# MINNESOTA ARMY NATIONAL GUARD

# CAMP RIPLEY TRAINING CENTER AND ARDEN HILLS ARMY TRAINING SITE

## 2018 CONSERVATION PROGRAM REPORT

Cover photography: Blanding's turtle (*Emys blandingii*) hatchling, Camp Ripley Training Center, August 2018. Photography by Camp Ripley Envrionmental staff.

# Minnesota Army National Guard

# Camp Ripley Training Center

# and

# Arden Hills Army Training Site

## 2018 Conservation Program Report

January 1 – December 31, 2018

Division of Ecological and Water Resources
Minnesota Department of Natural Resources
for the
Minnesota Army National Guard

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
CAMP RIPLEY SERIES REPORT NO. 28


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# Executive Summary

The purpose of this report is to summarize annual accomplishments for the conservation program of the Minnesota Army National Guard during calendar year 2018. The Camp Ripley Training Center and Arden Hills Army Training Site Integrated Natural Resources Management Plans (Minnesota Army National Guard 2018a, 2018b) provide a comprehensive five-year plan, and document the policies and future desired direction of the conservation programs for the Minnesota Army National Guard. The preparation, implementation and annual updates of Integrated Natural Resources Management Plans are required by the Sikes Act (16 U.S. Code § 670a – *Cooperative plan for conservation and rehabilitation*), Army policy, and several other federal directives including regulations and guidance issued by the U.S. Department of Defense. An annual review is required to track any changes and evaluate effectiveness of the program with the U.S. Fish and Wildlife Service, the Minnesota Department of Natural Resources and other appropriate state agencies.

The primary goals of the conservation program, as established by Camp Ripley, are to maintain ecosystem viability and ensure the sustainability of desired future conditions; to maintain, protect, and improve ecological integrity; to protect and enhance biological communities, particularly sensitive, rare, threatened and endangered species; to protect the ecosystems and their components from unacceptable damage or degradation; and to identify and restore degraded habitats.

The ability to achieve these goals depends directly on the health and condition of the natural resources under the Minnesota Army National Guard's purview. Protecting the ecological and biological integrity of its training lands ensures that those lands will continue to provide the vegetation, soil and water resources necessary for sustainable military training. Such protection will also preserve popular outdoor recreational activities at Camp Ripley.

The conservation program must remain flexible if it is to achieve long-term success. The program will achieve and maintain this flexibility by incorporating adaptive management techniques.

Adaptive management is a process by which new information from monitoring data, scientific literature, or both is used to evaluate the success of the management measures currently in place. This information is then used to determine changes in the management approach needed to ensure continued success of the program. The natural resources management program might also be required to adapt to unforeseen changes in military mission and legal requirements.

# Camp Ripley Training Center

Camp Ripley is located in the central portion of Minnesota approximately 100 miles northwest of the Minneapolis/Saint Paul metropolitan area (Figure 1). According to the 2003 property boundary survey, Camp Ripley occupies 52,699 acres (approximately 82 square miles) within Morrison County and

59 acres within Crow Wing County (52,758 acres total). Camp Ripley is bordered on the north by 11 miles of the Crow Wing River and on the east by 18 miles of the Mississippi River. Land ownership is 98% state land under the administration of the Minnesota Department of Military Affairs with the remainder under lease from Minnesota Power, an ALLETE company.

Camp Ripley's landscape was sculpted during the last glacial period, the Late Wisconsinan. Because the glaciers receded along the northern two-thirds of Camp, a sharp contrast is evident from north to south, both topographically and biologically. The high diversity of life forms (over 600 plant species, 233 migratory and resident bird species, 51 mammal species, and 23 reptile and amphibian species) is also a result of Camp Ripley's location along the forest transition zone in central Minnesota. Forest dominates the landscape, covering 28,035 acres or 55% of the installation. The remainder is almost equally divided between wetlands, dry open grass and brush lands, and other areas.

Camp Ripley's annual average for military and civilian utilization is 365,000 man-days. Since 2007, more than 3.68 million man-days of training have occurred. Organizations include all branches of the military, many international military units, as well as civilians from a variety of organizations including federal, state and local law enforcement agencies. Camp Ripley supports the federal mission for military training as a 7,800 person, year-round training facility for the Army National Guard, primarily consisting of units from Minnesota, North Dakota, South Dakota, Wisconsin, Iowa and Illinois. The state training mission focuses primarily on law enforcement activities, natural resource education and emergency management activities. The central mission of the natural resources management program is to ensure that the multiple demands for land use can be met without sacrificing the integrity of Camp Ripley's training mission and natural resources.

Inventory and monitoring surveys of flora and fauna are an ongoing part of the installation's Integrated Natural Resources Management Plan that was completed in 2003 and updated in 2018 (Minnesota Army National Guard 2018b). The Conservation Program Report represents annual updates to the Camp Ripley Integrated Natural Resources Management Plan. The data obtained will be used to help manage the conservation program and natural resources of the Minnesota Army National Guard.

