasion, a male (#2001) was also located among the sedges. The warmth of the sun may have promoted egg development in the females, particularly when compared to the water temperature in the adjacent wetland.

Female #2007 began staging toward her nesting site on 2 June when she was located at the south end of the wetland. She was later found in the grassland directly south of the wetlands on 3 June at 1200 hours. By palpating the eggs within her inguinal area, it was apparent that the eggs were fully developed and massive. Due to an unexpected shift in #2007's frequency, she was not relocated until 2300 hours on 3 June, when she was found in a wetland complex 750 meters to the south of her location earlier that day. It is presumed that she laid her eggs in the field between these two wetland complexes. She remained in that wetland throughout the summer and up to the time her transmitter was removed on 22 September.

Female #2000 was also gravid and remained at the wetland south of Normandy Road until 10 June, when she traveled to the wetland directly north of Normandy Road. On 12 June, she moved north of the wetland, traveling through forested areas. Repeated attempts to locate #2000 were unsuccessful. This may have been caused by the dense forest cover or unexpected changes in the transmitter frequency. The location of her nest site was never determined. She was not relocated until 29 September, when she was found in a small emergent marsh adjacent to Kodiak Road, 1,500 meters from her initial point of capture.

The third female was captured by hand on 9 June at the known nesting site directly southwest of Goose Lake. She was not gravid, nor did she appear to have deposited eggs. Due to the shortage of females located during this field season, a transmitter was attached to her carapace to determine habitat use over the summer months. Unfortunately she was not relocated until 21 September when her transmitter was removed. She was overwintering in a sedge meadow 150 meters west of the Camp boundary. She was found in the only visible opening of a floating sedge mat.

On 9 June, a Blanding's turtle nest was discovered in the traditional nest site southwest of Goose Lake. This area was first documented as a nest site in 1991 when three Blanding's turtles were observed at the site. The newly discovered nest was on the sandy-gravelly slope on the west side of Luzon Road. The site was on a sparsely vegetated east-facing ridge and located 1.5 meters from the top. The nest contained 18 eggs which were approximately 6 centimeters from the surface of the soil and 15 centimeters deep. Eggs were removed from the nest being careful to replace them with the air-bubble on the top side of the egg. On 16 September the nest was checked to determine the status of the nest. The nest appeared intact and two of the 18 eggs were removed. Although the shells were damaged in removing the eggs, the young turtles had large yolk sacs and appeared healthy. The turtles were retained to absorb their yolk sacs prior to being released on 21 September in a floating mat of vegetation on the south end of Goose Lake. The nest was still intact on 29 September, when it was checked for the last time in 1992. The nest and its remaining eggs should be checked during the spring of 1993 to determine the survival rate of the young turtles over the winter.

Other Baseline Surveys

Final reports summarizing the results of surveys for aquatic invertebrates and fish have been completed by the subcontractors and submitted to Camp Ripley. Over 107 distinct taxa of aquatic invertebrates were collected from 15 lakes and three streams within Camp Ripley (Montz and Hirsch 1993). Fish surveys were conducted at 44 stations including marshes, lakes, and creeks within Camp Ripley and rivers bordering the Camp. Forty-one species of fish were documented (Schmidt 1992). Final reports for butterfly and riverine mussel surveys are still being prepared. Sixty-five species of butterflies were collected at Camp Ripley (D. Hansen pers. comm.). Mussels surveys were conducted on the Mississippi and Crow Wing rivers, where eight species of mussels were recorded (R. Bright pers. comm). No rare species were documented in any of these surveys.

DISCUSSION

The animal surveys of 1991 and 1992 provide the first detailed look at the fauna of Camp Ripley. As a result of these surveys, a total of 192 species of birds, mammals and herpetofauna were identified as breeding or residing permanently on the Camp. The value of the data obtained from the LCTA and baseline surveys extends well beyond the boundaries of the installation. Documentation of 18 new county records of mammals and herps for Morrison County were obtained as a result of this effort (11 and 7, respectively). A total of 78 locations of state- or federally-listed species were documented at Camp Ripley, including six bird species, one mammal species, and three herp species. The number and diversity of rare animals, as well as the more common species, found at Camp Ripley underscores the importance of this installation to wildlife. The observations and recommendations presented in this section are based on the 1991 and 1992 survey data, in full recognition of its status as a preliminary report of a long-term effort to monitor and evaluate the natural resources at Camp Ripley. Several more years of data collection on core plots and special use plots is necessary before an accurate and comprehensive assessment of critical areas to rare animal species can be established. A larger body of data needs to be obtained before observed changes in animal population levels can be appropriately interpreted in terms of land use and management practices at Camp Ripley.

Birds

Camp Ripley and adjacent forests outside the Camp have the highest concentration of Red-shouldered Hawks known in the state. This state special concern species inhabits mature deciduous forests, particularly floodplain and other lowland hardwood forests. The primary threat to this species is loss and

degradation of forest and wetland habitat. Morrison County has 41 of the 139 (29%) Red-shouldered Hawk records in the DNR's Rare Features Database and of these, nearly half are from Camp Ripley. The remainder of the Morrison County records are concentrated near Camp Ripley, in the vicinity of Lake Alexander. The majority of the Red-shouldered Hawks from the Camp Ripley-Lake Alexander area were recorded in upland deciduous forests. This is somewhat unusual since elsewhere in Minnesota, as well as in Iowa, this species is far more common in floodplain forest than upland forest stands. It is not fully understood why Red-shouldered Hawks are so common in the upland forests of northern Morrison County, however it is probably related to the presence of large tracts of mature deciduous forest with an abundance of small lakes and other wetlands. Small wetland openings seem to be an important habitat component for this species. In addition, Red-shouldered Hawks typically nest in large forested tracts. The minimum area requirement for nesting Red-shouldered Hawks in the Middle Atlantic States was 555 acres (Robbins et al. 1989), and 242 acres for 12 nests in Iowa (Bednarz and Dinsmore 1982). In Missouri, forest stands with nests were characterized by a tall and relatively closed canopy, a mean tree density of 179-360 trees/acre, and variable shrub and ground covers. Trees were relatively large with mean tree diameter at breast height (dbh) ranging from 7.0-8.6 inches and a mean basal area of 100-159 feet^2/acre (Hands et al. 1989). In the Midwest, nests have been placed in a variety of tree species including oak and birch, however, the species of the nest tree apparently is less important than the structure of the tree (Bednarz and Dinsmore 1982). Nests are built in large trees averaging 82-95 feet tall and 18-25 inches in dbh (Hands et al. 1989).

Within Camp Ripley, forest tracts where breeding Red-shouldered Hawks were found have been identified as significant wildlife areas (Fig. 8). Forests should be managed to preserve large trees for nest-sites, and should maintain tree densities of 150-400 trees/acre (Bednarz and Dinsmore 1981). Selective cutting should not be permitted (Bryant 1986), particularly in forested areas with small lakes and wetlands. Establishing an annual survey of breeding Red-shouldered Hawks at Camp Ripley is recommended. Using the playback technique at permanent survey stations will enable the Camp to monitor population trends of this species. Several research topics could be addressed at Camp Ripley regarding management and life history of the Red-shouldered Hawk (Hands et al. 1989). The resulting information would be valuable not only to Camp Ripley, but could also provide insight into management elsewhere in the range of this species.

Other state-listed birds associated with forested tracts at Camp Ripley included the Bald Eagle and Osprey. Three Bald Eagle nesting territories were identified on Camp Ripley. This species, which is federally and state threatened, has been making a recent comeback in the region. Identifying new nests and monitoring the success of known nests is very important to assessing the status of this species. Nesting territories were identified at Hole-in-Day Marsh, Mud Lake, and along the Crow Wing River. The Hole-in-Day territory contains two nests, one of which was active during both years that animal surveys were conducted. The Mud Lake territory contained a single nest that was active both years and young were produced. The Crow Wing River territory was first discovered in 1991 by regional DNR Nongame staff. Subsequent monitoring of the nest revealed that it was active but failed in both 1991 and 1992. A management plan has been drawn up for the Crow Wing River territory, which follows management guidelines established by the Bald Eagle Recovery Plan to minimize disturbance near the nesting territory (Minnesota Department of Natural Resources 1984). Information on the occupancy and nesting success of these Bald Eagles is maintained by the Bald Eagle database, part of the Natural Heritage Information System at St. Paul.

Ospreys, state special concern species, have been recorded as nesting on a Sylvan Dam power pole for several years and young were observed at the nest during the 1991 animal surveys. During the winter

of 1991-92, the nest was removed from the power pole and reconstructed on a platform nearby. It was subsequently occupied by a pair of Osprey during summer, 1992. Although the nesting birds have been fairly tolerant of human visitation at the site, nest occupancy and nesting success should be monitored.

The importance of forested habitats to breeding birds is further supported by the number of species documented from forested wildlife core plots. These plots contained the highest species richness for breeding birds (Appendix 4). Forest-specific bird species, such as Pine Warblers that breed exclusively in pine forests, were documented on these plots, in addition to more generally-adapted species. Table 11 shows the relative abundance of breeding birds at Camp Ripley and indicates the habitat types where they are expected to occur. Many bird species found in forested sites are fairly tolerant of fragmentation and disturbance. However, a number of species, including most "classic" forest species, are more sensitive to disturbance and are generally associated with large tracts of forest. These include species such as Red-eyed Vireo, Least Flycatcher, Ovenbird, Scarlet Tanager, and Eastern Wood-Pewee. Forest interior birds have shown long term population declines in much of the eastern U.S. (Terborgh 1989). Factors responsible for the decline may include habitat loss on breeding and/or wintering grounds, as well as nest predation and parasitism. Although in Minnesota, much forested habitat remains and many forest interior species are still relatively common, steady, long-term declines indicate that these species are much less abundant than 20-30 years ago.

The Brown-headed Cowbird, a species that parasitizes the nests of other birds, has been implicated as one of the major causes of declines in forest interior birds (Terborgh 1989). Cowbirds were historically a prairie species, but they have greatly expanded their range and numbers with the clearing of forests and increases in agriculture, and now occupy a wide variety of habitats, including forest edges. Rates of nest parasitism may be so high in small forest fragments that reproductive success of forest interior birds is greatly reduced. Forest habitat at Camp Ripley includes both large contiguous tracts and many small fragmented stands.

Brown-headed Cowbirds were absent from 14 of the 41 forested LCTA core plots during the 1991 and 1992 bird surveys. Eleven of the 14 core plots without Brown-headed Cowbirds are located within relatively large stands of mature forest (tree cover sizes 5-8, based on DNR Phase II forest inventory maps; Fig. 9). Other forested areas in the installation were not sufficiently surveyed by LCTA or baseline wildlife plots and may merit additional surveys to evaluate their importance to forest interior birds relative to other tracts. Special use plots could be established in the forested area southeast of the southern impact area, southwest of Pantano Road, and the floodplain forest along the Crow Wing and Mississippi rivers in the northern portion of Camp. The distribution and abundance of Brown-headed Cowbirds within Camp Ripley may be a useful indicator of forest quality in terms of their value to forest interior birds. However, the impact of cowbird parasitism on forest bird species must be viewed on a landscape perspective and consider forest tracts beyond the boundaries of Camp Ripley, as well as those on the base.

More than one-half (130 species) of Minnesota's 234 breeding bird species are typical of forested habitats, while wetlands and open habitats support 70 and 34 species, respectively (Green 1991). The interspersion of different habitats typical of much of Minnesota, including Camp Ripley, usually results in high species richness. Birds typical of forests, grasslands and wetlands may be found together where preferred habitats interdigitate with one another. This patchiness of habitat types, which is the case for much of Camp Ripley, complicates comparisons of species richness and diversity among the LCTA core plots, as well as baseline surveys on Camp Ripley. For example, diversity of birds found in grassland LCTA core plots was quite high in both years, with the highest number of species among all habitats in 1991

(Appendix 4). However, grassland core plots were generally located in relatively small openings, in close proximity to forest edges. Of the eight grassland core plots, only two were relatively distant from forested habitat (plot# 4, 30). In fact, many of the species found within the grassland core plots are typical of forests or habitat edges. Less than one-fourth of the 38 species found in grassland core plots are typical of open habitats and many of the species are more closely associated with forests and forest edges. Among the ten most common birds recorded from grassland core plots, only three, Clay-colored Sparrow, Eastern Kingbird, Brewer's Blackbird, are true grassland species.

According to land surveyors notes from the mid-1800's, the pre-settlement vegetation of Camp Ripley contained two large grassland areas, the old Franzen School area in the northwest part of Camp and the Cantonment Area. Activities at the Camp have created other large grassland areas, including the two impact areas, tank range, and the Arno Road grassland. In large grasslands where core plots do not already exist, special use plots should be established to provide a bird species assemblage more representative of grassland habitats.

One Upland Sandpiper, a species of special concern, was observed south of Arno Road in 1992. This species is typical of grasslands, including native prairie, grazed pastures, and hayfields. It is fairly common in western Minnesota, but is rare in the heavily-forested regions of the state. The Loggerhead Shrike, a state threatened species and candidate for federal listing, has previously nested in southern Morrison County, however, surveys for this species in 1991 and 1992 did not locate any nesting pairs. Appropriate grassland habitat is present in Camp Ripley and future surveys should look for this species.

Several state-listed birds associated with wetland habitats were documented at Camp Ripley, and three wetland complexes were identified as significant wildlife areas due to the presence of rare wetland bird species (Fig. 8). Yellow Rails, state special concern, were found at five locations in Camp Ripley. Morrison County is at the southern edge of this species' range in Minnesota. Yellow Rails are restricted to grassy wetlands, particularly those dominated by sedges. Important microhabitat components for Yellow Rails include water depths of 2-10 inches (3-6 inches is optimal) and a fairly dense litter layer (previous years' growth of sedges or grasses). When water depths are too high or low, habitat will not be used, even if the vegetative structure is ideal. This species is therefore very susceptible to natural variation in water depth (such as droughts), as well as human activities such as drainage or impoundments. Two other wetland species, the Sharp-tailed Sparrow and Wilson's Phalarope, were not found within Camp Ripley but were documented in sedge meadows elsewhere in Morrison County. These special concern species have habitat requirements very similar to Yellow Rails and future surveys may reveal their presence at Camp Ripley.

American Bitterns, state special concern, were recorded from wetlands at Camp Ripley. This species is fairly common in northern Minnesota, but uncommon to rare in the southern part of the state. It typically occurs in cattail marshes and to a lesser extent shrub swamps, sedge meadows, and flooded ditches.

Trumpeter Swans have been observed since 1990 in a wetland north of Normandy Road. The Trumpeter Swan was extirpated as a breeding bird in Minnesota in the 1880's, due to overhunting, however, reintroduction efforts by DNR resulted in a population of approximately 200 free-flying Trumpeter Swans in the state during the summer months. A pair of swans nested on Camp Ripley in 1990, and two young were fledged. These adult birds (#83, 85) were released as two-year olds from Detroit Lakes in 1989. These adults were not observed at Camp Ripley after 1990, however, one immature bird, presumed to be young from the previous season, was observed at that same wetland all summer in 1991. During the summer 1992, a single adult bird was observed at the wetland, but did not nest. Although it is unknown

if birds will continue to return to Camp Ripley, the nesting site and other areas of potential habitat should be protected.

Mammal surveys

Forty-one species of mammals were recorded from Camp Ripley (Appendix 2). Included among these mammals was the nearly ubiquitous White-footed mouse, that was found in 85 percent of LCTA wildlife plots, and the Least chipmunk, that occurred at a single site and constitutes the southern-most location recorded for this species in Minnesota. Appendix 5 summarizes the small mammals captured from LCTA plots by general habitat groupings. Table 12 presents the relative abundance of these species at Camp Ripley and indicates habitat types where they are expected to occur.

One aspect of the 1991 and 1992 small mammal surveys that deserves mentioning was the dramatic drop in numbers between the two years. A 48-percent decline in the number of total captures was observed on LCTA plots between 1991 and 1992. The White-footed mouse and the Southern red-backed vole comprised the majority of small mammal captures (59% and 18% of total captures in 1991, and 38% and 19% of total captures in 1992, respectively). Between the two field seasons, White-footed mice captures declined by 66 percent. Southern red-backed voles declined by 45 percent, which is closer to the overall small mammals decline of 48 percent. The magnitude of decline for White-footed mice suggests that 1991 may have been an eruptive year for this species and the population was at a maximum level. Other studies have indicated that this species is capable of dramatic fluctuations in numbers from year to year (Terman 1968) and this may be a partial explanation for the observed decline in this species in 1992. However, it is unlikely that all small mammals would have experienced a synchronous decline in their numbers. One factor may be due to the survey design, that removes all captured individuals from the core plot. Despite the high reproductive potential of insectivores and rodents, it may take more than a single season for small mammals to repopulate the area around the core plot. For this reason, it has been suggested that LCTA small mammal surveys be conducted on a three-to-five year rotation to enable populations to return to normal levels.

The most important discovery revealed by the mammal surveys at Camp Ripley was the presence of Prairie voles. This state special concern species is quite rare throughout the state and restricted to dry prairie habitats. The occurrence of Prairie voles in Camp Ripley was surprising when compared to results of surveys in equivalent habitats outside the base. Mammal surveys conducted in Morrison County during 1991 found no Prairie voles, despite a concerted effort that targeted suitable grassland habitats.