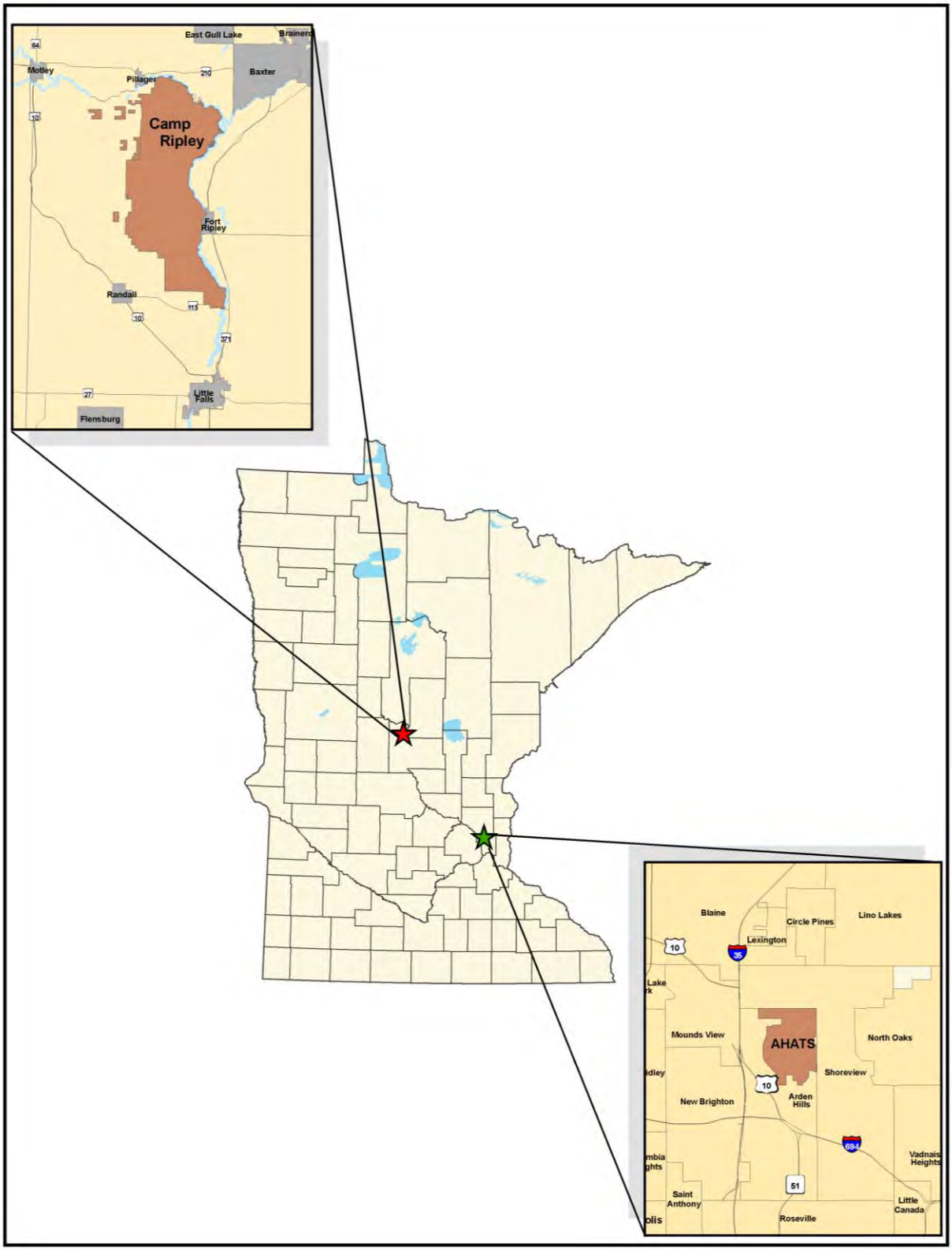
## Arden Hills Army Training Site

The Twin Cities Army Ammunition Plant was one of six government owned – contractor operated plants built to produce small arms ammunition during World War II. The Minnesota Army National Guard began leasing its current facility in 1972 and the organizational maintenance shop buildings were constructed in 1973. In September 2000, the Minnesota Army National Guard acquired accountability for a portion of the 2,347-acre installation. That portion of the Twin Cities Army Ammunition Plant is now known as the Arden Hills Army Training Site and consists of 1,500 acres, which is available for military training and environmental management (Figure 1). The Arden Hills Army Training Site is located in the northern portion of the city of Arden Hills, approximately eight miles north

of Saint Paul and six miles northeast of Minneapolis. Other surrounding municipalities include New Brighton, Mounds View and Shoreview.

Population and monitoring studies along with management of the flora and fauna is an ongoing part of the installation's Integrated Natural Resources Management Plan, which was approved in 2001 and updated in 2018 (Minnesota Army National Guard 2018a). The Conservation Program Report represents annual updates to the Arden Hills Army Training Site Integrated Natural Resources Management Plan. The data obtained is used to help manage the natural resources on Arden Hills Army Training Site. Thirty-one mammal species, 147 bird species and 298 plant species have been identified at the training site.

Figure 1. Location of Camp Ripley Training Center and Arden Hills Army Training Site, Minnesota.



# Introduction

This conservation program report provides Integrated Natural Resources Management Plan (INRMP) accomplishments for Camp Ripley Training Center and Arden Hills Army Training Site (AHATS). It is intended to support and complement the military mission of the Minnesota Army National Guard (MNARNG) while also promoting sound conservation stewardship principles. It summarizes the activities of the Camp Ripley and AHATS conservation program, and also serves as a component of the annual update to the INRMP. This document is Appendix A of the Camp Ripley INRMP (MNARNG 2018b) and AHATS INRMP (MNARNG 2018a). The INRMP goals and objectives for Camp Ripley and AHATS are updated annually and can be found in Appendix B of the INRMP (MNARNG 2018a, 2018b).

# Responsibilities

The Camp Ripley Command – Environmental (CRE) office is responsible for conservation program planning and implementation for the MNARNG. This includes, but is not limited to, preparing plans, developing projects, implementing projects, conducting field studies, securing permits, geographic information system support, preparing reports, and facilitating land use activities between military operations and other natural resource agencies. The environmental staff who work directly for the garrison commander are responsible for MNARNG's conservation programs statewide. Environmental staff who work directly for the Facilities Management Office have statewide responsibility for MNARNG's compliance, restoration and pollution prevention programs.

# Partnerships

In the interest of sound conservation, the MNARNG has developed partnerships with a variety of organizations and resource agencies. Some of these partnerships have resulted in formal interagency agreements with Central Lakes College in Brainerd, Minnesota, the Minnesota Department of Natural Resources, Divisions of Ecological and Water Resources and Forestry, and St. Cloud State University in Saint Cloud, Minnesota. These agreements have been extremely cost effective and beneficial. The MNARNG also relies on expertise of staff from other state and federal agencies and organizations who contribute significantly to the support of the MNARNG conservation program, including Cass County Soil and Water Conservation District, Crow Wing Soil and Water Conservation District, the Minnesota Department of Agriculture, Minnesota Board of Water and Soil Resources, Minnesota Department of Corrections, Minnesota Department of Health, Minnesota Pollution Control Agency, Minnesota Department of Transportation, Morrison Soil and Water Conservation District, The Conservation Fund, The Nature Conservancy, and the U.S. Fish and Wildlife Service. Other partners include the Disabled American Veterans of Minnesota, Minnesota Deer Hunters Association, and Minnesota State Archery Association.

The success of the conservation program for the MNARNG is also attributed to a partnership between the environmental and military operations offices, represented by a shared training area coordinator position. This partnership has enabled the MNARNG to provide a quality training experience for its soldiers without sacrificing the integrity of the conservation program.

## Program Areas

For the purpose of documenting its accomplishments, the conservation program of the MNARNG is divided into the following program areas within each installation: cultural resources, natural resources, land use management and outreach and recreation.

## Camp Ripley Training Center

## Cultural Resources

By Patrick Neumann, Minnesota Department of Military Affairs

### Program Overview

Cultural resources management is the identification of culturally, historically, architecturally and archaeologically significant properties, the management of those properties in a manner that is consistent with applicable state and federal laws and regulations, the mission of Army National Guard, and respectful of the intrinsic values of the properties. The MNARNG must comply with federal laws regarding cultural resources if conducting operations considered a federal undertaking. A federal undertaking means a project, activity or program funded in whole, or in part, under the direct or indirect jurisdiction of a federal agency, including those carried out by, or on behalf of, a federal agency; those carried out with federal assistance; and those requiring a federal permit, license or approval. Construction projects, improvements and activities carried out by the MNARNG through federal funding are defined as a federal undertaking requiring compliance with federal historic preservation laws. The primary laws regarding cultural resources management are:

1. The National Historic Preservation Act of 1966 (as amended)
2. The Native American Graves Protection and Repatriation Act
3. The National Environmental Policy Act
4. The American Antiquities Act of 1906
5. The Archaeological and Historic Preservation Act of 1974
6. The American Indian Religious Freedom Act of 1978
7. The Energy Independence and Security Act of 2007

There are also several executive orders, Department of Defense directives, Army regulations, and Army memorandums concerning how the MNARNG executes these laws and manages the cultural resources under its care. The MNARNG also complies with state historic preservation laws which can be

found at https://www.revisor.mn.gov/pubs/. While this section of the annual update includes revised numbers, totals, and progress toward goals as well as achievements, it is meant to be only an update. For more complete information regarding the MNARNG cultural resources program and how it is administered please reference the MNARNG Integrated Cultural Resources Management Plan (MNARNG 2019).

## Field Survey

There has been an ongoing effort over the last several years by the MNARNG to survey the lands and structures it controls for cultural and archaeological resources. This survey work greatly accelerates the timeframe of compliance with federal preservation laws. A typical survey for historic structures or land for cultural resources can take anywhere from several weeks to several months, depending on the size and complexity of the survey required. The CRE office of the MNARNG chose to survey the most utilized areas of Camp Ripley as well as its readiness centers across the state. This has led to a greatly reduced turnaround time for permitting construction projects and other maintenance activities. When a federal undertaking is considered, a consultation must occur between the MNARNG and the Minnesota State Historic Preservation Office (SHPO) as well as tribal representatives and other interested parties. If the undertaking occurs on un-surveyed land or historic structures, it could take several months or longer to acquire concurrence from the SHPO that the MNARNG's plans do not affect any cultural or historic resources. On surveyed land this is reduced to a 30-day review period barring any concerns by the SHPO or interested parties.

Surveys were conducted in 2016 and 2017 in Maneuver areas J, G, and F as well as the site of the platted town of Crow Wing West. With this survey the entirety of Camp Ripley is considered surveyed to the level of a Phase I cultural resource investigation.

During the 2016 – 2017 survey the contractor, Commonwealth Cultural Resources, recorded seven previously undocumented Pre-Contact sites. Three were isolated finds, meaning the sites were recorded based on the recovery of one piece of lithic material. Two of these sites did not contain any temporally diagnostic artifacts. One site is associated with a woodland tradition occupation. It is recommended that out of the seven sites located, three should be scheduled for a Phase II investigation to determine site eligibility for the National Register of Historic Places.

During the same investigation one previously unidentified Post-Contact (Euroamerican) archaeological site was located. This site was determined to be associated with an abandoned farmstead. The investigation also included the Phase I survey within the historically platted town site of West Crow Wing. As with two previous attempts to locate cultural features associated with the platted town, no town-related features were documented. This further strengthens the evidence that West Crow Wing is a "paper town," one which was platted and planned and then never developed.

With the completion of this contract, the inventory required by the National Historic Preservation Act (54 U.S. Code § 306101 – *Assumption of responsibility for preservation of historic property*), for Camp Ripley is completed. This inventory is invaluable in the planning process in order to identify culturally significant areas at Camp Ripley and to avoid them early in the planning process for projects that may disturb these resources.

## Partnerships

A graduate student from St. Cloud State University (SCSU) served an internship at Camp Ripley to gain experience and produce work that will further progress toward a Master of Science degree in cultural resources management. The project chosen by the student in consultation with SCSU professors and the MNARNG was the completion of a National Register Nomination form for the Governor's Lodge. The Governor's Lodge at Camp Ripley is a log lodge built in the 1930s by the Civilian Conservation Corps as part of the original cantonment construction. It is currently eligible for the register and therefore managed by the MNARNG as an historic structure. The intern achieved and surpassed the goals set for the project. The intern was able to clarify and cite more precisely the history of the construction and use of the Governor's Lodge, dispelling several myths and disinformation surrounding the Governor's Lodge.

The cultural resources manager has been invited back to SCSU to present other possible internships to the graduate program of the Department of Anthropology. Potential internships will be available for archaeological resources, historical resources, and other cultural resource initiatives.

## Submittals

Several construction projects were submitted to the SHPO as well as tribal consultants for review in 2017 – 2018. Projects included various earth moving training activities, maintenance of historic structures, as well as downrange construction. All projects were reviewed and the findings of no cultural resources being affected received concurrence from the SHPO and tribal consultants.