Camp Ripley lies along the prairie-forest transition zone. Historically, prairies in this area were small, isolated tracts that remained open largely due to fires, natural disturbances or edaphic characteristics that restricted the encroachment of brush and trees. Presently, most of these native prairie openings have become forested because of fire suppression or have been converted to agricultural uses. While the Prairie vole was probably never abundant in this region, these recent landscape changes have likely excluded the Prairie vole from areas where it once occurred. Maintenance of substantial open areas at Camp Ripley, on the other hand, may have ensured the persistence of Prairie voles at the installation. The regular burns conducted at Camp Ripley to maintain large open areas appears to be appropriate management for sustaining populations of Prairie voles. Important grassland tracts documented as having this species were those south of Arno Road and around historic Old Fort Ripley, where two baseline grids were located, and around core plots #4, 6, 32, and 33. The core plot grasslands included tank and machine gun ranges, which periodically receive heavy use by troops. However, these surveys were

unable to assess the negative impact of military activities on the resident vole populations. Eight grassland sites have been designated as significant wildlife areas based on the presence of Prairie voles (Fig. 8). Special use plots should be established in the Arno Road and Old Fort Ripley grasslands.

Prairie voles were found in association with the more common Meadow vole at Camp Ripley. Where these two species co-occur, the Prairie vole generally occupies drier grasslands, with more diverse vegetation and less cover (Jones and Birney 1988). This was found to be the case at Camp Ripley, as well. In addition, Meadow voles prefer heavier cover of dead grass (Birney et al. 1976) and may displace the Prairie voles when litter is allowed to accumulate. Regular burning should reduce litter build-up, while still retaining an appropriate amount of vegetative cover for Prairie voles. Additional inventory work is recommended to (1) identify other grassland areas in Camp Ripley where Prairie voles occur, (2) to determine the size of Prairie vole populations, and (3) to delineate areas within the larger grassland sites where these voles reside. This detailed locational information can assist Camp personnel with planning training activities on these open lands. Military maneuvers need not be eliminated from these areas, however, minimizing the severity of impact in sectors where the voles are located is recommended.

Another example of range overlap among closely-related species at Camp Ripley was found between the Northern and Southern flying squirrels. Generally, these species occupy separate distributions within mature forest regions of Minnesota. Where they occur together, the Southern flying squirrel often is found in the deciduous forests, while the Northern flying squirrel is restricted to conifer swamps (Hazard 1982). However, at Camp Ripley, this habitat separation was not observed, and both species were recorded throughout the installation from similar tracts of mature forest. Northern flying squirrels were taken from core plots 17, 70, and 78, while Southern flying squirrels were recorded from core plots 8, 15, 40, 41, and 47. While these species are not rare, the observed range overlap at Camp Ripley presents intriguing questions concerning competition and habitat partitioning between these two species. The Camp would be an excellent area to study these questions in more detail.

Summer resident bats at Camp Ripley were not adequately addressed by the mammal surveys. During the two years, bats were regularly observed foraging at night along the shoreline vegetation of the Mississippi River, smaller water courses, and other wetlands at Camp. Tree bats, including the Red bat, Hoary bat and Silver-haired bat, must certainly utilize the forested areas of Camp Ripley as day roosts and possibly as maternity colony sites. Any of the four cave bats, the Little brown myotis, Northern myotis, Big brown bat, and Eastern pipistrelle, could be found here, as well. This is a group of mammals that merits additional study. Bats have been suggested as potential indicator species for forest quality assessment, however, the difficulty in obtaining information about summer bat populations has deterred many from pursuing this area of research. Despite these reservations, Camp Ripley, with its diversity of habitats and wetlands, would provide an ideal natural laboratory to explore the importance of forested habitats to bats.

Herpetofauna

Camp Ripley supports a diverse herpetofauna, with 22 of the 25 species expected to occur in central Minnesota recorded at the installation (Appendix 3). These species include three salamanders, nine toads and frogs, five turtles, one skink, and four snakes. This may not be a comprehensive list of the herpetofauna at the training site, but it does represent the most common species, as well as some of the uncommon ones. Other species that may occur within the training site include the Western hognose snake found elsewhere in Morrison County, Smooth green snake, and Brown snake. While forest dwelling

species clearly dominate the herp community at Camp Ripley, grassland and wetland species are present where suitable habitat exists. Table 13 indicates the relative abundances of amphibian and reptile species documented at Camp Ripley and identifies habitat types where they are likely to occur.

Wetlands are essential for all amphibians and several of the reptiles at Camp Ripley. Although some herps may temporarily utilize wetlands as breeding or overwintering sites, others, such as adult Green frogs and Mink frogs, rarely travel far from the water's edge (Vogt 1981). The five species of turtles found within or adjacent to Camp utilize emergent marshes, sedge meadows, lakes, and rivers as breeding, feeding, and overwintering sites. The state-listed Snapping turtle is present in emergent marshes, lakes, streams and rivers throughout the Camp.

Blanding's turtles were documented at 14 locations at Camp Ripley. This species is threatened in Minnesota and is being considered for federal listing due, in large part, to the loss and degradation of critical habitat. Blanding's turtles require two habitat types: wetlands that provide food and shelter, and grasslands that serve as nesting sites. Wetlands suitable to Blanding's turtles are typically shallow with thick sediments and emergent vegetation. Nesting sites are commonly located on south-facing slopes of open grasslands. This largely aquatic turtle is unique for its tendency to travel relatively long distances over land to reach traditional nesting sites and overwintering sites. Their tendency to travel long distances makes these turtles particularly vulnerable to a number of hazards, such as being hit by cars as they cross roads or captured by predators.

The southwest portion of Camp Ripley was the focus for Blanding's turtle surveys due to previous reports and the number of suitable wetlands in this area. However, three additional sightings of Blanding's turtles were recorded at the north end of Camp in 1992. Appropriate wetland habitat was found here, including backwaters of the Crow Wing River, and suitable nesting habitat was also present. Habitat alteration and fragmentation caused by housing developments, roads, railroad tracks, and fences, act as barriers to the movement of these turtles from wetlands to their nesting sites. The greatest danger to adult Blanding's turtles is during the nesting season (first two weeks of June) and during the spring and fall migration (May and September) when they are moving over land. Emerging hatchlings are most vulnerable in the late summer as they travel from the nesting site to suitable wetlands.

Management for Blanding's turtles should include the protection of wetlands, known nesting sites, and travel corridors. Although threats at Camp Ripley appear to be minimal, wetlands should be buffered against run-off, filling and draining. In addition, during the nesting season and peak emerging period, activities should be minimized near grasslands and roadsides known to be nesting sites and travel corridors. Turtle crossing signs may be beneficial in high use areas. The removal of the bottom section of the fencing around Goose Lake would allow free movement of the Blanding's turtles in that area. All reliable sightings of Blanding's turtles in any portion of Camp should be reported and this information maintained and mapped to provide additional data on travel corridors and population concentrations.

Survey results from 1991 and 1992 indicate that species of forest dwelling frogs and toads are the most abundant herpetofauna within Camp Ripley and are widespread due to the high proportion of forested habitat (Table 13). Wood frogs and American toads dominated forested drift fences, and Spring peepers, a forest wetland species, were the most abundant frogs recorded during anuran call surveys. Although biases inherent with particular survey techniques need to be considered when making population estimates, the results provide some indication of species abundances.

Two forest dwelling salamanders, the Central newt and Blue-spotted salamander, were captured in the

deciduous forest drift fence on the north end of Camp. Although this was the only record for the Central newt in Camp, Blue-spotted salamanders were found in several terrestrial searches within forested habitat. The Central newt is an important distributional record, because this species is poorly documented in Minnesota and is difficult to find due to its small size and secretive habits.

The mature forests of Camp Ripley contain prime habitat for forest dwelling amphibians due to the interspersion of small wetlands and an abundance of litter and rotting logs on the forest floor. Forest wetlands provide an essential component in the life cycle of forest dwelling frogs, toads, and salamanders. They serve as breeding sites and support maturation of eggs and tadpoles. Anurans have been shown to be valuable indicators of habitat quality due to their high sensitivity to chemical pollutants and habitat degradation occurring in both terrestrial and aquatic habitats. Concerns about global declines in frog and toad populations have received much attention from the scientific community (Barinaga 1990).

Herp species occupying grassland habitat include Leopard frog, Chorus frog and Northern prairie skink. Although Leopard and Chorus frogs prefer grasslands near aquatic habitats, the Northern prairie skink can occupy dry grasslands far from a water source. The state-listed Eastern hognose snake was frequently documented along roads within Camp. This species typically occurs in grasslands, open woods, and river floodplains. Areas with loose sandy soils are preferred and much of their time is spent underground in small mammal tunnels (Vogt 1981). Their primary food source is toads. Suitable habitat and food is abundant at Camp Ripley and threats to the Eastern hognose snake are fairly minimal. The greatest danger to this species is being hit by vehicles when basking along the roadside or attempting to cross. Also, injury from individuals, who mistake it for a venomous species, is a potential threat on base.

Snakes and turtles are susceptible to physical injury as a result of being struck by vehicles. Education of Camp staff and visiting troops to avoid these animals when encountered on roads will go a long way toward minimizing this problem. However, the greater threat to all herpetofauna at Camp Ripley is the destruction and the degradation of the habitats upon which they depend. Military training activities and resource management practices should avoid impacts to wetlands whenever possible or minimize the impact to these habitats. Changes in herpetofauna due to the impacts of military activities and resource management practices should be monitored and evaluated on a regular basis. Establishment of permanent surveys stations for anuran call surveys and drift fences, especially in areas of intensive use such as bivouac sites, will provide for long-term monitoring of frog and toad populations. The continuation of such surveys will not only improve population estimates, but should detect changes in population levels.

RECOMMENDATIONS

Animal surveys conducted during 1991 and 1992 represent the initial efforts of a long term survey at Camp Ripley. Survey results have provided insight into areas of significant wildlife habitat at Camp Ripley, and the following management recommendations for the protection of rare species reiterate those proposed in the discussion section.

1. Establish and manage significant wildlife areas to protect rare species.

   a. Significant forested areas were identified based on the presence of breeding Red-shouldered Hawks, and forest size and structure. Land-use and management of these large forested areas should limit further fragmentation to ensure protection of this rare species as well as other forest

dwelling animals.

b. Three wetland complexes were identified as significant wildlife areas based on the presence of the Yellow Rail, American Bittern, and Blanding's turtle. Wetlands should be protected from filling, draining, and degradation by siltation.
c. Eight grasslands were identified as significant wildlife areas due to the presence of the Upland Sandpiper and Prairie vole. Grasslands known to be inhabited by Prairie voles should be burned on a regular basis to suppress brush and reduce the litter layer. Military activities should be coordinated to minimize impacts on grasslands where the voles are located.

2. In addition to the on-going LCTA surveys, it is recommended that survey efforts also be directed toward long-term monitoring of select species within the Camp.

a. Playback surveys should be conducted annually for Red-shouldered Hawks at permanent survey stations to monitor population trends.
b. Yellow Rails, Sharp-tailed Sparrows, and American Bitterns should be surveyed in suitable wetlands to determine presence and abundance.
c. Surveys should be conducted for Loggerhead Shrikes on an annual basis.
d. Frog and toad breeding calls should be monitored at permanent survey stations on a yearly basis to determine population trends.

3. Species-specific management guidelines should be established to ensure the protection of rare species.

a. Bald Eagle nest management plans should be created for Bald Eagle territories at Mud Lake and Hole-in-Day Marsh.
b. If Trumpeter Swans establish a breeding territory within Camp, management guidelines should be developed.
c. To protect slow moving reptiles such as turtles and snakes, Camp Ripley staff and visiting troops should be informed of the protected status of some of these species and be encouraged to avoid them when encountered on roads, particularly during spring or fall migration, or during the turtle nesting season.
d. All reliable sightings of Blanding's turtles should be reported and maintained at a central location. The lower section of the fence around Goose Lake should be removed to allow free movement of Blanding's turtles.

4. Special use plots for animal surveys should be established to augment the core plots and provide data for specific purposes.

a. Special use plots should be established within three forested areas to determine the presence and abundance of forest songbirds and Brown-headed Cowbirds in forest tracts otherwise unsampled.
b. Special use plots should also be established within five grasslands to provide survey results more typical of grassland habitat, and to monitor Prairie vole populations.
c. Special use plots should be established in areas which undergo intensive military activities on a regular basis. Forested bivouac sites should include special use plots to determine impacts of such military activities on forest wildlife.

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Many people should be recognized for their contributions to this project. This final report on the animals at Camp Ripley is the result of their investment of technical expertise, detailed knowledge of the animal groups, the installation and its goals, coordination with military activities, and many long, grueling hours in the field. However, it only marks the beginning of a significant effort to combine military training objectives with sustainable resource management at Camp Ripley.

Within the Department of Natural Resources, several key people have been involved in the planning, execution and analysis of the animal surveys at Camp Ripley. Lee Pfannmuller, the former DNR Nongame Research Supervisor, deserves special recognition for being a major player in the initial stages of the animal surveys. Carmen Converse, the County Biological Survey Supervisor, and Dave Heinzen, Division of Forestry Resource Assessment Supervisor, have been instrumental in planning and administration of the various survey activities. Steve Stucker, MCBS Avian Ecologist, advised in the selection of baseline bird survey sites and trained the bird survey staff in both LCTA and baseline survey techniques. In addition, he assisted with the analysis and interpretation of bird survey results and contributed substantially to the text on birds in this report. The DNR Area Office, including Gary Johnson, Area Wildlife Manager; Jim Lilienthal, Area Fisheries Supervisor; and John Korzeniowski, Field Forester, provided much support in the form of equipment and technical expertise. Pam Perry, Nongame Regional Supervisor, also provided insight into nongame species present within Camp Ripley. Special thanks needs to be given to Al Epp, CBS Information Systems Manager, and Tom Klein, CBS Graphic Artist, for data management assistance, graphics, figures, and illustrations used in this report.

All the field staff deserve many thanks for their contribution to collecting the field data and for enduring not only the usual field hazards, such as mosquitoes, ticks, rain and hot weather, but also those field conditions unique to Camp Ripley. These included tanks roaring past during a bird point count, opposing troops opening fire while checking a small mammal grid, and rolling over a log during a terrestrial herp search to find a DUD rather than a snake. Special appreciation is extended to two field staff, Ralph Hanson and Karen Maier, who contributed substantially to the survey effort. Ralph worked tirelessly during both years of the survey, conducting bird surveys in 1991 and participating in all aspects of the animal surveys in 1992. Karen worked diligently in the field and carried her enthusiasm for field work through to the long and arduous process of compiling the data collected from the two years of surveys. Her assistance with preparing many of the summary tables and appendices in this report was indispensable.

Camp Ripley personnel have supported this project in numerous ways. Colonel Murdoch, former Camp Commander, provided the foresight and motivation behind the LCTA survey effort at Camp Ripley. John Ebert, State Environmental Coordinator, coordinated financial support for the various animal surveys. Martin Skoglund, Camp Environmental Coordinator, enthusiastically supported the LCTA and baseline animal surveys, and provided expertise on environmental issues and concerns of the Camp. Larry Hoyt, LCTA Field Crew Leader, provided assistance in LCTA core plots locations, logistics and equipment. Sergeant John Stewart and other personnel at Range Control were not only determined to ensure our safety, but showed a genuine interest in our survey efforts. Based on years of work at the installation, shift sergeants and others were able to contribute many sightings and details about the animals at Camp Ripley. Lastly, use of helicopters was crucial in relocating radio-tagged Blanding's turtles, and was greatly appreciated.

LITERATURE CITED

Barinaga, M. 1990. Where have all the froggies gone? Science 247:1033-1034.

Bednarz, J.C., and J.J. Dinsmore. 1981. Status, habitat use, and management of red-shouldered hawks in Iowa. J. Wildl. Manage. 45:236-241.

Bednarz, J.C., and J.J. Dinsmore. 1982. Nest-sites and habitat of red-shouldered and red-tailed hawks in Iowa. Wilson Bull. 94:31-45.

Birney, E.C., W.E. Grant, and D.D. Baird. 1976. Importance of vegetative cover to cycles of *Microtus* populations. Ecology 57:1043-1053.

Blondel, J., C. Ferry, and B. Frochet. 1981. Point counts with unlimited distance. Studies in Avian Biology 6:414-420.

Bryant, A.A. 1986. Influence of selective logging on red-shouldered hawk *(Buteo lineatus)*, in Waterloo Region, Ontario, 1953-1978. Can. Field-Nat. 100:520-525.

Coffin, B., and L. Pfannmuller, editors. 1988. Minnesota's endangered flora and fauna. University of Minnesota Press, Minneapolis, 473 pp.

Green, J.C. 1991. A landscape classification for breeding birds in Minnesota: an approach to describing regional biodiversity. The Loon 63:80-91.

Hands, H.M., R.D. Drobney and M.R. Ryan. 1989. Status of the red-shouldered hawk in the northcentral United States. U.S. Fish and Wildlife Service. 21 pp.

Hazard, E.B. 1982. The mammals of Minnesota. University of Minnesota Press, Minneapolis, 280 pp.

Jones, Jr., J.K., and E.C. Birney. 1988. Handbook of mammals of the north-central states. University of Minnesota Press, Minneapolis, 396 pp.

Minnesota Department of Natural Resources. 1984. Minnesota Department of Natural Resources' management guidelines for Bald Eagle breeding areas. Minnesota Dept. of Natural Resources, St. Paul, 9 pp.

Minnesota Natural Heritage Program. 1992a. Minnesota's Native Vegetation: a key to natural communities. Unpublished version 1.4. Minnesota Dept. of Natural Resources, St. Paul. 99 pp.

Minnesota Natural Heritage Program. 1992b. A user's guide to the Minnesota Natural Heritage Information System. Minnesota Dept. of Natural Resources, St. Paul.

Montz, G.R., and J.K. Hirsch. 1993. The aquatic invertebrate fauna of Camp Ripley Military Reservation. Final report, Section of Ecological Services, Division of Fish and Wildlife, Minnesota Dept. of Natural Resources, St. Paul.

Robbins, C.S., D.K. Dawson, and B.A. Dowell. 1989. Habitat area requirements of breeding forest birds of the Middle Atlantic States. Wildl. Monogr. 103. 34pp.

Schmidt, K. 1992. Camp Ripley Military Reservation fish survey results. Final report, Section of Ecological Services, Division of Fish and Wildlife, Minnesota Dept. of Natural Resources, St. Paul. 17 pp.

Sheridan, D. 1991. Camp Ripley natural areas, Morrison County, Minnesota. Draft report. Minnesota County Biological Survey, Section of Wildlife, Division of Fish and Wildlife, Minnesota Dept. of Natural Resources, St. Paul. 13 pp.

Stucker, S.P. 1992. 1991 Bird surveys in Kittson and Roseau counties. The Loon 64:107-113.

Tazik, D.J., S.D. Warren, V.E. Diersing, R.B. Shaw, R.J. Brozka, C.F. Bagley, and W.R. Whitworth. 1991. U.S. Army Land Condition-Trend Analysis field methods. Draft report. U.S. Army Construction Engineering Research Laboratory, Champaign-Urbana, Illinois, 66 pp.

Terborgh, J. 1989. Where have all the birds gone? Essays on the biology and conservation of birds that migrate to the American tropics. Princeton University Press, Princeton, New Jersey, 202 pp.

Terman, R.C. 1968. Population dynamics. Pages 412-450, *in* J.A. King, editor. Biology of *Peromyscus* (Rodentia). Special Publication No. 2, American Society of Mammalogists.

Vogt, R.C. 1981. Natural history of amphibians and reptiles in Wisconsin. The Milwaukee Public Museum, Milwaukee, Wisconsin, 205 pp.

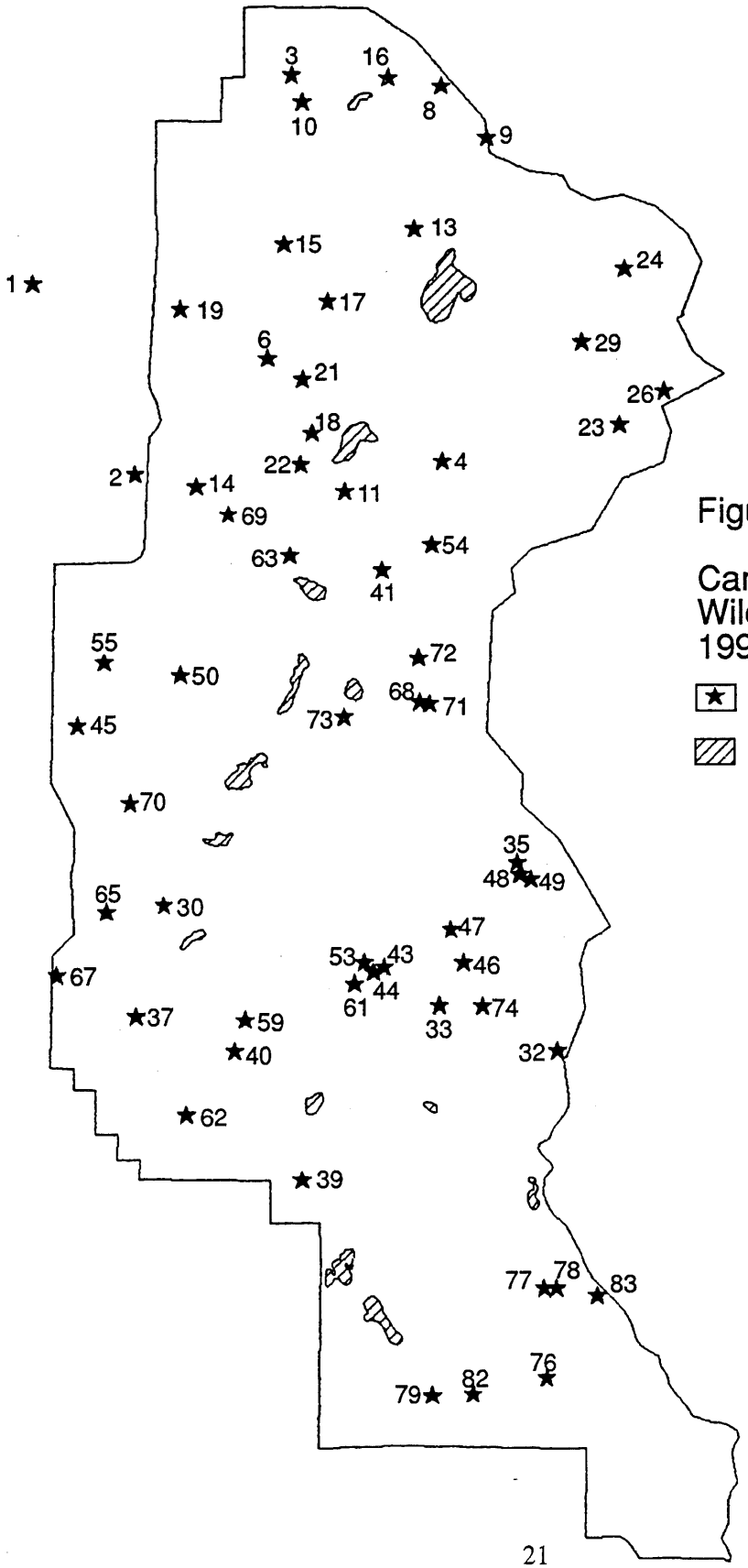

Figure 1.

Camp Ripley LCTA Wildlife Core Plots 1991 - 1992

LCTA wildlife plots

Prominent lakes

1 mile
1 km

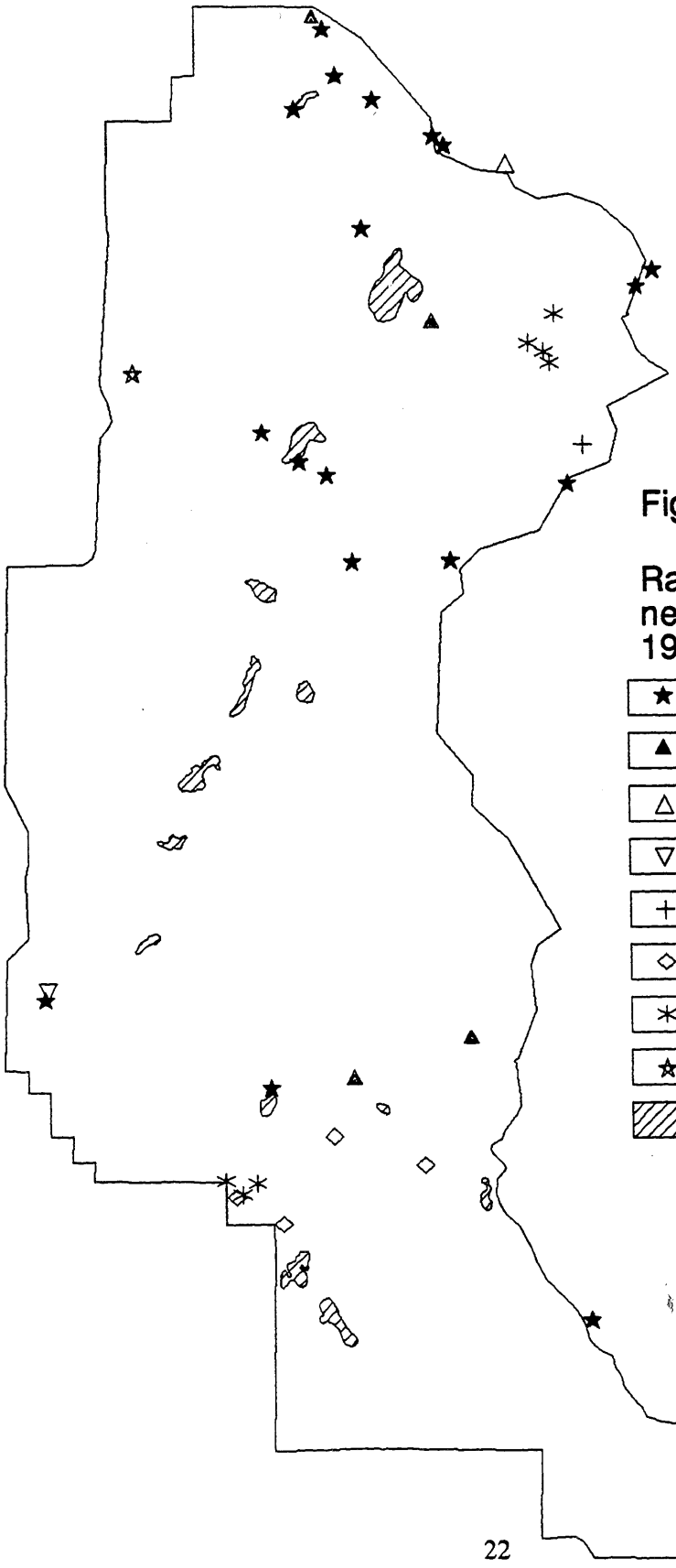

Figure 2.

Rare birds and colonial waterbird nesting sites of Camp Ripley 1991 - 1992

- ★ Red-shouldered Hawk
- ▲ Bald Eagle Nest
- △ Osprey Nest
- ▽ Trumpeter Swan
- \+ Great Blue Heron Nesting Colony
- ◇ American Bittern
- ✳ Yellow Rail
- ☆ Upland Sandpiper
- ▨ Prominent lakes

N

1 mile
1 km

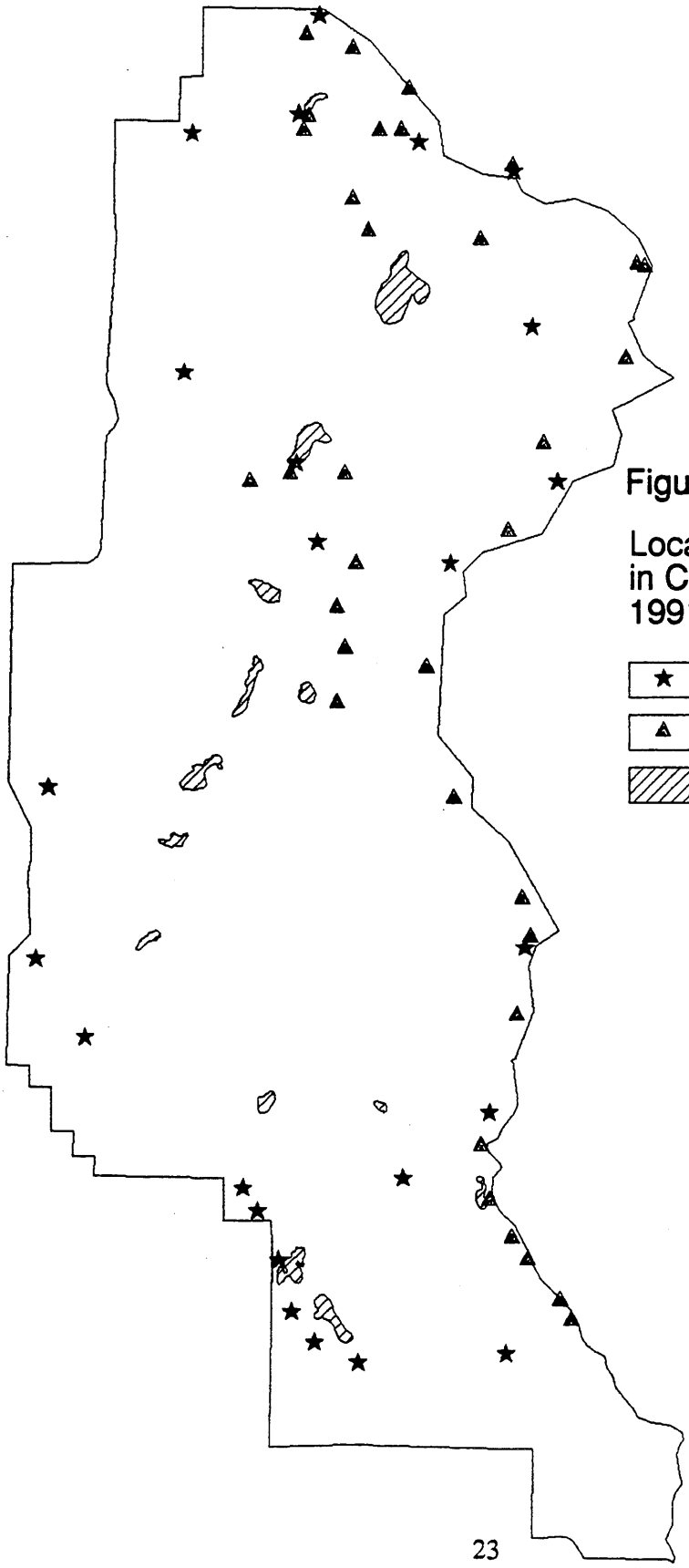

Figure 3.

Locations of baseline bird surveys in Camp Ripley 1991 - 1992

Bird Point Counts

Hawk Playbacks

Prominent lakes

N

1 mile

1 km

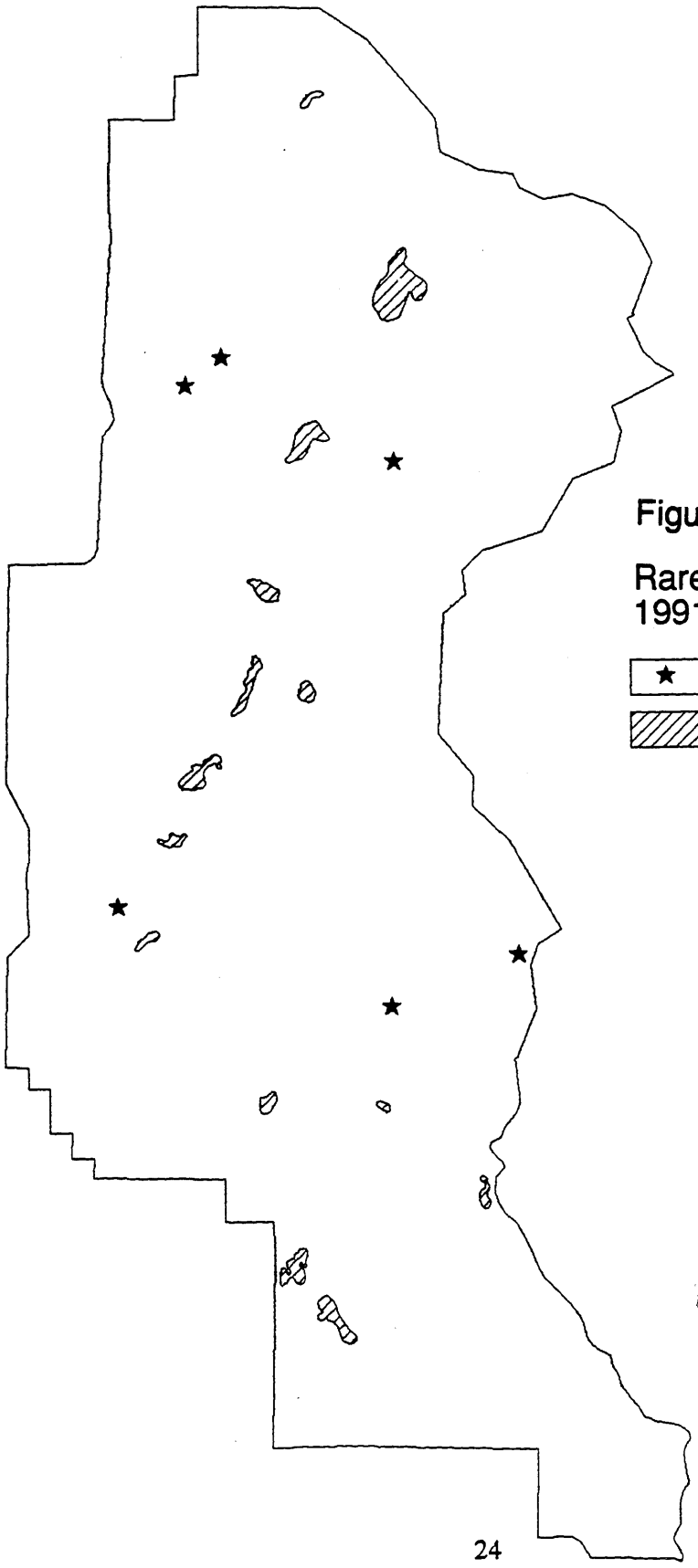

Figure 4.