Thanks in large part to the previous survey work completed over the last several years, all of the projects were reviewed and found to have no adverse effects in a very short timeframe. Without the early and continuous involvement in the planning stages, the consultation process would have been much longer and much more expensive.

## American Indian Tribal Consultations

Face-to-face American Indian consultations are held annually between federally recognized tribes of Minnesota as well as tribes that have an historical interest in properties now maintained by the MNARNG. This year's tribal consultation was held on May 17 at the Grand Casino Mille Lacs Hotel in Onamia, Minnesota. The consultation was contracted to be facilitated by Commonwealth Heritage Group, Inc. The MNARNG cultural resources management office received replies from six tribes

represented by seven individuals in total. The tribes who replied and attended were the Mille Lacs Band of Ojibwe, the Upper Sioux Community, and Mdewakonton Sioux Community. Tribes were invited to discuss the state of the MNARNG cultural resources management program, the conservation program, and a way forward for future annual tribal consultation. The meeting was recorded and meeting minutes were provided through contract by Dr. Katie Egan-Bruhy and Mark Bruhy, Commonwealth Heritage Group, Inc.

Tribal consultations are also part of the National Historic Preservation Act documentation submittal process. Tribes are allowed the same 30-day review period allotted to the SHPO to address any concerns regarding tribal burials, sacred sites, or archaeological sites. During 2016, there were several instances where tribes did raise concerns about potential impacts, all of which were addressed and found to have no adverse effects to any cultural resources.

It was agreed by all attendees that the 2019 consultation will be once again held at Camp Ripley. This was a request by attending tribal representatives as it is a central location and the primary area of concern during discussions.

## State Historic Preservation Office Visit

On June 19 staff of the SHPO visited Camp Ripley in response to an invititation to tour the resources found on the installation. The SHPO representatives toured several facilities, archaeological sites, and performed an assessment of the Governor's Lodge to determine if it retained enough of its historic structure and setting to be eligible for the National Register. As a result the nomination for the lodge will be moving forward. Future projects and concerns were also discussed in a non-official manner for guidance and clarification moving forward.

## Secretary of Defense Environmental Awards – Cultural Resources

The MNARNG cultural resources management program was the recipient of the Secretary of Defense Environmental Award. This award recognizes efforts to promote effective cultural resources management through proactive stewardship of Department of Defense's (DoD) extensive and rich heritage assets, including archaeological sites, cultural items, the historic built environment, and cultural landscapes. Through dynamic cultural resources management programs that partner with installation stakeholders, such as master planning, public works, and range management, DoD identifies and evaluates cultural resources that impact training, testing, and operational capabilities. Successful partnerships with American Indian tribes, states and other historic preservation stakeholders protect cultural resources in a manner that sustains mission readiness while acting as responsible stewards of our collective heritage.

# Natural Resources

Natural resource planning is an integral part of the conservation program for the MNARNG. The MNARNG uses the Integrated Natural Resource Management Plan (INRMP) as the guidance document for implementing the conservation program. The planning process used in developing the INRMP focuses on using key stakeholders from the MNARNG, Minnesota Department of Natural Resources (DNR), the U.S. Fish and Wildlife Service and other organizations that have an interest in the MNARNG's conservation program. Together, these stakeholders represent the Integrated Natural Resources Management Planning Committee. The primary responsibility of the Planning Committee is to ensure that the INRMP not only satisfies the military mission but also provides a foundation for sound stewardship principles that adequately address the issues and concerns that are raised by all stakeholders. Annually, stakeholders discuss and review the INRMP for Camp Ripley, and present their annual accomplishments and work plans for the next year.

## Forestry

By Jake Kitzmann, Minnesota Department of Military Affairs

The nearly 53,000 acre footprint of Camp Ripley is made up of a variety of cover types with approximately 28,035 acres of forests representing the majority of the land cover. Of these forested areas, oak and northern hardwoods stands represent the majority of the forest. Aspen and birch stands also make up a large proportion of the forest on Camp with interspersed stands of conifer species throughout the installation. Current management strategies maintain an extended age rotation in the forest of Camp Ripley with the majority of stands ranging between 60 and 80 years in age. All forestry activities are done through interagency agreement with the DNR Division of Forestry.

Projects scheduled were primarily focused on forest health and regeneration treatments (Table 1). Hardwood thinning was prescribed on approximately 45 acres to reduce basal area to approximately 90 square feet per acre. Forest regeneration treatments were largely carried out utilizing clear cutting with approximately 10% of standing timber reserved in patches throughout the harvest area to take advantage of both coppice sprouting and reseeding by mast trees. These treatments were carried out on approximately 230 acres. Stantec was contracted for consulting services with the DNR and CRE to prepare a Forest Management Plan for Camp Ripley. This project will be completed in early 2019.

## Reforestation

Browse protection was applied at seven sites covering 68 acres on Camp Ripley to protect recently planted seedlings from deer browsing. These sites were planted with a variety of conifer species including red pine (*Pinus resinosa*), white pine (*Pinus strobus*), and jack pine (*Pinus banksiana*) at densities ranging from 350 to 800 trees per acre. For many of the sites this is the fourth year of browse protection being applied and these applications will continue until the trees have reached approximately 48 inches in height. This ensures that the terminal bud is out of easy reach of white-tailed deer.

## Timber Sales

In September, the annual timber auction was conducted by the DNR Division of Forestry at Range Control. Five tracts were prepared for sale and sold. The auction results are listed in Figure 2 and Table 1. The status of existing permits on Camp Ripley are listed below (Tables 1 – 3).

Figure 2. Location of timber sales, Camp Ripley Training Center, Minnesota, 2018.