Rare mammals of Camp Ripley
1991 - 1992

★ Prairie Vole

Prominent lakes

N

1 mile
1 km

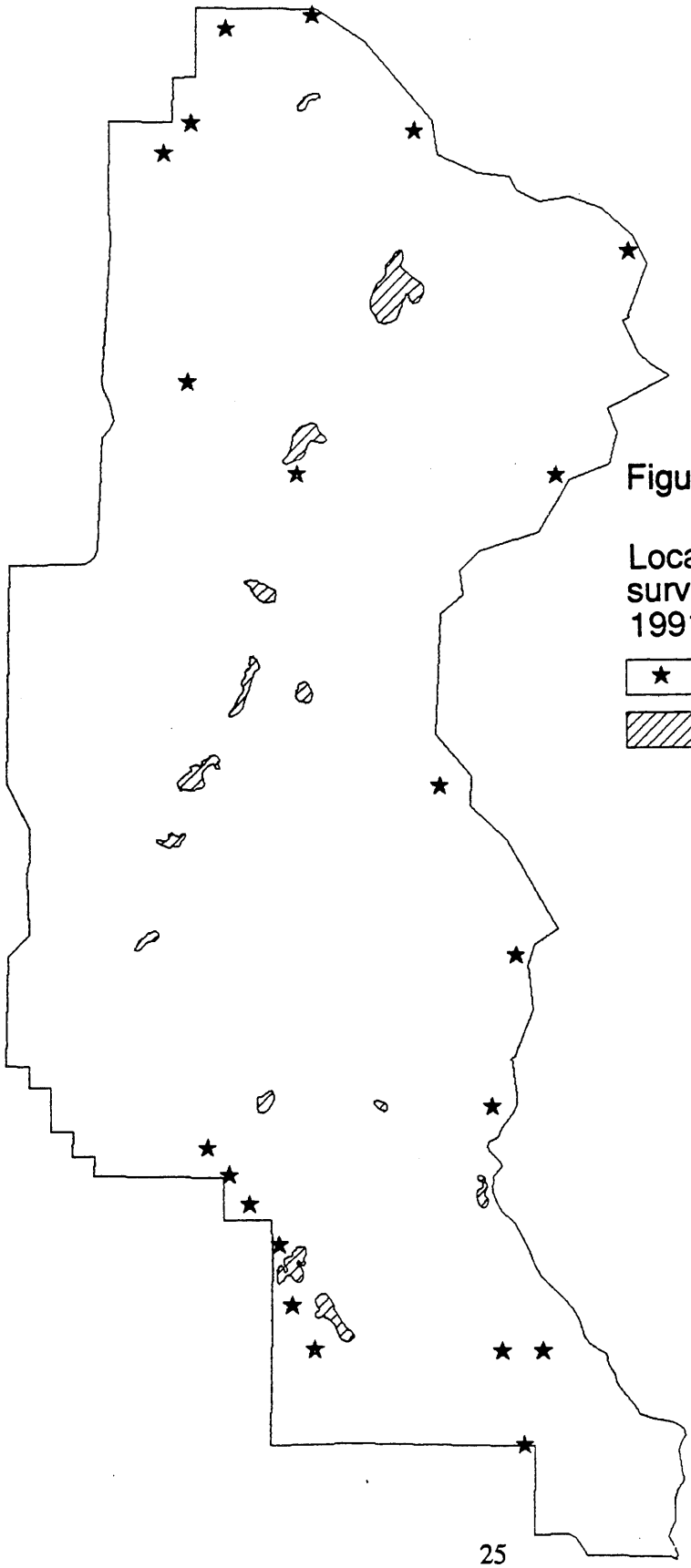

Figure 5.

Locations of baseline mammal surveys in Camp Ripley 1991 - 1992

★ Mammal Trap Grids

Prominent lakes

N

1 mile
1 km

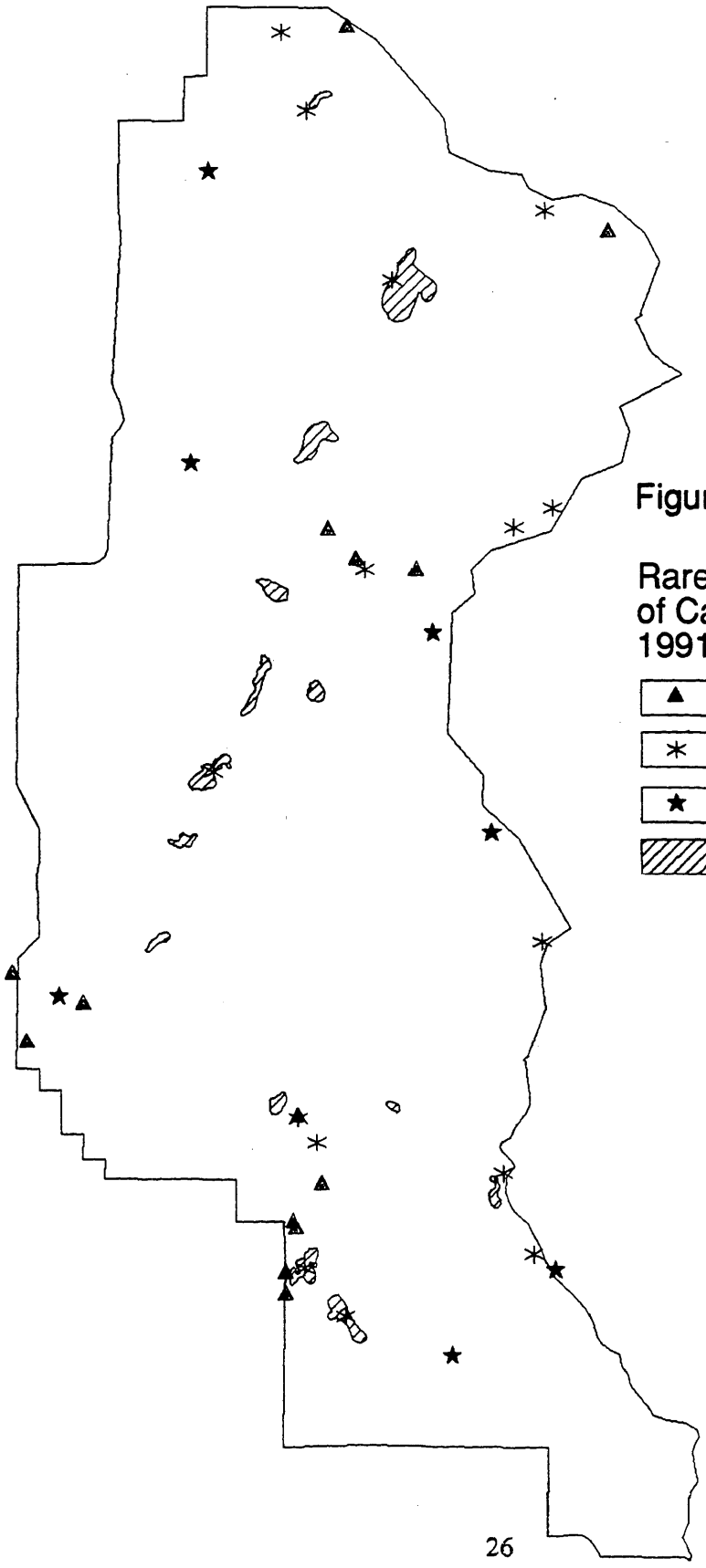

Figure 6.

Rare amphibians and reptiles of Camp Ripley 1991 - 1992

- ▲ Blanding's Turtle
- ✳ Snapping Turtle
- ★ Eastern Hognose Snake
- Prominent lakes

N

1 mile
1 km

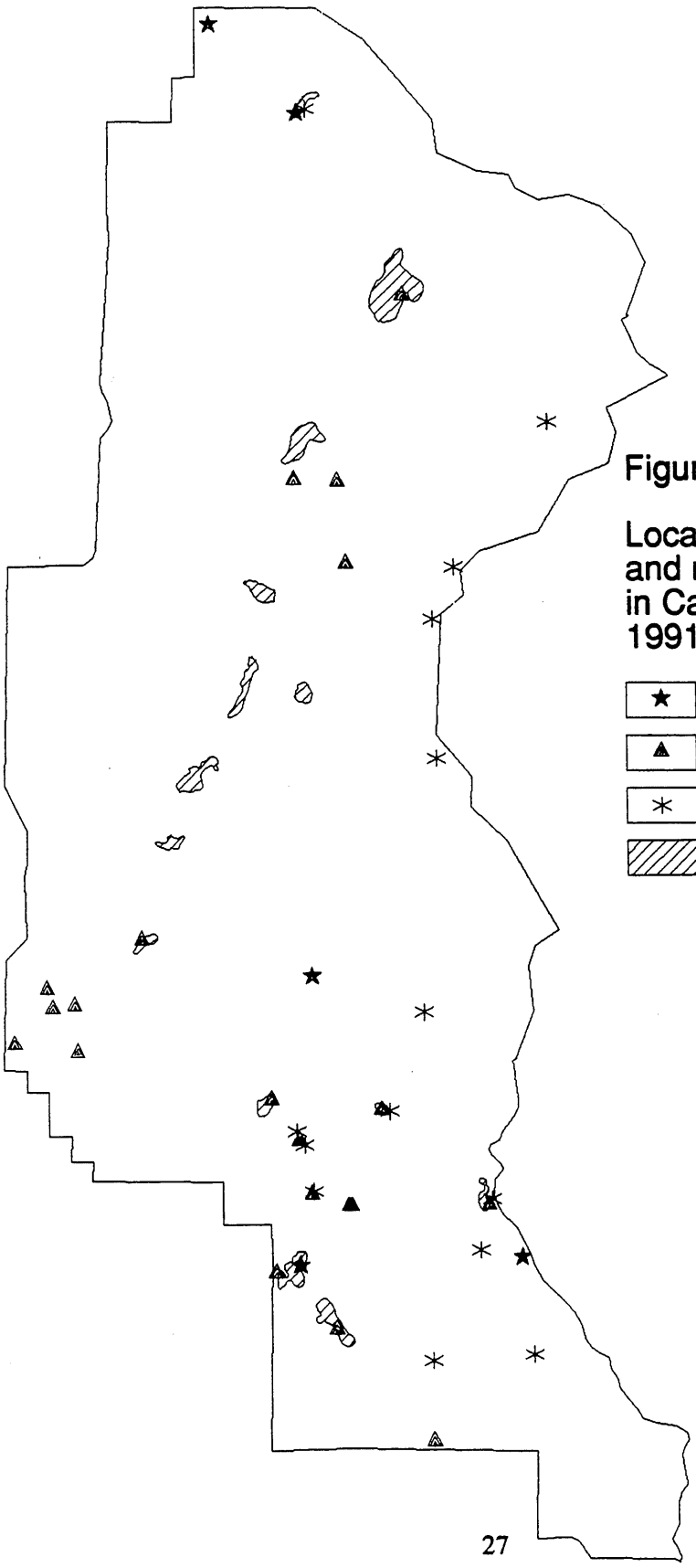

Figure 7.

Locations of baseline amphibian and reptile surveys in Camp Ripley 1991 - 1992

- Herp Drift Fences
- Turtle Trapping Sites
- Anuran Survey Sites
- Prominent lakes

1 mile
1 km

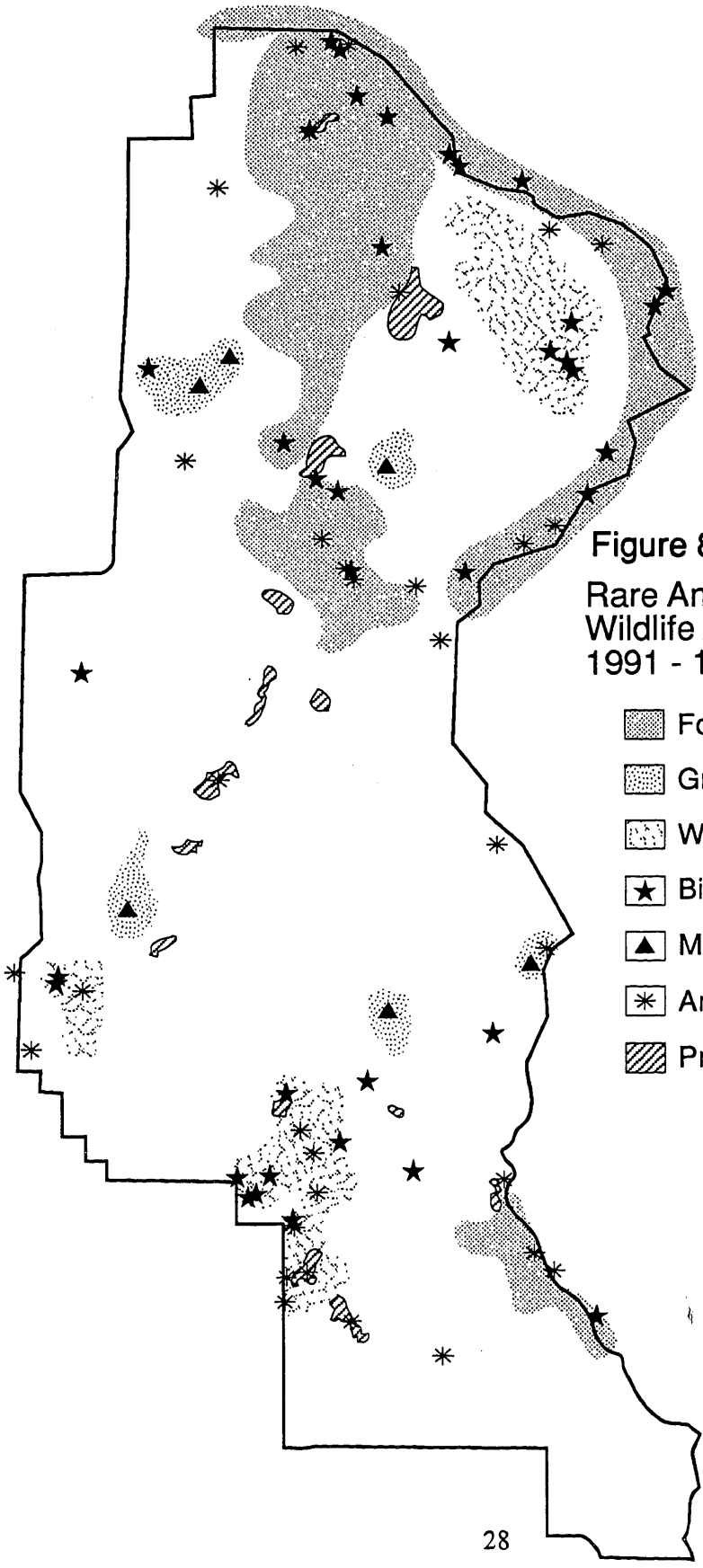

Figure 8.

Rare Animals and Significant Wildlife Areas of Camp Ripley 1991 - 1992

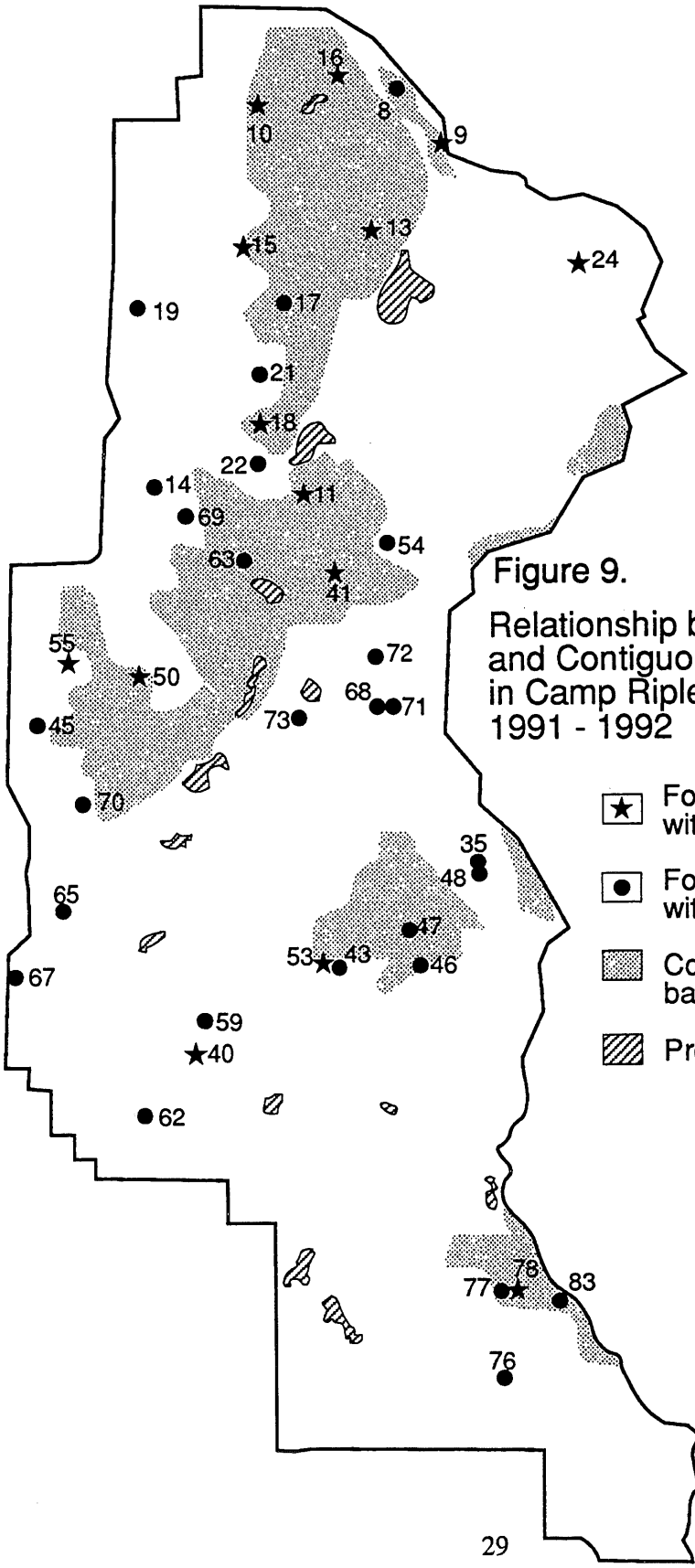

Figure 9.

Relationship between Brown-headed Cowbirds and Contiguous Mature Forested Areas in Camp Ripley.
1991 - 1992

- Forested core plots without Brown-headed Cowbirds
- Forested core plots with Brown-headed Cowbirds
- Contiguous Mature Forest Areas based on 1989 Phase II data
- Prominent lakes

N

1 mile
1 km

Table 1. Schedule of Camp Ripley animal survey activities and personnel.

Animal Group	Year	Date	Survey	Personnel
Project Coordination	1991 - 1993	Gerda Nordquist and Carol Dorff		
Birds	1991	22 May - 10 July	LCTA	Steve Stucker Ralph Hanson
	1992	26 May - 3 July	LCTA & Baseline	Steve Stucker Sharon Moen Gary Swanson
Mammals	1991	22 July - 23 August	LCTA & Baseline	Gerda Norquist Carol Dorff Steve Emerson Angie Hodgson Brett Lilienthal Greg Mastey Kathy Smith
	1992	20 July - 28 August	LCTA & Baseline	Gerda Nordquist Ralph Hanson Michael Lee Karen Maier Joe Whittaker
Herps	1991	22 April - 20 September	Baseline	Carol Dorff Richard Durtsche Brett Lilienthal
	1992	27 April - 15 September	Baseline	Carol Dorff Ralph Hanson Karen Maier
Aquatic Invertebrates	1992	20 - 24 April 28 September - 1 October	Baseline	Gary Montz Jodi Hirsch Karen Maier
Butterflies	1992	1 May - 31 August	Baseline	Dean Hansen
Fish	1992	20 - 24 April 7 - 11 September	Baseline	Konrad Schmidt
Mussels	1992	1 July - 15 August	Baseline	Dr. Robert Bright Stephanie Breidenbach Ruth Heisler Brett Lilienthal Diana Rocha

Table 2. Habitat designations of LCTA wildlife core plots according to the Plant Community Classification Codes and animal survey habitat types at Camp Ripley.

Core Plot	PCCC*	Habitat Types **
1	DESH	Lowland Grass/Shrub
2	CLGR	Plantation
3	CLGR	Grassland
4	CLGR	Grassland
6	CLGR	Grassland
8	CLWO	Coniferous/Deciduous Forest
9	CLWO	Deciduous Forest
10	CLWO	Deciduous Forest
11	CLWO	Deciduous Forest
13	CLWO	Deciduous Forest
14	CLWO	Deciduous Forest
15	CLWO	Deciduous Forest
16	CLWO	Deciduous Forest
17	CLWO	Deciduous Forest
18	CLWO	Deciduous Forest
19	CLWO	Aspen Regeneration
21	CLWO	Aspen Regeneration
22	CLWO	Aspen Regeneration
23	DEGR	Plantation
24	CLWO	Coniferous/Deciduous Forest
26	CLGR	Grassland
29	CLSH	Lowland Grass/Shrub
30	CLGR	Grassland
32	CLGR	Grassland
33	CLFO	Grassland
35	CLWO	Deciduous Forest
37	CLGR	Grassland
39	CLGR	Lowland Grass/Shrub
40	CLWO	Coniferous/Deciduous Forest
41	CLWO	Deciduous Forest
43	CLWO	Deciduous Forest
44	OPWO	Upland Shrub
45	CLWO	Deciduous Forest
46	CLWO	Deciduous Forest
47	CLWO	Deciduous Forest
48	DEWO	Deciduous Forest
49	CLGR	Plantation
50	CLWO	Deciduous Forest
53	CLWO	Deciduous Forest
54	CLWO	Deciduous Forest
55	CLWO	Aspen Regeneration
59	CLWO	Deciduous Forest
61	DEFO	Upland Shrub
62	CLWO	Deciduous Forest
63	CLWO	Deciduous Forest

Table 2. Continued.

Core Plot	PCCC*	Habitat Types **
65	CLWO	Deciduous Forest
67	CLWO	Deciduous Forest
68	CLWO	Aspen Regeneration
69	CLWO	Deciduous Forest
70	CLWO	Aspen Regeneration
71	DEWO	Aspen Regeneration
72	CLWO	Aspen Regeneration
73	CLWO	Aspen Regeneration
74	CLGR	Lowland Grass/Shrub
76	CLWO	Deciduous Forest
77	CLWO	Deciduous Forest
78	CLWO	Deciduous Forest
79	CLGR	Plantation
82	DESH	Lowland Grass/Shrub
83	DEWO	Coniferous/Deciduous Forest

* The PCCC system was developed by CERL using line-transect data collected by the LCTA vegetation crew in 1991.

CLFO = Closed Forbland
CLGR = Closed Grassland
CLSH = Closed Shrubland
CLWO = Closed Woodland
DEFO = Dense Forbland
DEGR = Dense Grassland
DESH = Dense Shrubland
DEWO = Dense Woodland
OPWO = Open Woodland

** Habitat types were determined by extracting select species from the belt-transect data collected by the LCTA vegetation crew in 1991 (trees $\geq$ 3 m; understory < 3 m).

Table 3. Rare animal species and features documented at Camp Ripley during the 1991 and 1992 animal surveys.

Species and Features	Status
Birds	
Bald Eagle *(Haliaeetus leucocephalus)*	State and Federally Threatened
Upland Sandpiper *(Bartramia longicauda)*	State Special Concern
American Bittern *(Botaurus lentiginosus)*	State Special Concern
Red-shouldered Hawk *(Buteo lineatus)*	State Special Concern
Yellow Rail *(Coturnicops noveboracensis)*	State Special Concern
Osprey *(Pandion haliaetus)*	State Special Concern
Trumpeter Swan *(Cygnus buccinator)*	State Non-listed Rare Species
Great Blue Heron nesting colony	State Non-listed Rare Feature
Mammals	
Praire vole *(Microtus ochrogaster)*	State Special Concern
Herpetofauna	
Blanding's turtle *(Emydoidea blandingii)*	State Threatened/Federal Candidate
Snapping turtle *(Chelydra serpentina)*	State Special Concern
Eastern hognose snake *(Heterodon platyrhinos)*	State Special Concern

Table 4. Frequency of occurrence for breeding bird species recorded on LCTA wildlife core plots at Camp Ripley during 1991 and 1992. (84 species total; 64 species in 1991, 75 species in 1992).

Common Name	# Plots	
	1991	1992
Red-eyed Vireo	44	43
American Redstart	32	32
Ovenbird	28	32
Brown-headed Cowbird	27	23
Least Flycatcher	25	21
Scarlet Tanager	20	24
Eastern Wood-pewee	16	21
Veery	16	19
Yellow-throated Vireo	16	17
Great Crested Flycatcher	13	24
American Goldfinch	13	19
Yellow Warbler	13	18
Clay-colored Sparrow	12	13
Song Sparrow	12	7
Indigo Bunting	10	13
Golden-winged Warbler	9	14
Chipping Sparrow	9	11
Blue Jay	8	13
Red-breasted Nuthatch	8	
Common Yellowthroat	7	19
Gray Catbird	7	17
Black-capped Chickadee	7	12
Vesper Sparrow	7	10
Chestnut-sided Warbler	6	15
Rose-breasted Grosbeak	6	5
Eastern Kingbird	5	12

Table 4. Continued.

Common Name	# Plots	
	1991	1992
Field Sparrow	5	10
Ruffed Grouse	4	7
Sedge Wren	4	4
Hairy Woodpecker	3	9
Ruby-throated Hummingbird	3	6
Swamp Sparrow	3	4
Downy Woodpecker	3	4
Red-winged Blackbird	3	4
Cedar Waxwing	3	4
Alder Flycatcher	3	3
Pine Warbler	3	3
House Wren	3	1
Mourning Warbler	3	
Broad-winged Hawk	3	
American Robin	2	6
Mourning Dove	2	5
Eastern Bluebird	2	5
Warbling Vireo	2	4
Brewer's Blackbird	2	2
Hermit Thrush	2	
Yellow-bellied Sapsucker	1	5
Northern Oriole	1	5
Barn Swallow	1	4
White-breasted Nuthatch	1	4
Pileated Woodpecker	1	3
Tree Swallow	1	2
Nashville Warbler	1	2
Marsh Wren	1	1

Table 4. Continued.

Common Name	# Plots	
	1991	1992
LeConte's Sparrow	1	1
Northern Harrier	1	1
Killdeer	1	1
Whip-poor-will	1	1
Blue-gray Gnatcatcher	1	1
Bald Eagle	1	
Winter Wren	1	
Wood Duck	1	
Savannah Sparrow	1	
American Crow	1	
Yellow-billed Cuckoo		5
Black-and-white Warbler		4
Black-billed Cuckoo		3
Grasshopper Sparrow		2
Brown Creeper		2
Common Nighthawk		2
Cooper's Hawk		2
Blue-winged Warbler		1
Tennessee Warbler		1
Wood Thrush		1
Bank Swallow		1
Eastern Phoebe		1
Red-tailed Hawk		1
Northern Flicker		1
Northern Rough-winged Swallow		1
Yellow-bellied Flycatcher		1
Brown Thrasher		1
Red-shouldered Hawk		1

Table 4. Continued.

Common Name	# Plots	
	1991	1992
American Woodcock		1
Bobolink		1

Table 5. Frequency of occurrence for breeding bird species recorded from baseline point count surveys at Camp Ripley in 1992. (67 species total).

Common Name	# Points
Song Sparrow	38
Red-eyed Vireo	26
Common Yellowthroat	26
Veery	22
American Redstart	22
Ovenbird	18
American Crow	20
Great Crested Flycatcher	19
Brown-headed Cowbird	18
Clay-colored Sparrow	18
American Goldfinch	17
Yellow-throated Vireo	18
Yellow Warbler	17
Eastern Wood-pewee	16
Blue Jay	14
Least Flycatcher	14
Field Sparrow	12
Red-winged Blackbird	12
Chipping Sparrow	12
Mourning Dove	12
Golden-winged Warbler	11
Gray Catbird	10
Swamp Sparrow	10
Sedge Wren	8
White-breasted Nuthatch	9
Red-tailed Hawk	7
Common Loon	7

Table 5. Continued.

Common Name	# Points
Cedar Waxwing	6
Scarlet Tanager	6
Eastern Bluebird	6
Great Blue Heron	4
Pine Warbler	4
Pileated Woodpecker	5
Alder Flycatcher	5
Northern Oriole	5
Indigo Bunting	5
Vesper Sparrow	5
Tree Swallow	6
Killdeer	4
Chestnut-sided Warbler	4
Winter Wren	2
Eastern Kingbird	3
Nashville Warbler	4
Red-shouldered Hawk	3
Northern Flicker	3
Cliff Swallow	3
Black-and-white Warbler	3
Black-capped Chickadee	3
Downy Woodpecker	4
Eastern Phoebe	2
Yellow-bellied Sapsucker	3
Mallard	2
Osprey	2
Ring-necked Pheasant	2
American Woodcock	2
Cooper's Hawk	2

Table 5. Continued.

Common Name	# Points
Sharp-shinned Hawk	1
Wood Duck	1
Grasshopper Sparrow	1
Ruffed Grouse	1
Broad-winged Hawk	1
Yellow-billed Cuckoo	1
Black-billed Cuckoo	1
Wood Thrush	1
Mourning Warbler	1
Rose-breasted Grosbeak	1
Hairy Woodpecker	1
Blue-gray Gnatcatcher	1
Common Grackle	1
Barred Owl	1
American Robin	1

Table 6. Small mammal species captured from trap grids on LCTA wildlife core plots at Camp Ripley in 1991 and 1992. (18 species total; 15 species in 1991, 16 species in 1992).

Common Name	# Plots (60)		# Animals	
	1991	1992	1991	1992
White-footed mouse	50	38	874	297
Southern red-backed vole	42	34	260	144
Eastern chipmunk	30	23	80	64
Meadow jumping mouse	23	28	68	62
Masked shrew	21	12	32	17
Meadow vole	18	16	73	60
Deer mouse	12	15	28	28
Short-tailed shrew	11	21	11	40
Thirteen-lined ground squirrel	9	11	28	39
Snowshoe hare	5	1	7	1
Prairie vole	3	3	11	10
Northern flying squirrel	2	1	2	1
Arctic shrew	1	3	1	5
Short-tailed weasel	1		1	
Least chipmunk	1		1	
Southern flying squirrel		5		5
Plains pocket gopher		1		1
Pygmy shrew		1		1
TOTAL ANIMALS CAPTURED			1477	775

Table 7. Occurrence of small mammal species on baseline trap grids at Camp Ripley in 1991 and 1992. (Occurrence indicates presence only, and not number of individuals. 13 grids in 1991, 8 grids in 1992; 12 species total).

1991 Trapping Summary: 12 species

Common Name	Occurrence
Masked shrew	11
White-footed mouse	10
Meadow jumping mouse	9
Meadow vole	8
Southern red-backed vole	7
Short-tailed shrew	5
Eastern chipmunk	5
Thirteen-lined ground squirrel	4
Arctic shrew	3
Prairie vole	2
House Mouse	1
Prairie deer mouse	1

1992 Trapping Summary: 5 species

Common Name	Occurrence
Prairie deer mouse	7
Thirteen-lined ground squirrel	7
Meadow vole	5
Arctic shrew	1
Meadow jumping mouse	1

Table 8. Anuran species documented from anuran call surveys at Camp Ripley in 1991 and 1992. (14 wetland sites surveyed; 7 species total).

Common Name	# Sites
American toad	6
Cope's gray treefrog	4
Spring peeper	14
Eastern gray treefrog	7
Chorus frog	7
Green frog	1
Northern leopard frog	8

Table 9. Total captures of amphibians and reptiles from five drift fences at Camp Ripley in 1991. (Drift fences were open May through mid-July, September; 12 species total).

Drift Fence Habitat	Common Name	# Animals
Deciduous Forest	American toad	66
	Wood frog	84
	Leopard frog	2
	Mink frog	19
	Green frog	2
	Spring peeper	7
	Blue-spotted salamander	7
	Central newt	1
	Eastern garter snake	1
	Snapping turtle	1
	Total	190
Floodplain Forest	American toad	32
	Wood frog	106
	Leopard frog	3
	Mink frog	2
	Green frog	10
	Snapping turtle	1
	Total	154
Forest/Grassland Edge	American toad	9
	Wood frog	1
	Leopard frog	3
	Eastern tiger salamander	1
	Northern prairie skink	1
	Total	15
Open Grassland	American toad	2
	Wood frog	4
	Leopard frog (Northern)	145
	Leopard frog (Burn's)	1
	Green frog	1
	Northern prairie skink	4
	Eastern garter snake	3
	Total	160
Aquatic Edge	American toad	6
	Wood frog	1
	Leopard frog	5
	Northern prairie skink	10
	Eastern garter snake	1
	Total	23

Table 10. Data recorded from Blanding's turtles captured at Camp Ripley during 1991 and 1992 surveys.

1991

Location	Date	Sex	Age	Carapace L x W	Weight	Notch #
Frog Lake	29 May 1991	Male	-	260 x 175 mm	6.7 kg	none
West Boundary Road (Goose Lake) Nest Site	3 June 1991	Female	17	238 x 155 mm	2.3 kg	none
	3 June 1991	Female	20+	-	-	none
Marne Road - Cunningham Road Intersection	6 June 1991	Male	-	274 x 175 mm	2.7 kg	none
Luzon Road - Marne Road Intersection	10 June 1991	Female	-	236 x 175 mm	2.2 kg	none

1992

Location	Date	Sex	Age	Carapace L x W	Weight	Notch #
Holden Lake (East)	13 May 1992	Male	20	269 x 180 mm	2.25 kg	2003
Luzon Road Wetland	19 May 1992	Male	21	273 x 186 mm	2.70 kg	2002
Normandy Road (South) Wetland	20 May 1992	Male	20+	282 x 186 mm	3.05 kg	2001
	20 May 1992	Juvenile	11	217 x 152 mm	1.65 kg	2005
	20 May 1992	Male	19	264 x 180 mm	2.45 kg	2004
	20 May 1992	Female	20+	267 x 182 mm	2.85 kg	2000
	22 May 1992	Male	S	263 x 174 mm	2.65 kg	2006
	22 May 1992	Female	20+	269 x 177 mm	3.00 kg	2007
	22 May 1992	Male	18	256 x 175 mm	2.20 kg	2008
West Boundary Road (Goose Lake) Nest Site	9 June 1992	Female	20+	238 x 164 mm	1.95 kg	2010

Table 11. Relative abundances of breeding bird species at Camp Ripley and general habitat associations for all birds documented in Morrison County during MCBS animals surveys in 1991 and 1992.