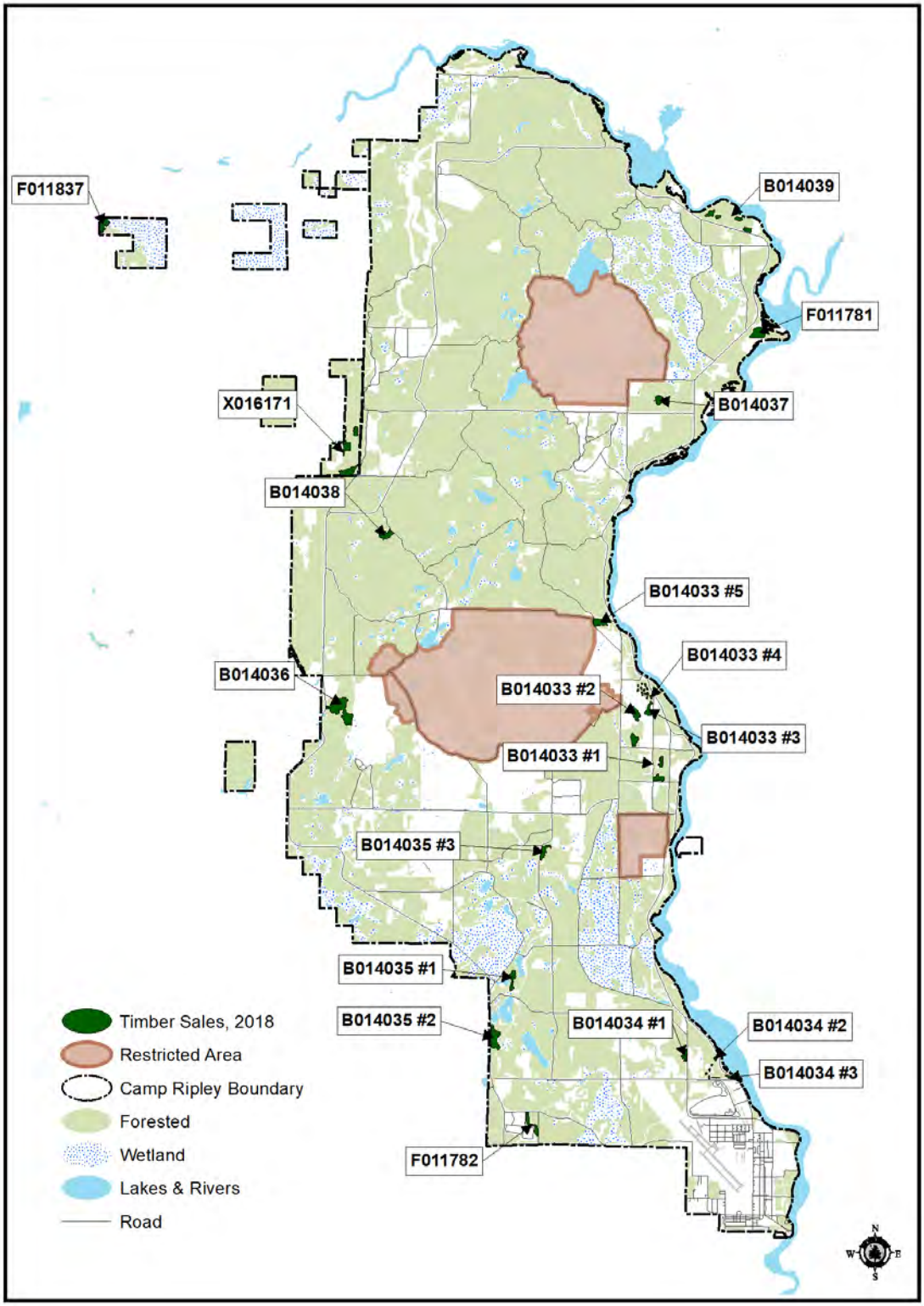


Table 1. Auction timber sales, Camp Ripley Training Center, Minnesota, 2018.

| Permit # | Acres | Biomass (tons)[a] | Cords / Species | Revenue | Successful Bidder |
|---|---|---|---|---|---|
| B014033 | 61 | 864 | 746 / Aspen<br>690 / Oak species<br>32 / Paper birch<br>20 / Basswood<br>14 / Sugar maple | $26,593.50 | Shawn Fletcher Trucking |
| B014034 | 12.8 | 92 | 84 / Aspen<br>65 / Norway pine<br>43 / Mixed hardwoods | $3,578.29 | Edin Logging Inc |
| B014035 | 42.2 | 325 | 460 / Aspen<br>111 / Pine species<br>71 / Mixed hardwoods | $11,647.26 | Edin Logging Inc |
| B014036 | 45.9 | 355 | 285 / Oak species<br>230 / Aspen<br>125 / Northern hardwoods | $10,228.75 | Hennen Enterprises LLC |
| B014037 | 8.2 | 159 | 174 / Aspen<br>86 / Oak<br>45 / Northern hardwoods | $5,368.66 | Hennen Enterprises LLC |
| B014038 | 14.4 | 170 | 320 / Aspen<br>42 / Mixed hardwoods | $5,385.06 | Unsold |
| B014039 | 15.8 | 245 | 320 / Aspen<br>150 / Pine species<br>38 / Oak<br>29 / Northern hardwoods | $14,461.74 | Hennen Enterprises LLC |
| X016171 | 29.7 | 375 | 405 / Aspen<br>270 / Norway pine<br>35 / Mixed hardwoods<br>23 / Northern hardwoods | $13,562.85 | Edin Logging Inc |
| **2018 TOTAL** | **230** | **2585** | **4,913 cords** | **$86,348.55[b]** | |

[a] Biomass is not totaled into final cords due to different units of measure and whether it is included or added in to sale.
[b] Amount is for only the sold sales and does not include unsold wood.