Abundance Codes:
- 1 = rare
- 2 = infrequent
- 3 = occasional
- 4 = common
- 5 = abundant
- * = summer resident, found in Morrison County, but outside of Camp Ripley
- m = migrant, Morrison County or Camp Ripley

Habitat Codes:
- CF = coniferous forest
- LCF = lowland coniferous forest
- DF = deciduous forest
- LDF = lowland deciduous forest
- US = upland shrub
- SS = shrub swamp
- ED = forest edge
- GL = dry grassland
- WM = wet meadow/sedge fen
- EM = emergent marsh
- OW = open water (lake/river)

- P = Primary habitat
- x = Secondary habitat

Species	Abund	CF	LCF	DF	LDF	US	SS	ED	GL	WM	EM	OW
Common Loon	3											P
Pied-billed Grebe	3										x	P
Horned Grebe	m										x	P
Red-necked Grebe	*										x	P
American White Pelican	m										x	P
Double-crested Cormorant	1										x	P
American Bittern	3						x			x	P	
Least Bittern	2										P	
Great Blue Heron	4										x	P
Great Egret	m										x	P
Green-backed Heron	3										x	P

Table 11. Continued.

Species	Abund	CF	LCF	DF	LDF	US	SS	ED	GL	WM	EM	OW
Black-crowned Night-Heron	m										x	P
Trumpeter Swan	1											
Canada Goose	4										x	P
Wood Duck	4			x							x	P
Green-winged Teal	m										x	P
Mallard	4										x	P
Northern Pintail	m										x	P
Blue-winged Teal	4										x	P
Northern Shoveler	m										x	P
Gadwall	m										x	P
Redhead	m										x	P
Ring-necked Duck	3										x	P
Lesser Scaup	m										x	P
Common Goldeneye	m										x	P
Bufflehead	m										x	P
Hooded Merganser	2										x	P
Turkey Vulture	3	x		x	x	x	x	x	P			
Osprey	2	x									x	P
Bald Eagle	2	x									x	P
Northern Harrier	3						x		P	x	x	

Table 11. Continued.

Species	Abund	CF	LCF	DF	LDF	US	SS	ED	GL	WM	EM	OW
Sharp-shinned Hawk	2	P		x								
Cooper's Hawk	3			P	x							
Northern Goshawk	*	P	x	x								
Red-shouldered Hawk	3			x	P							
Broad-winged Hawk	3			P	x							
Red-tailed Hawk	4			x		x		x	P			
Golden Eagle	m											
American Kestrel	3					x		x	P			
Gray Partridge	*								P			
Ring-necked Pheasant	2					x		x	P			
Ruffed Grouse	4	x		P				x				
Wild Turkey	*			P				x				
Yellow Rail	2									P		
Virginia Rail	3									x	P	
Sora	4									x	P	
American Coot	1										x	P
Sandhill Crane	2								x	P	x	
Killdeer	3								P		x	x
Spotted Sandpiper	3										x	P
Upland Sandpiper	1								P			

Table 11. Continued.

Species	Abund	CF	LCF	DF	LDF	US	SS	ED	GL	WM	EM	OW
Short-billed Dowitcher	m											
Common Snipe	4						x	x	x	P	x	
American Woodcock	3			P		x		x				
Wilson's Phalarope	*									P	x	x
Ring-billed Gull	*											P
Caspian Tern	m											
Forster's Tern	*										x	P
Black Tern	2										x	P
Rock Dove	2								P			
Mourning Dove	4	x		x	x	x		P	x			
Black-billed Cuckoo	3			P		x	x	x				
Yellow-billed Cuckoo	1			x	P			x				
Great Horned Owl	4	x		P	x			x	x			
Barred Owl	3	x		x	P							
Long-eared Owl	1	P	x	x								
Common Nighthawk	3					x			P		x	x
Whip-poor-will	3	x		P				x				
Chimney Swift	2			x				x	P			
Ruby-throated Hummingbird	3			x	x	x		P				
Belted Kingfisher	3										x	P

Table 11. Continued.

Species	Abund	CF	LCF	DF	LDF	US	SS	ED	GL	WM	EM	OW
Red-headed Woodpecker	2			P	x			x				
Red-bellied Woodpecker	1			x	P							
Yellow-bellied Sapsucker	3	x		P	x							
Downy Woodpecker	4	x	x	P	x			x				
Hairy Woodpecker	4	x	x	P	x			x				
Northern Flicker	3			P	x	x		x	x			
Pileated Woodpecker	3	x		P	x							
Olive-sided Flycatcher	1	x	P									
Eastern Wood-Pewee	4	x		P	x							
Yellow-bellied Flycatcher	m	x	P									
Alder Flycatcher	3						P	x		x		
Least Flycatcher	5	x		P	x			x				
Eastern Phoebe	2			x	x			P			x	x
Great Crested Flycatcher	4			P	x			x				
Western Kingbird	*								P			
Eastern Kingbird	4					x		x	P			
Horned Lark	2								P			
Purple Martin	*			x		x		x	P		x	
Tree Swallow	4					x		x	x		x	P
N. Rough-winged Swallow	2					x			P		x	x

Table 11. Continued.

Species	Abund	CF	LCF	DF	LDF	US	SS	ED	GL	WM	EM	OW
Bank Swallow	3					x			P		x	x
Cliff Swallow	3					x			P		x	
Barn Swallow	3					x			P		x	
Blue Jay	4	x	x	P	x	x		x				
American Crow	4	x		x	x	x		x	P			
Black-capped Chickadee	4	x	x	P	x	x		x				
Red-breasted Nuthatch	2	P	x	x								
White-breasted Nuthatch	4	x		P	x							
Brown Creeper	1	x		P	x							
House Wren	4			x	x	x	x	P				
Winter Wren	2	x	P									
Sedge Wren	4						x		x	P	x	
Marsh Wren	3									x	P	
Blue-gray Gnatcatcher	1			x	P			x				
Eastern Bluebird	3							x	P			
Veery	4	x	x	P	x			x				
Hermit Thrush	1	x	P									
Wood Thrush	2			P	x							
American Robin	4	x		x	x	x		P	x			
Gray Catbird	4			x	x	P	x	x				

Table 11. Continued.

Species	Abund	CF	LCF	DF	LDF	US	SS	ED	GL	WM	EM	OW
Brown Thrasher	3			x	x	P		x				
Cedar Waxwing	4	x		x	x	x		P				
Loggerhead Shrike	m					x			P			
European Starling	1			x		x		x	P			
Yellow-throated Vireo	4			P	x							
Warbling Vireo	3			x	x			P				
Red-eyed Vireo	5	x	x	P	x			x				
Blue-winged Warbler	m											
Golden-winged Warbler	3			x		x		P				
Nashville Warbler	3	P	x	x								
Northern Parula	m											
Yellow Warbler	4			x	x	x	P	x		x	x	
Chestnut-sided Warbler	3			x		P		x				
Black-throated Blue Warbler	m											
Yellow-rumped Warbler	m											
Blackburnian Warbler	m											
Pine Warbler	4	P										
Bay-breasted Warbler	m											
Blackpoll Warbler	m											
Cerulean Warbler	*			x	P							

Table 11. Continued.

Species	Abund	CF	LCF	DF	LDF	US	SS	ED	GL	WM	EM	OW
Black-and White Warbler	2	P	x	x								
American Redstart	5	x	x	P	x			x				
Ovenbird	5	x		P	x							
Northern Waterthrush	m	x	x				P					
Mourning Warbler	3	x		x				P				
Common Yellowthroat	5	x	x	x	x	x	P	x	x	x	x	
Canada Warbler	m											
Scarlet Tanager	4			P	x							
Northern Cardinal	*			x	x	x		P				
Rose-breasted Grosbeak	4			P	x			x				
Indigo Bunting	4			x		x		P	x			
Dickcissel	*					x			P			
Rufous-sided Towhee	2			x		P		x				
Chipping Sparrow	4	x	x	x				P	x			
Clay-colored Sparrow	5					x		x	P	x		
Field Sparrow	4					x		x	x			
Vesper Sparrow	3								P			
Savannah Sparrow	3								P	x		
Grasshopper Sparrow	2								P			
LeConte's Sparrow	2								x	P	x	

Table 11. Continued.

Species	Abund	CF	LCF	DF	LDF	US	SS	ED	GL	WM	EM	OW
Sharp-tailed Sparrow	*									P	x	
Song Sparrow	4			x		x	x	P	x			
Swamp Sparrow	4						x			x	P	
White-throated Sparrow	m											
Bobolink	1					x			P	x		
Red-winged Blackbird	4						x	x	x	x	P	
Eastern Meadowlark	*					x			P			
Western Meadowlark	2					x			P			
Yellow-headed Blackbird	2										P	
Brewer's Blackbird	2							x	P			
Common Grackle	2	x		x	x	x		P	x			
Brown-headed Cowbird	5	x	x	x	x	x	x	x	x	x	x	
Northern Oriole	4			P	x			x				
Purple Finch	1	P	x	x				x				
House Finch	*							P	x			
American Goldfinch	4			x	x	x	x	x	P	x		
House Sparrow	1							x	P			

Table 12. Relative abundances of mammal species at Camp Ripley and general habitat associations for all mammals documented in Morrison County during MCBS animal surveys in 1991 and 1992.

Abundance Codes:
- 1 = rare
- 2 = infrequent
- 3 = occasional
- 4 = common
- 5 = abundant
- * = found in Morrison County, but outside of Camp Ripley

Habitat Codes:
- CF = coniferous forest
- LCF = lowland coniferous forest
- DF = deciduous forest
- LDF = lowland deciduous forest
- US = upland shrub
- SS = shrub swamp
- ED = forest edge
- GL = dry grassland
- WM = wet meadow/sedge fen
- EM = emergent marsh
- OW = open water (lake/river)

- P = Primary habitat
- x = Secondary habitat

Common Name	Abund	CF	LCF	DF	LDF	US	SS	ED	GL	WM	EM	OW
Arctic Shrew	2		x				x			P	x	
Masked Shrew	4		x	x	P	x	x			x		
Pygmy Shrew	1	x	x	P	x	x		x				
Water Shrew	*									x	x	P
Short-tailed Shrew	4			x	P	x	x	x		x		
Star-nosed Mole	1		P		x		x			x		
Big Brown Bat	?			x	x			P				x
Red Bat	*			x	x			P				x
Hoary Bat	?	x		x	x			P				x
Eastern Cottontail	3			x		x		P				
Snowshoe Hare	2	x	P	x	x	x	x					
White-tailed Jackrabbit	2								P			
Least Chipmunk	1	P		x				x				

Table 12. Continued.

Common Name	Abund	CF	LCF	DF	LDF	US	SS	ED	GL	WM	EM	OW
Eastern Chipmunk	4	x		P		x		x				
Woodchuck	2	x		x		x		P	x			
Thirteen-lined Ground Squirrel	5					x		x	P			
Gray Squirrel	4			P				x				
Fox Squirrel	2			x				P				
Red Squirrel	3	P	x	x								
Northern Flying Squirrel	2	x	P	x	x							
Southern Flying Squirrel	3			P	x							
Plains Pocket Gopher	5							x	P			
Beaver	4			x	x							P
White-footed Mouse	5			P	x	x		x				
Prairie Deer Mouse	3							x	P			
Woodland Deer Mouse	4	P		x								
Southern Red-backed Vole	5	x	P		x		x					
Prairie Vole	3								P			
Meadow Vole	5						x	x	P	x		
Muskrat	4										x	P
Norway Rat	*											
House Mouse	1											
Meadow Jumping Mouse	4				x		x			P	x	

Table 12. Continued.

Common Name	Abund	CF	LCF	DF	LDF	US	SS	ED	GL	WM	EM	OW
Porcupine	5	P		x	x							
Coyote	5							x	P			
Red Fox	3					x		P	x			
Black Bear	3	x		P		x		x				
Raccoon	4			P	x	x		x				
Short-tailed Weasel	3		x	x	x	x		P		x		
Mink	3				x						x	P
Badger	2					x		x	P			
Striped Skunk	4			x		x		P	x			
River Otter	2											P
Bobcat	1			x	x	x	x	P				
White-tailed Deer	5	x		x		x		P	x			

Table 13. Relative abundances of amphibian and reptile species at Camp Ripley and general habitat associations for all herpetofauna documented in Morrison County during MCBS animal surveys in 1991 and 1992.

Abundance Codes:

1 = rare
2 = infrequent
3 = occasional
4 = common
5 = abundant
* = found in Morrison County, but outside of Camp Ripley

Habitat Codes:

CF = coniferous forest
LCF = lowland coniferous forest
DF = deciduous forest
LDF = lowland deciduous forest
US = upland shrub
SS = shrub swamp
ED = edge
GL = dry grassland
WM = wet meadow/sedge fen
EM = emergent marsh
OW = open water (lake/river)
GEN = generalist

P = Primary habitat
x = Secondary habitat

Common Name	Abund	CF	LCF	DF	LDF	US	SS	ED	GL	WM	EM	OW
Blue-spotted Salamander	3	x	x	P	x						x	
Tiger Salamander	2			x	x			P	x	x	x	
Central Newt	1		x	P	x						x	
American Toad	4	x	x	P	x	x	x	x	x	x	x	
Cope's Gray Treefrog	4				x		x	P		x	x	
Eastern Gray Treefrog	5	x	x	x	P	x	x			x	x	
Spring Peeper	5			x	x		P			x	x	
Chorus Frog	4				x		x	x	P	x	x	
Green Frog	3			x	x					x	x	P
Mink Frog	3									x	P	x
Wood Frog	5	x	x	P	x						x	
Northern Leopard Frog	4					x	x	x	x	P	x	x
Snapping Turtle	3										P	x

Table 13. Continued..

Common Name	Abund	CF	LCF	DF	LDF	US	SS	ED	GL	WM	EM	OW
Map Turtle	3											P
Painted Turtle	5										P	x
Blanding's Turtle	3									x	P	x
Spiny Softshell Turtle	4											P
Northern Prairie Skink	3							x	P			
Northern Red-bellied Snake	3	x	x	x	x	x	x	P	x			
Plains Garter Snake	3				x	x	x	x	P			
Eastern Garter Snake	4	x	x	x	x	x	x	P	x	x		
Western Hognose Snake	*							x	P			
Eastern Hognose Snake	2				x	x	x	P	x	x		

Appendix 1. Taxonomic list of bird species documented in Camp Ripley and the surrounding area during the 1991 and 1992 field seasons. (CODE = VertID code from USFWS Checklist of Vertebrates of the United States, the U.S. Territories, and Canada; * = found outside of Camp Ripley, within Morrison County; ^ = documented in Morrison County during migration).

Family	Scientific Name	Common Name	Authority	Code
Gaviidae	*Gavia immer*	Common Loon	Brunnich, 1764	GAIM
Podicipedidae	*Podilymbus podiceps*	Pied-billed Grebe	Linnaeus, 1758	POPO
	Podiceps auritus^	Horned Grebe	Linnaeus, 1758	POAU
	*Podiceps grisegena**	Red-necked Grebe	Boddaert,1783	POGR
Pelicanidae	*Pelecanus erythrorhynchos*^	American White Pelican	Gmelin, 1789	PEER
Phalacrocoracidae	*Phalacrocorax auritus*	Double-crested Cormorant	Lesson, 1831	PHAU
Ardeidae	*Botaurus lentiginosus*	American Bittern	Rackett, 1813	BOLE
	Ixobrychus exilis	Least Bittern	Gmelin, 1789	IXEX
	Ardea herodias	Great Blue Heron	Linnaeus, 1758	ARHE
	Casmerodius albus^	Great Egret	Linnaeus, 1758	CAAL2
	Butorides striatus	Green-backed Heron	Linnaeus, 1758	BUST
	Nycticorax nycticorax^	Black-crowned Night-Heron	Linnaeus, 1758	NYNY
Anatidae	*Cygnus buccinator*	Trumpeter Swan	Richardson, 1832	CYBU
	Branta canadensis	Canada Goose	Linnaeus, 1758	BRCA1
	Aix sponsa	Wood Duck	Linnaeus, 1758	AISP
	Anas crecca^	Green-winged Teal	Linnaeus, 1758	ANCR
	Anas platyrhynchos	Mallard	Linnaeus, 1758	ANPL
	Anas acuta^	Northern Pintail	Linnaeus, 1758	ANAC
	Anas discors	Blue-winged Teal	Linnaeus, 1758	ANDI
	Anas clypeata^	Northern Shoveler	Linnaeus, 1758	ANCL
	Anas strepera^	Gadwall	Linnaeus, 1758	ANST
	Aythya valisineria^	Redhead	Eyton, 1838	AYAM
	Aythya collaris	Ring-necked Duck	Donovan, 1809	AYCO
	Aythya affinis^	Lesser Scaup	Eyton, 1838	AYAF
	Bucephala clangula^	Common Goldeneye	Linnaeus, 1758	BUCL
	Bucephala albeola^	Bufflehead	Linnaeus, 1758	BUAL
	Lophodytes cucullatus	Hooded Merganser	Linnaeus, 1758	LOCU1
Cathartidae	*Cathartes aura*	Turkey Vulture	Linnaeus, 1758	CAAU

Appendix 1, continued.

Family	Scientific Name	Common Name	Authority	Code
Accipitridae	*Pandion haliaetus*	Osprey	Linnaeus, 1758	PAHA
	Haliaeetus leucocephalus	Bald Eagle	Linnaeus, 1766	HALE
	Circus cyaneus	Northern Harrier	Linnaeus, 1766	CICY
	Accipiter striatus	Sharp-shinned Hawk	Vieillot, 1807	ACST
	Accipiter cooperii	Cooper's Hawk	Bonaparte, 1828	ACCO
	*Accipiter gentilis**	Northern Goshawk	Linnaeus, 1758	ACGE
	Buteo lineatus	Red-shouldered Hawk	Gmelin, 1788	BULI
	Buteo platypterus	Broad-winged Hawk	Vieillot, 1823	BUPL
	Buteo jamaicensis	Red-tailed Hawk	Gmelin, 1788	BUJA
	Aquila chrysaetos^	Golden Eagle	Linnaeus, 1758	AQCH
Falconidae	*Falco sparverius*	American Kestrel	Linnaeus, 1758	FASP
Phasianidae	*Perdix perdix**	Gray Partridge	Linnaeus, 1758	PEPE
	Phasianus colchicus	Ring-necked Pheasant	Linnaeus, 1758	PHCO
	Bonasa umbellus	Ruffed Grouse	Linnaeus, 1766	BOUM
	*Meleagris gallopavo**	Wild Turkey	Linnaeus, 1758	MEGA
Rallidae	*Coturnicops noveboracensis*	Yellow Rail	Gmelin, 1789	CONO
	Rallus limicola	Virginia Rail	Vieillot, 1819	RALI
	Porzana carolina	Sora	Linnaeus, 1758	POCA1
	Fulica americana	American Coot	Gmelin, 1789	FUAM
Gruidae	*Grus canadensis*	Sandhill Crane	Linnaeus, 1758	GRCA1
Charadriidae	*Charadrius vociferus*	Killdeer	Linnaeus, 1758	CHVO
Scolopacidae	*Actitis macularia*	Spotted Sandpiper	Linnaeus, 1766	ACMA
	Bartramia longicauda	Upland Sandpiper	Bechetein, 1812	BALO
	Limnodromus griseus^	Short-billed Dowitcher	Gmelin, 1789	LIGR
	Gallinago gallinago	Common Snipe	Linnaeus, 1758	GAGA
	Scolopax minor	American Woodcock	Gmelin, 1789	SCMI
	*Phalaropus tricolor**	Wilson's Phalarope	Viellot, 1819	PHTR
Laridae	*Larus delawarensis**	Ring-billed Gull	Ord, 1815	LADE1
	Sterna caspia^	Caspian Tern	Palias, 1770	STCA1
	*Sterna forsteri**	Forster's Tern	Nuttall, 1834	STFO

Appendix 1, continued.

Family	Scientific Name	Common Name	Authority	Code
Laridae con't.	*Chlidonias niger*	Black Tern	Linnaeus, 1758	CHNI
Columbidae	*Columba livia*	Rock Dove	Gmelin, 1789	COLI
	Zenaida macroura	Mourning Dove	Linnaeus, 1758	ZEMA
Cuculidae	*Coccyzus erythropthalmus*	Black-billed Cuckoo	Wilson, 1811	COER
	Coccyzus americanus	Yellow-billed Cuckoo	Linnaeus, 1758	COAM
Strigidae	*Bubo virginianus*	Great Horned Owl	Gmelin, 1788	BUVI
	Strix varia	Barred Owl	Barton, 1799	STVA
	Asio otus	Long-eared Owl	Linnaeus, 1758	ASOT
Caprimulgidae	*Chordeiles minor*	Common Nighthawk	Forster, 1771	CHMI
	Caprimulgus vociferus	Whip-poor-will	Wilson, 1812	CAVO
Apodidae	*Chaetura pelagica*	Chimney Swift	Linnaeus, 1758	CHPE
Trochilidae	*Archilochus colubris*	Ruby-throated Hummingbird	Linnaeus, 1758	ARCO
Alcedinidae	*Ceryle alcyon*	Belted Kingfisher	Linnaeus, 1758	CEAL
Picidae	*Melanerpes erythrocephalus*	Red-headed Woodpecker	Linnaeus, 1758	MEER
	Melanerpes carolinus	Red-bellied Woodpecker	Linnaeus, 1758	MECA
	Sphyrapicus varius	Yellow-bellied Sapsucker	Linnaeus, 1766	SPVA1
	Picoides pubescens	Downy Woodpecker	Linnaeus, 1766	PIPU
	Picoides villosus	Hairy Woodpecker	Linnaeus, 1766	PIVI
	Colaptes auratus	Northern Flicker	Linnaeus, 1758	COAU
	Dryocopus pileatus	Pileated Woodpecker	Linnaeus, 1758	DRPI
Tyrannidae	*Contopus borealis*	Olive-sided Flycatcher	Swainson, 1832	COBO
	Contopus virens	Eastern Wood-Pewee	Linnaeus, 1766	COVI1
	Empidonax flaviventris^	Yellow-bellied Flycatcher	Baird & Baird, 1843	EMFL
	Empidonax alnorum	Alder Flycatcher	Brewster, 1895	EMAL
	Empidonax minimus	Least Flycatcher	Baird & Baird, 1843	EMMI1
	Sayornis phoebe	Eastern Phoebe	Latham, 1790	SAPH
	Myiarchus crinitus	Great Crested Flycatcher	Linnaeus, 1758	MYCR
	*Tyrannus verticalis**	Western Kingbird	Say, 1823	TYVE
	Tyrannus tyrannus	Eastern Kingbird	Linnaeus, 1758	TYTY

Appendix 1, continued.

Family	Scientific Name	Common Name	Authority	Code
Alaudidae	*Eremophila alpestris*	Horned Lark	Linnaeus, 1758	ERAL
Hirundinidae	*Progne subis**	Purple Martin	Linnaeus, 1758	PRSU
	Tachycineta bicolor	Tree Swallow	Vieillot, 1808	TABI
	Stelgidopteryx serripennis	Northern Rough-winged Swallow	Audubon, 1838	STSE
	Riparia riparia	Bank Swallow	Linnaeus, 1758	RIRI
	Hirundo pyrrhonata	Cliff Swallow	Vieillot, 1817	HIPY
	Hirundo rustica	Barn Swallow	Linnaeus, 1758	HIRU
Corvidae	*Cyanocitta cristata*	Blue Jay	Linnaeus, 1758	CYCR
	Corvus brachyrhynchos	American Crow	Brehm, 1822	COBR1
Paridae	*Parus atricapillus*	Black-capped Chickadee	Linnaeus, 1766	PAAT
Sittidae	*Sitta canadensis*	Red-breasted Nuthatch	Linnaeus, 1766	SICA1
	Sitta carolinesis	White-breasted Nuthatch	Latham, 1790	SICA2
Certhiidae	*Certhia americana*	Brown Creeper	Bonaparte, 1838	CEAM
Troglodytidae	*Troglodytes aedon*	House Wren	Vieillot, 1808	TRAE
	Troglodytes troglodytes	Winter Wren	Linnaeus, 1758	TRTR
	Cistothorus platensis	Sedge Wren	Latham, 1790	CIPL
	Cistothorus palustris	Marsh Wren	Wilson, 1810	CIPA
Muscicapidae	*Polioptila caerulea*	Blue-gray Gnatcatcher	Linnaeus, 1766	POCA
	Sialia sialis	Eastern Bluebird	Linnaeus, 1758	SISI
	Catharus fuscescens	Veery	Stephens, 1817	CAFU2
	Catharus guttatus	Hermit Thrush	Pallas, 1811	CAGU
	Hylocichla mustelina	Wood Thrush	Gmelin, 1789	HYMU
	Turdus migratorius	American Robin	Linnaeus, 1766	TUMI
Mimidae	*Dumetella carolinensis*	Gray Catbird	Linnaeus, 1766	DUCA
	Toxostoma rufum	Brown Thrasher	Linnaeus, 1758	TORU
Bombycillidae	*Bombycilla cedrorum*	Cedar Waxwing	Vieillot, 1808	BOCE
Laniidae	*Lanius ludovicianus*^	Loggerhead Shrike	Linnaeus, 1766	LALU
Sturnidae	*Sturnus vulgaris*	European Starling	Linnaeus, 1758	STVU
Vireonidae	*Vireo flavifrons*	Yellow-throated Vireo	Vieillot, 1808	VIFL

Appendix 1, continued.

Family	Scientific Name	Common Name	Authority	Code
Vireonidae con't.	*Vireo gilvus*	Warbling Vireo	Vieillot, 1808	VIGI
	Vireo olivaceus	Red-eyed Vireo	Linnaeus, 1766	VIOL
Emberizidae	*Vermivora pinus*^	Blue-winged Warbler	Linnaeus, 1766	VEPI
	Vermivora chrysoptera	Golden-winged Warbler	Linnaeus, 1766	VECH
	Vermivora ruficapilla	Nashville Warbler	Wilson, 1811	VERU
	Parula americana^	Northern Parula	Linnaeus, 1758	PAAM
	Dendroica petechia	Yellow Warbler	Linnaeus, 1766	DEPE1
	Dendroica pensylvanica	Chestnut-sided Warbler	Linnaeus, 1766	DEPE
	Dendroica caerulescens^	Black-throated Blue Warbler	Gmelin, 1789	DECA1
	Dendroica coronata^	Yellow-rumped Warbler	Linnaeus, 1766	DECO
	Dendroica fusca^	Blackburnian Warbler	Muellen, 1776	DEFU
	Dendroica pinus	Pine Warbler	Wilson, 1811	DEPI
	Dendroica castanea^	Bay-breasted Warbler	Wilson, 1810	DECA2
	Dendroica striata^	Blackpoll Warbler	Forster, 1772	DEST
	*Dendroica cerulea**	Cerulean Warbler	Wilson, 1810	DECE
	Mniotilta varia	Black-and-White Warbler	Linnaeus, 1766	MNVA
	Setophaga ruticilla	American Redstart	Linnaeus, 1758	SERU1
	Seiurus aurocapillus	Ovenbird	Linnaeus, 1766	SEAU
	Seiurus noveboracensis^	Northern Waterthrush	Gmelin, 1789	SENO
	Oporornis philadelphicus	Mourning Warbler	Wilson, 1810	OPPH
	Geothlypis trichas	Common Yellowthroat	Linnaeus, 1776	GETR
	Wilsonia canadensis^	Canada Warbler	Linnaeus, 1766	WICA
	Piranga olivacea	Scarlet Tanager	Gmelin, 1789	PIOL
	*Cardinalis cardinalis**	Northern Cardinal	Linnaeus, 1758	CACA4
	Pheucticus ludovicianus	Rose-breasted Grosbeak	Linnaeus, 1766	PHLU
	Passerina cyanea	Indigo Bunting	Linnaeus, 1766	PACY
	*Spiza americana**	Dickcissel	Gmelin, 1789	SPAN
	Pipilo erythrophthalmus	Rufous-sided Towhee	Linnaeus, 1758	PIER
	Spizella passerina	Chipping Sparrow	Bechetein, 1798	SPPA2

Appendix 1, continued.

Family	Scientific Name	Common Name	Authority	Code
Emberizidae con't.	*Spizella pallida*	Clay-colored Sparrow	Swainson, 1832	SPPA1
	Spizella pusilla	Field Sparrow	Wilson, 1810	SPPU1
	Pooecetes gramineus	Vesper Sparrow	Gmelin, 1789	POGR1
	Passerculus sandwichensis	Savannah Sparrow	Gmelin, 1789	PASA
	Ammodramus savannarum	Grasshopper Sparrow	Gmelin, 1789	AMSA
	Ammodramus leconteii	LeConte's Sparrow	Audubon, 1843	AMLE
	*Ammodramus caudacatus**	Sharp-tailed Sparrow	Gmelin, 1788	AMCA1
	Melospiza melodia	Song Sparrow	Wilson, 1810	MEME
	Melospiza georgiana	Swamp Sparrow	Latham, 1790	MEGE
	*Zonotrichia albicollis^*	White-throated Sparrow	Gmelin, 1789	ZOAL
	Dolichonyx oryzivorus	Bobolink	Linnaeus, 1758	DOOR
	Agelaius phoeniceus	Red-winged Blackbird	Linnaeus, 1766	AGPH
	*Sturnella magna**	Eastern Meadowlark	Linnaeus, 1758	STMA2
	Sturnella neglecta	Western Meadowlark	Audubon, 1844	STNE1
	Xanthocephalus xanthocephalus	Yellow-headed Blackbird	Bonaparte, 1826	XAXA
	Euphagus cyanocephalus	Brewer's Blackbird	Wagler, 1829	EUCY
	Quisqalus quiscula	Common Grackle	Linnaeus, 1758	QUQU
	Molothrus ater	Brown-headed Cowbird	Boddaert, 1783	MOAT
	Icterus galbula	Northern Oriole	Linnaeus, 1758	ICGA
Fringillidae	*Carpodacus purpureus*	Purple Finch	Gmelin, 1789	CAPU1
	*Carpodacus mexicanus**	House Finch	Muller, 1776	CAME2
	Carduelis tristis	American Goldfinch	Linnaeus, 1758	CATR
Passeridae	*Passer domesticus*	House Sparrow	Linnaeus, 1758	PADO1

Appendix 2. Taxonomic list of mammal species documented in Camp Ripley and the surrounding area during the 1991 and 1992 fiels seasons. (CODE = VertID code from USFWS Checklist of Vertebrates of the United States, the U.S. Territories, and Canada; * = found outside of Camp Ripley, within Morrison County).

Family	Scientific Name	Common Name	Authority	Code
Soricidae	*Sorex arcticus*	Arctic Shrew	Kerr, 1792	SOAR
	Sorex cinereus	Masked Shrew	Kerr, 1792	SOCI
	Sorex hoyi	Pygmy Shrew	Baird, 1858	SOHO
	*Sorex palustris**	Northern Water Shrew	Richardson, 1828	SOPA1
	Blarina brevicauda	Short-tailed Shrew	Say, 1823	BLBR
Talpidae	*Condylura cristata*	Star-nosed Mole	Linnaeus, 1758	COCR
Vespertilionidae	*Eptesicus fuscus*	Big Brown Bat	Paisot de Beuvois, 1796	EPFU
	*Lasiurus borealis**	Red Bat	Miller, 1776	LABO
	Lasiurus cinereus	Hoary Bat	Palisot de Beauvois, 1796	LACI
Leporidae	*Sylvilagus floridanus*	Eastern Cottontail	J.A. Allen, 1890	SYFL
	Lepus americanus	Snowshoe Hare	Erxieben, 1777	LEAM
	Lepus townsendii	White-tailed Jackrabbit	Bachman, 1839	LETO
Sciuridae	*Tamias minimus*	Least Chipmunk	Bechman, 1839	TAMI
	Tamias striatus	Eastern Chipmunk	Linnaeus, 1758	TAST
	Marmota monax	Woodchuck	Linnaeus, 1758	MAMO
	Spermophilus tridecemlineatus	Thirteen-lined Ground Squirrel	Mitchell,1821	SPTR
	Sciurus carolinensis	Gray Squirrel	Gmelin, 1788	SCCA
	Scuirus niger	Fox Squirrel	Linnaeus, 1758	SCNI
	Tamiasciurus hudsonicus	Red Squirrel	Erxieben, 1777	TAHU
	Glaucomys sabrinus	Northern Flying Squirrel	Shaw, 1801	GLSA
	Glaucomys volans	Southern Flying Squirrel	Linnaeus, 1758	GLVO
Geomyidae	*Geomys bursarius*	Plains Pocket Gopher	Shaw, 1800	GEBU
Castoridae	*Castor canadensis*	Beaver	Kuhl, 1820	CACA8
Muridae	*Peromyscus leucopus*	White-footed Mouse	Rafinesque, 1818	PELE1
	Peromyscus maniculatus bairdii	Prairie Deer Mouse	Osgood, 1909	PEMA1
	Peromyscus maniculatus gracilis	Woodland Deer Mouse	Osgood, 1909	PEMA1
	Clethrionomys gapperi	Southern Red-backed Vole	Vigors, 1830	CLGA
	Microtus ochrogaster	Prairie Vole	Wagner, 1842	MIOC

Appendix 2, continued.

Family	Scientific Name	Common Name	Authority	Code
Muridae con't	*Microtus pennsylvanicus*	Meadow Vole	Ord, 1815	MIPE
	Ondatra zibethicus	Muskrat	Linnaeus, 1766	ONZI
	*Rattus norvegicus**	Norway Rat	Berkenhout, 1769	RANO
	Mus musculus	House Mouse	Linnaeus, 1758	MUMU
Zapodidae	*Zapus hudsonius*	Meadow Jumping Mouse	Zimmermann, 1780	ZAHU
Erethizontidae	*Erethizon dorsatum*	Porcupine	Linnaeus, 1758	ERDO
Canaidae	*Canis latrans*	Coyote	Say, 1823	CALA2
	Vulpes vulpes	Red Fox	Linnaeus, 1758	VUVU
Ursidae	*Ursus americanus*	Black Bear	Pallas, 1780	URAM
Procyonidae	*Procyon lotor*	Raccoon	Linnaeus, 1758	PRLO
Mustelidae	*Mustela ermina*	Short-tailed Weasel	Linnaeus, 1758	MUER
	Mustela vison	Mink	Schreber, 1777	MUVI
	Taxidea taxus	Badger	Schreber, 1778	TATA
	Lutra canadensis	River Otter	Schreber, 1776	LUCA1
	Mephitis mephitis	Striped Skunk	Schreber, 1776	MEME1
Felidae	*Lynx rufus*	Bobcat	Schreber, 1776	LYRU
Cervidae	*Odocoileus virginianus*	White-tailed Deer	Zimmermann, 1780	ODVI

Appendix 3. Taxomonic list of amphibians and reptiles documented in Camp Ripley and the surronding area during the 1991 and 1992 field seasons. (CODE = VertID code from USFWS Checklist of Vertebrates of the United States, the U.S. Territories, and Canada; * = found outside of Camp Ripley, within Morrison County).