Table 2. Timber sales, Camp Ripley Training Center, Minnesota 2007 – 2008.

| Year | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014[a] | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Acres | 641 | 402 | 237 | 340.5 | 168.8 | 190.8 | 338.2 | 266.2 | 252.1 | 171.2 | 230 |
| Volume (Cords) | 12,893 | 6,482 | 5,505 | 6,893.5 | 3,452 | 2,676 | 4,362 | 5,340 | 6,271 | 1,954 | 4,913 |
| Appraised Value | $206,326.00 | $87,895.00 | $78,846.30 | $88,648.05 | $64,564.55 | $35,129.10 | $124,195.17 | $102,054.39 | $97,237.62 | $32,327.60 | $91,733.61 |
| Sold Value | $406,703.38 | $99,786.36 | $124,909.25 | $98,893.20 | $63,291.00 | $6,385.75 | $116,429.62 | $133,305.34 | $229,493.95 | $49,877.95 | $86,348.55 |
| Type of Harvest (Acres) | Regenerate aspen (133)<br><br>Military corridor development (43)<br><br>Range development (464) | Regenerate aspen (258)<br><br>Military corridor development (83)<br><br>Pine thinning (61) | Regenerate aspen (32.5)<br><br>Digital Multipurpose Training Range (Center Range) (204.5) | Regenerate aspen (80.7)<br><br>Digital Multipurpose Training Range (Center Range) (228.3)<br><br>Remove aspen from oak overstory (31.5) | Regenerate aspen (71.6)<br><br>Regenerate jack pine and aspen (62.3)<br><br>Harwood thinning (34.9) | Regenerate aspen (56.7)<br><br>Military corridor development (56.2)<br><br>Reoffered sales (77.9) | Regenerate aspen (57.9)<br><br>Pine thinning (248.8)<br><br>Timber stand improvement (31.5) | Regenerate aspen (125.5)<br><br>Regenerate jack pine and aspen (39.0)<br><br>Pine thinning (56.2)<br>Variable density thinning (45.5) | Regenerate aspen (66.4)<br><br>Regenerate jack pine and aspen (89.3)<br><br>Military development (96.4) | Regenerate aspen (9.0)<br><br>Regenerate pine and aspen (21.6)<br><br>Regenerate Oak (12.6)<br><br>Hardwood thinning (128.0) | Regenerate aspen (83.6)<br><br>Regenerate oak (24)<br><br>Regenerate pine and aspen (8.2)<br><br>Hardwood thinning (56.8)<br><br>Pine thinning (41) |

[a]Only includes sold stands.

## Land Fund

During the 2008 legislative session, the Minnesota Legislature enacted legislation (Minn. Statutes 190.25 subd. 3A; Appendices H and I in Dirks and Dietz 2010) to allow the adjutant general to appropriate funds from a special revenue fund. The land fund was created to accumulate the proceeds resulting from timber sales on Camp Ripley for the purpose of forest development. The legislation provides a funding source for forest management activities, including timber harvest and reforestation on Camp Ripley.

Receipts for timber sales beginning in 2008 are displayed in Table 3. The 2018 forest development projects and expenditures from the land fund are outlined in Table 4. Encumbrances since 2008 from the land fund are presented in Table 5.

Table 3. Land fund timber sales receipts, Camp Ripley Training Center, Minnestoa, 2008 to October 2018.

| Year | Permit # | Expires | Status | Sold Value | Bid Guarantee | Security | Added Timber | Over/Under Run | Final Amount |
|---|---|---|---|---|---|---|---|---|---|
| 2008 | | | | | | | | | |
| | X011138 | Mar-2011 | Closed | $17,532.00 | | | | $3,521.95 | $21,053.95 |
| | X011139 | | Closed | $15,231.78 | | | | $662.10 | $15,893.88 |
| | X011140 | | Closed | $34,940.50 | | | | $0.00 | $34,940.50 |
| | X011141 | | Closed | $32,530.10 | | | | (-$9,993.74) | $22,536.36 |
| | B010655 | | Closed | $157,773.00 | | | | (-$38,572.28) | $119,200.72 |
| | B010656 | | Closed | $153,830.43 | | | | $7,735.90 | $161,566.33 |
| | | | | | | | | **2008 Subtotal** | **$375,191.74** |
| 2009 | | | | | | | | | |
| | B011023 | Mar-2011 | Closed | $6,332.45 | | | | (-$642.62) | $5,689.83 |
| | B011024 | Mar-2011 | Closed | $14,913.60 | | | | $0.00 | $14,913.60 |
| | B011025 | Mar-2012 | Closed | $14,046.74 | | | | (-$865.02) | $13,181.72 |
| | B011026 | Mar-2011 | Closed | $16,214.00 | | | | $0.00 | $16,214.00 |
| | B011027 | Mar-2011 | Closed | $3,687.90 | | | | $0.00 | $3,687.90 |
| | B011028 | Mar-2011 | Closed | $33,424.40 | | | | (-$2,995.56) | $30,428.84 |
| | B011029 | Mar-2012 | Canceled | $11,167.17 | | | | | $0.00 |
| | | | | | | | | **2009 Subtotal** | **$84,115.89** |
| 2010 | | | | | | | | | |
| | B011349 | Mar-2012 | Closed | $61,231.90 | | | | $5,282.17 | $66,514.07 |
| | B011350 | Mar-2012 | Closed | $49,233.65 | | | | $5,485.46 | $54,719.11 |
| | B011351 | Mar-2012 | Closed | $5,825.30 | | | | $0.00 | $5,825.30 |
| | B011353 | Mar-2012 | Expired | $8,618.40 | | | | | $1,101.00 |
| | | | | | | | | **2010 Subtotal** | **$128,159.48** |
| 2011 | | | | | | | | | |
| | B011608 | May 31-2013 | Expired | $10,245.40 | | | | | $2,356.44 |
| | BO11685 | May 31-2013 | Closed | $10,438.95 | | | | $0.00 | $10,841.92 |
| | BO11686 | May 31-2012 | Closed | $60,650.40 | | | | $0.00 | $60,650.40 |
| | BO11687 | May 31-2013 | Closed | $9,695.35 | | | | $0.00 | $9,695.35 |
| | BO11688 | May 31-2013 | Closed | $7,863.35 | | | | $0.00 | $7,863.35 |
| | | | | | | | | **2011 Subtotal** | **$91,407.46** |

Table 3. Land fund timber sales receipts, Camp Ripley Training Center, Minnesota, 2008 to October 2018.

| Year | Permit # | Expires | Status | Sold Value | Bid Guarantee | Security | Added Timber | Over/Under Run | Final Amount |
|---|---|---|---|---|---|---|---|---|---|
| 2012 | | | | | | | | | |
| | B012053 | March 31-2014 | Closed | $27,140.15 | | | | (-$3,825.50) | $23,314.65 |
| | BO12054 | March 31-2014 | Closed | $6,654.75 | | | | (-$769.97) | $5,884.78 |
| | BO12055 | March 31-2014 | Canceled | Unsold | | | | | |
| | BO12056 | March 31-2014 | Canceled | Unsold | | | | | |
| | BO12057 | March 31-2014 | Closed | $29,496.10 | | | | (-$6,522.22) | $23,636.88 |
| | | | | | | | | **2012 Subtotal** | **$52,836.31** |
| 2013 | | | | | | | | | |
| | B012438 | March 31-2015 | Closed | $3,905.00 | | | | $109.30 | $4,014.30 |
| | BO12439 | March 31-2015 | Canceled | Unsold | | | | | |
| | BO12440 | March 31-2015 | Canceled | Unsold | | | | | |
| | BO12441 | March 31-2015 | Canceled | Unsold | | | | | |
| | BO12442 | March 31-2015 | Canceled | Unsold | | | | | |
| | B012443 | March 31-2015 | Closed | $2,480.75 | | | | (-$172.92) | $2,307.84 |
| | B012444 | March 31-2015 | Canceled | Unsold | | | | | |
| | | | | | | | | **2013 Subtotal** | **$6,322.14** |
| 2014 | | | | | | | | | |
| | B012744 | May 31-2019 | Sold | $3,055.25 | | $458.29 | | | |
| | BO12745 | May 31-2016 | Closed | $8,242.25 | | | | $1,834.01 | $10,076.26 |
| | BO12746 | May 31-2019 | Active | $2,995.30 | | $1,914.5 | 420.25 | | |
| | BO12747 | May 31-2016 | Closed | $62,954.91 | | | | | $62,954.91 |
| | BO12748 | May 31-2016 | Closed | $13,913.20 | | | | $3,276.11 | $17,789.31 |
| | B012749 | May 31-2016 | Closed | $18,372.60 | | | $594.75 | $878.50 | $19,845.85 |
| | B012750 | May 31-2016 | Unsold | Unsold | | | | | |
| | B012751 | May 31-2016 | Closed | $12,484.66 | | | $5,194.60 | | $14,655.25 |
| | | | | | | | | **2014 Subtotal** | **$125,321.58** |
| 2015 | | | | | | | | | |
| | B013112 | May 31-2017 | Closed | $36,186.92 | | | $1,005.90 | $6,385.35 | $43,578.17 |
| | B013113 | May 31-2018 | Active | $14,063.97 | | $14,063.97 | | | |
| | B013114 | May 31-2017 | Closed | $30,918.70 | | | | $6,902.04 | $37,820.74 |
| | B013115 | May 31-2017 | Closed | $21,878.25 | | | $429.97 | (-$1,404.52) | $20,903.70 |

Table 3. Land fund timber sales receipts, Camp Ripley Training Center, Minnesota, 2008 to October 2018.

| Year | Permit # | Expires | Status | Sold Value | Bid Guarantee | Security | Added Timber | Over/Under Run | Final Amount |
|---|---|---|---|---|---|---|---|---|---|
| 2015 | B013116 | May 31-2017 | Closed | $30,257.50 | | | | $16,339.05 | $46,608.30 |
| | | | | | | | | **2015 Subtotal** | **$148,910.91** |
| 2016 | | | | | | | | | |
| | B013380 | May 31-2017 | Closed | $101,337.63 | | | $1,455.00 | $3,232.49 | $106,160.10 |
| | B013381 | May 31-2018 | Closed | $26,243.35 | | | 370.30 | $4,839.50 | $31,453.15 |
| | B013382 | May 31-2018 | Sold | $26,860.45 | ,928.82 | $2,100.25 | | | |
| | B013383 | May 31-2018 | Forfeited | $5,632.10 | | | | | $844.82 |
| | B013384 | May 31-2018 | Closed | $69,420.42 | | | 388.50 | $7,081.87 | $76,890.74 |
| | | | | | | | | **2016 Subtotal** | **$214,503.99** |
| 2017 | | | | | | | | | |
| | B013725 | May 31-2019 | Active | $13,501.77 | | $13,501.77 | | | |
| | B013726 | May 31-2019 | Sold | $4,028.64 | | 604.30 | | | |
| | B013727 | May 31-2019 | Sold | $6,622.27 | | $993.34 | | | |
| | B013728 | May 31-2019 | Closed | $22,549.91 | | | 302.50 | $533.02 | $23,385.31 |
| | B013729 | May 31-2019 | Sold | $3,175.36 | | $476.30 | | | |
| | | | | | | | | **2017 Subtotal** | **$23,385.31** |
| 2018 | | | | | | | | | |
| | X016171 | May 31-2020 | Active | $13,562.85 | | $15,562.85 | | | |
| | BO14033 | May 31-2020 | Active | $29,593.80 | | $29,593.80 | 907.20 | | |
| | BO14034 | May 31-2020 | Sold | $3,578.29 | | $536.74 | | | |
| | BO14035 | May 31-2020 | Sold | $11,647.26 | | $1,470.52 | | | |
| | BO14036 | May 31-2020 | Sold | $10,228.75 | | $1,534.31 | | | |
| | B014037 | May 31-2020 | Sold | $5,368.66 | | $805.30 | | | |
| | B014038 | May 31-2020 | Unsold | Unsold | | | | | |
| | B014039 | May 31-2020 | Active | $14,461.74 | | $14,461.74 | | | |
| | | | | | | | | **2018 Subtotal** | **$0.00** |
| **SUBTOTALS** | | | | **$1,928.82** | | **$98,077.98** | | | **$1,250,999.63** |
| Subtotal for Closed 2008 – 2016 Auction Sales | | | | | | | | | **$1,250,999.63** |
| Subtotal received to date for Closed Sales + Bid Guarantees + Securities+ Added Timber | | | | | | | | | **$1,351,006.43** |
| **Informal Sales** | | | | | | | | | |
| | F010327 | 5/15/2009 | Canceled | $65.64 | | | | | $65.64 |

Table 3. Land fund timber sales receipts, Camp Ripley Training Center, Minnesota, 2008 to October 2018.