Family	Scientific Name	Common Name	Authority	Code
Ambystomidae	*Ambystoma laterale*	Blue-spotted Salamander	Hallowell, 1856	AMLA
	Ambystoma tigrinum	Tiger Salamander	Green, 1825	AMTI
Salamandridae	*Notophthalmus viridescens*	Central Newt	Rafinesque, 1820	NOVI
Bufonidae	*Bufo americanus*	American Toad	Holbrook, 1836	BUAM
Hylidae	*Hyla chrysoscelis*	Cope's Gray Treefrog	Cope, 1889	HYCH
	Hyla versicolor	Eastern Gray Treefrog	LeConte, 1825	HYVE
	Hyla crucifer	Spring Peeper	Weid & Neuwied, 1839	HYCR
	Pseudacris triseriata	Chorus Frog	Weid & Neuwied, 1839	PSTR
Ranidae	*Rana clamitans*	Green Frog	Latreille, 1801	RACL
	Rana septentrionalis	Mink Frog	Baird, 1854	RASE
	Rana sylvatica	Wood Frog	LeConte, 1825	RASY
	Rana pipiens	Northern Leopard Frog	Schreber, 1782	RAPI
Chelydridae	*Chelydra serpentina*	Snapping Turtle	Linnaeus, 1758	CHSE1
Emydidae	*Graptemys geographica*	Map Turtle	Le Sueur, 1817	GRGE
	Chrysemys picta	Painted Turtle	Schneider, 1783	CHPI
	Emydoidea blandingii	Blanding's Turtle	Holbrook, 1838	EMBL
Trionychidae	*Trionyx spiniferus*	Spiny Softshell Turtle	Lesuer, 1827	TRSP
Scincidae	*Eumeces septentrianalis*	Northern Prairie Skink	Baird, 1859	EUSE
Colubridae	*Storeria occipitomaculata*	Northern Red-bellied Snake	Storer, 1839	STOC
	Thamnophis radix	Plains Garter Snake	Baird & Girard, 1853	THRA
	Thamnophis sirtalis	Eastern Garter Snake	Ruthven, 1908	THSI
	Heterodon nasicus *	Western Hognose Snake	Baird and Girard 1852	HENA
	Heterodon platyrhinos	Eastern Hognose Snake	Latreillein: Sonnini, 1801	HEPL

Appendix 4. Breeding bird species documented from LCTA wildlife core plots and grouped by habitat type.

Coniferous-Deciduous Forest (4 core plots: #8,24,40,83)

1991		1992	
Species (22 total)	# plots	Species (23 total)	# plots
Red-eyed Vireo	4	Great Crested Flycatcher	4
Eastern Wood-pewee	3	Ovenbird	4
Pine Warbler	3	Red-eyed Vireo	4
Great Crested Flycatcher	3	Pine Warbler	3
Ovenbird	3	Eastern Wood-pewee	2
American Redstart	3	Blue Jay	2
Chipping Sparrow	3	Least Flycatcher	2
Ruffed Grouse	2	Scarlet Tanager	2
Brown-headed Cowbird	2	Chipping Sparrow	2
Downy Woodpecker	2	Warbling Vireo	2
Broad-winged Hawk	1	Ruffed Grouse	1
Veery	1	Veery	1
Hermit Thrush	1	American Goldfinch	1
Chestnut-sided Warbler	1	Common Nighthawk	1
Yellow Warbler	1	Chestnut-sided Warbler	1
Least Flycatcher	1	Pileated Woodpecker	1
Mourning Warbler	1	Gray Catbird	1
Black-capped Chickadee	1	Black-capped Chickadee	1
Indigo Bunting	1	Indigo Bunting	1
Scarlet Tanager	1	Hairy Woodpecker	1
White-breasted Nuthatch	1	American Redstart	1
Nashville Warbler	1	Yellow-bellied Sapsucker	1
		Blue-winged Warbler	1

Appendix 4, continued.

Deciduous Forest (28 core plots: #9,10,11,13,14,15,16,17,18,35,41,43,45,46,47,48,50,53, 54,59,62,63,65,67,69,76,77,78)

1991		1992	
Species (33 total)	# plots	Species (46 total)	# plots
Red-eyed Vireo	28	Red-eyed Vireo	28
Least Flycatcher	23	Cvenbird	24
Ovenbird	22	American Redstart	23
American Redstart	19	Scarlet Tanager	20
Scarlet Tanager	15	Least Flycatcher	17
Yellow-throated Vireo	14	Eastern Wood-pewee	15
Eastern Wood-pewee	13	Yellow-throated Vireo	14
Brown-headed Cowbird	12	Brown-headed Cowbird	12
Veery	7	Great Crested Flycatcher	11
Red-breasted Nuthatch	7	Veery	8
Great Crested Flycatcher	6	American Goldfinch	7
Blue Jay	4	Blue Jay	7
Black-capped Chickadee	4	Chestnut-sided Warbler	7
Ruffed Grouse	2	Common Yellowthroat	6
Broad-winged Hawk	2	Yellow Warbler	5
Rose-breasted Grosbeak	2	Black-capped Chickadee	5
Cedar Waxwing	1	Indigo Bunting	5
Hermit Thrush	1	Hairy Woodpecker	5
American Crow	1	Downy Woodpecker	4
Chestnut-sided Warbler	1	White-breasted Nuthatch	4
Yellow Warbler	1	Yellow-bellied Sapsucker	4
Pileated Woodpecker	1	Golden-winged Warbler	4
Mourning Warbler	1	Ruby-throated Hummingbird	3
Indigo Bunting	1	Brown Creeper	2
Downy Woodpecker	1	Yellow-billed Cuckoo	2
Hairy Woodpecker	1	Black-billed Cuckoo	2

Appendix 4, continued.

Deciduous Forest (continued)

1991		1992	
Species	# plots	Species	# plots
Blue-gray Gnatcatcher	1	Gray Catbird	2
Vesper Sparrow	1	Northern Oriole	2
Clay-colored Sparrow	1	Black-and-white Warbler	2
Chipping Sparrow	1	Chipping Sparrow	2
Yellow-bellied Sapsucker	1	Ruffed Grouse	1
Winter Wren	1	Red-shouldered Hawk	1
Warbling Vireo	1	Whip-poor-will	1
		Pileated Woodpecker	1
		Yellow-bellied Flycatcher	1
		Rose-breasted Grosbeak	1
		Blue-gray Gnatcatcher	1
		American Woodcock	1
		Clay-colored Sparrow	1
		Field Sparrow	1
		North. Rough-winged Swallow	1
		American Robin	1
		Eastern Kingbird	1
		Tennessee Warbler	1
		Warbling Vireo	1
		Mourning Dove	1

Appendix 4, continued.

Upland Shrub (2 core plots: #44,61)

1991		1992	
Species (15 total)	# plots	Species (16 total)	# plots
Cedar Waxwing	1	Yellow Warbler	2
American Goldfinch	1	Gray Catbird	2
Whip-poor-will	1	Common Yellowthroat	2
Yellow Warbler	1	Clay-colored Sparrow	2
Gray Catbird	1	Field Sparrow	2
Common Yellowthroat	1	Ruby-throated Hummingbird	1
Brown-headed Cowbird	1	Cedar Waxwing	1
Black-capped Chickadee	1	American Goldfinch	1
Indigo Bunting	1	Black-billed Cuckoo	1
Scarlet Tanager	1	Eastern Wood-pewee	1
American Redstart	1	Blue Jay	1
Clay-colored Sparrow	1	Brown-headed Cowbird	1
Field Sparrow	1	Great Crested Flycatcher	1
House Wren	1	Indigo Bunting	1
Red-eyed Vireo	1	Eastern Bluebird	1
		Red-eyed Vireo	1

Appendix 4, continued.

Grassland (8 core plots: #3,4,6,26,30,32,33,37)

1991		1992	
Species (38 total)	# plots	Species (33 total)	# plots
Clay-colored Sparrow	6	Eastern Kingbird	8
Song Sparrow	4	Vesper Sparrow	7
American Goldfinch	3	Clay-colored Sparrow	7
Eastern Kingbird	3	Song Sparrow	4
Red-winged Blackbird	2	American Robin	4
Yellow Warbler	2	Red-winged Blackbird	3
Brewer's Blackbird	2	American Goldfinch	3
Brown-headed Cowbird	2	Gray Catbird	3
Great Crested Flycatcher	2	Field Sparrow	3
Scarlet Tanager	2	Mourning Dove	3
Vesper Sparrow	2	Cedar Waxwing	2
Field Sparrow	2	Brewer's Blackbird	2
American Robin	2	Common Yellowthroat	2
Red-eyed Vireo	2	Barn Swallow	2
Mourning Dove	2	Northern Oriole	2
Wood Duck	1	Brown-headed Cowbird	2
Cedar Waxwing	1	Eastern Bluebird	2
Killdeer	1	Chipping Sparrow	2
Northern Harrier	1	Red-tailed Hawk	1
Blue Jay	1	Common Nighthawk	1
Gray Catbird	1	Killdeer	1
Least Flycatcher	1	Sedge Wren	1
Common Yellowthroat	1	Northern Flicker	1
Bald Eagle	1	Yellow Warbler	1
Northern Oriole	1	Bobolink	1
Indigo Bunting	1	Least Flycatcher	1
Savannah Sparrow	1	Great Crested Flycatcher	1

Appendix 4, continued.

Aspen Regeneration (9 core plots: #19,21,22,55,68,70,71,72,73)

1991		1992	
Species (23 total)	# plots	Species (33 total)	# plots
Red-eyed Vireo	9	Red-eyed Vireo	9
American Redstart	8	American Redstart	8
Brown-headed Cowbird	7	Chestnut-sided Warbler	7
Veery	6	Yellow Warbler	7
American Goldfinch	6	Veery	6
Yellow Warbler	6	Gray Catbird	6
Golden-winged Warbler	6	Golden-winged Warbler	6
Indigo Bunting	5	Ruffed Grouse	5
Chestnut-sided Warbler	4	Brown-headed Cowbird	5
Rose-breasted Grosbeak	4	Black-capped Chickadee	5
Blue Jay	3	Indigo Bunting	5
Gray Catbird	3	American Goldfinch	4
Ruby-throated Hummingbird	2	Great Crested Flycatcher	4
Song Sparrow	2	Yellow-billed Cuckoo	3
Ovenbird	2	Eastern Wood-pewee	3
Alder Flycatcher	1	Blue Jay	3
Great Crested Flycatcher	1	Common Yellowthroat	3
Mourning Warbler	1	Rose-breasted Grosbeak	3
Black-capped Chickadee	1	Ovenbird	3
Scarlet Tanager	1	Yellow-throated Vireo	3
Chipping Sparrow	1	Cooper's Hawk	2
House Wren	1	Ruby-throated Hummingbird	2
Yellow-throated Vireo	1	Scarlet Tanager	2
		Hairy Woodpecker	2
		American Bittern	1
		Least Flycatcher	1
		Wood Thrush	1

Appendix 4, continued.

Aspen Regeneration (continued)

1991		1992	
Species	# plots	Species	# plots
		Northern Oriole	1
		Chipping Sparrow	1
		American Robin	1
		Eastern Kingbird	1
		Warbling Vireo	1
		Mourning Dove	1

Appendix 4, continued.

Plantation (4 core plots: #2,23,49,79)

1991		1992	
Species (10 total)	# plots	Species (14 total)	# plots
Vesper Sparrow	4	Chipping Sparrow	4
Clay-colored Sparrow	4	Field Sparrow	4
Chipping Sparrow	3	American Goldfinch	3
American Goldfinch	2	Vesper Sparrow	3
Song Sparrow	2	Clay-colored Sparrow	3
Field Sparrow	2	Grasshopper Sparrow	2
Eastern Kingbird	2	Barn Swallow	2
Barn Swallow	1	Eastern Bluebird	2
Indigo Bunting	1	Eastern Kingbird	2
Eastern Bluebird	1	Common Yellowthroat	1
		Brown-headed Cowbird	1
		Bank Swallow	1
		Tree Swallow	1
		House Wren	1

Appendix 5. Small mammal species documented from LCTA wildlife core plots and grouped by habitat.

Coniferous-Deciduous Forest (4 core plots: #8,24,40,83)

1991		1992	
Species (6 total)	# grids	Species (10 total)	# grids
Southern red-backed vole	4	Southern red-backed vole	4
White-footed mouse	4	White-footed mouse	4
Eastern chipmunk	3	Meadow jumping mouse	3
Meadow jumping mouse	3	Southern flying squirrel	2
Masked shrew	2	Short-tailed shrew	1
Meadow vole	1	Plains pocket gopher	1
		Meadow vole	1
		Deer mouse	1
		Masked shrew	1
		Eastern chipmunk	1

Deciduous Forest (28 core plots: #9,10,11,13,14,15,16,17,18,35,41,43,45,46,47,48, 50,53,54,59,62,63,65,67,69,76,77,78)

1991		1992	
Species (11 total)	# grids	Species (10 total)	# grids
White-footed mouse	28	White-footed mouse	26
Southern red-backed vole	24	Southern red-backed vole	21
Eastern chipmunk	16	Eastern chipmunk	13
Masked shrew	6	Meadow jumping mouse	13
Meadow jumping mouse	5	Short-tailed shrew	9
Short-tailed shrew	4	Deer mouse	8
Deer mouse	2	Masked shrew	6
Snowshoe hare	1	Southern flying squirrel	3
Meadow vole	1	Snowshoe hare	1
Northern flying squirrel	2	Pygmy shrew	1
Short-tailed weasel	1		

Appendix 5, continued.

Upland Shrub (2 core plots: #44,61)

1991		1992	
Species (7 total)	# grids	Species (5 total)	# grids
Meadow vole	2	Short-tailed shrew	2
White-footed mouse	2	Meadow jumping mouse	2
Southern red-backed vole	1	Southern red-backed vole	1
Masked shrew	1	White-footed mouse	1
Thirteen-lined ground squirrel	1	Thirteen-lined ground squirrel	1
Eastern chipmunk	1		
Meadow jumping mouse	1		

Grassland (8 core plots: #3,4,6,26,30,32,33,37)

1991		1992	
Species (9 total)	# grids	Species (8 total)	# grids
Deer mouse	7	Deer mouse	6
Meadow vole	6	Thirteen-lined ground squirrel	6
Thirteen-lined ground squirrel	4	Meadow vole	5
Meadow jumping mouse	4	Prairie vole	3
Prairie vole	3	Meadow jumping mouse	3
White-footed mouse	3	Short-tailed shrew	1
Eastern chipmunk	3	White-footed mouse	1
Southern red-backed vole	2	Eastern chipmunk	1
Masked shrew	2		

Appendix 5, continued.

Lowland Grass/Shrub (5 core plots: #1,29,39,74,82)

1991		1992	
Species (7 total)	# grids	Species (7 total)	# grids
Meadow vole	3	Meadow vole	4
White-footed mouse	3	Arctic shrew	2
Short-tailed shrew	2	Masked shrew	2
Southern red-backed vole	2	Short-tailed shrew	1
Masked shrew	2	Southern red-backed vole	1
Meadow jumping mouse	2	Eastern chipmunk	1
Arctic shrew	1	Meadow jumping mouse	1

Aspen Regeneration (9 core plots: #19,21,22,55,68,70,71,72,73)

1991		1992	
Species (10 total)	# grids	Species (9 total)	# grids
Southern red-backed vole	9	Southern red-backed vole	7
White-footed mouse	9	Eastern chipmunk	7
Masked shrew	7	Short-tailed shrew	6
Eastern chipmunk	7	Meadow jumping mouse	6
Meadow jumping mouse	6	White-footed mouse	4
Short-tailed shrew	5	Masked shrew	3
Snowshoe hare	4	Meadow vole	2
Meadow vole	1	Northern flying squirrel	1
Deer mouse	1	Deer mouse	1
Least chipmunk	1		

Appendix 5, continued.

Plantation (4 core plots: #2,23,49,79)

1991		1992	
Species (6 total)	# grids	Species (5 total)	# grids
Meadow vole	4	Meadow vole	4
Thirteen-lined ground squirrel	4	Thirteen-lined ground squirrel	4
White-footed mouse	2	Short-tailed shrew	1
Deer mouse	2	White-footed mouse	1
Masked shrew	2	Arctic shrew	1
Meadow jumping mouse	2		

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Dorff, Carol J.
Animal surveys at the
Minnesota Army National

DATE	ISSUED TO

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