| | Permit # | Expires | Status | Sold Value | Bid Guarantee | Security | Added Timber | Over/Under Run | Final Amount |
|---|---|---|---|---|---|---|---|---|---|
| | F010358 | 11/30/2009 | Closed | $2,541.00 | | | | | $2,541.00 |
| | F010384 | 11/30/2009 | Closed | $440.00 | | | | | $440.00 |
| | F010385 | 11/30/2009 | Closed | $600.00 | | | | | $600.00 |
| | F010431 | 1/13/2010 | Closed | $6,819.00 | | | | | $6,819.00 |
| | F010486 | 3/15/2010 | Closed | $165.00 | | | | | $165.00 |
| | F010656 | May-2011 | Closed | $5,154.00 | | | | | $5,154.00 |
| | F010657 | May-2011 | Closed | $143.00 | | | | | $267.35 |
| | F011082 | 3/31/2015 | Closed | $3,119.30 | | | | $944.72 | $4,064.02 |
| | F011171 | 3/31/2014 | Closed | $3,038.54 | | | $420.75 | | $3,400.50 |
| | F011172 | 3/31/2014 | Closed | $4,504.33 | | | | | $4,004.71 |
| | F011214 | 4/15/2014 | Closed | $50.00 | | | | | $50.00 |
| | F011299 | 5/31/2015 | Closed | $2,936.94 | | | | | $2,936.94 |
| | F011414 | 5/31/2015 | Closed | $7,321.06 | | | | $184.88 | $7,505.94 |
| | F011417 | 5/31/2016 | Closed | $1,988.30 | | | | $1,392.62 | $3,380.92 |
| | F011781 | 5/31/2018 | Closed | $1,147.00 | | | | $71.23 | $1,218.23 |
| | F011782 | 5/31/2018 | Closed | $5,087.40 | | | | $491.50 | $5,578.90 |
| | F011837 | 5/31/2018 | Closed | $5,782.04 | | | | $1,066.89 | $6,848.93 |
| **Informal Sales Subtotal** | | | | | | | | | **$55,041.08** |
| **Fuelwood Permits** (9/25/08 - 10/30/18) | | | | | | | | | |
| | | 227 (5 cords) | $25/each | | | | | | $5,925.00 |
| | | 70 (10 cords) | $50/each | | | | | | $3,500.00 |
| **Fuelwood Permits Subtotal** | | | | | | | | | **$9,425.00** |
| **GRAND TOTAL RECEIPTS (9/1/2008 to 10/30/2018)** | | | | | | | | | **$1,415,472.51** |

Table 4. Scope of work for forest development, Camp Ripley Training Center, Minnesota, 2018.

| Project Number | Project Description | Estimated Cost |
|---|---|---|
| CR–Dev18–001 | Forest health/thinning treatment on stand 2417 NP67, 2802 NP56, 2459 NP57, 2437 O67 | $7,000.00 |
| CR–Dev18–002 | Forest health/thinning treatment on stands 2359 NP59, 2306 NP57 | $10,125.00 |
| CR–Dev18–003 | Forest health/thinning treatment on stand 2261 O55 | $6,700.00 |
| CR–Dev18–004 | Forest health/thinning treatment on stand 1917 NP56 | $2,650.00 |
| CR–Dev18–005 | Forest regeneration treatment on stands 1661 OX54, 1698 A55, 1674 A55, 1640 OX44 | $3,120.00 |
| CR–Dev18–006 | Forest regeneration/health treatment on stands 1555 O54, 1543 OX52, 1509 OX53, 1514 A53 | $12,075.00 |
| CR–Dev18–007 | Forest regeneration treatment on stand 1341 A54 | $2,385.00 |
| CR–Dev18–008 | Forest regeneration treatment on stand 763 A56 | $2,685.00 |
| CR–Dev18–009 | Forest regeneration treatment on stands 313 A55, 278 JP54 | $3,510.00 |
| CR–Dev18–010 | Forest health/thinning treatment on stands 1535 O55, 1560 O66 | $11,175.00 |
| CR–Dev18–011 | Provide browse protection to planted pine seedlings on site 2162 WP11 4th year | $500.00 |
| CR–Dev18–012 | Provide browse protection to planted pine seedlings on site 233 NP11 4th year | $500.00 |
| CR–Dev18–013 | Provide browse protection to planted pine seedlings on site 3006 JP10 4th year | $525.00 |
| CR–Dev18–014 | Provide browse protection to planted pine seedlings on site 2722 JP11 4th year | $1,500.00 |
| CR–Dev18–015 | Provide browse protection to planted pine seedlings on site 637 WP11 4th year | $950.00 |
| CR–Dev18–016 | Provide browse protection to planted pine seedlings on site 14 COA 2nd year | $950.00 |
| CR–Dev18–017 | Provide browse protection to planted pine seedlings on site 28 UG 2nd year | $500.00 |
| CR–Dev18–018 | Supplies: paint, flagging for timber sale development | $1,200.00 |
| CR-Dev18-019 | Develop and inventory 2000 acres in 2017 | $12,000.00 |
| CR-Dev18-020 | Jack pine seed collection, seed extraction, storage | $2,500.00 |
| **Forest Development Total** | | **$82,550.00** |

Table 5. Land fund encumbrances, Camp Ripley Training Center, Minnesota, 2009 – 2018.

| **Land Fund Encumbrances** | | | |
|---|---|---|---|
| **Date** | **Description[a]** | **Category** | **Amount** |
| 5/6/2009 | IAA with DNR–Forestry | Professional services | $20,000.00 |
| 8/13/2009 | IAA with DNR–Forestry | Professional services and trees | $12,700.00 |
| 8/20/2009 | Supplies | Forestry supplies | $3,492.88 |
| 1/14/2010 | Supplies | Forestry supplies | $68.00 |
| 3/25/2010 | Supplies | Forestry supplies | $52.74 |
| 7/29/2010 | IAA with DNR–Forestry | Professional services | $59,740.00 |
| 11/10/2010 | IAA with DNR–Forestry | Professional services (2011) | $59,930.00 |
| 10/4/2011 | IAA with DNR–Forestry | Professional services (2012) | $73,600.00 |
| 3/2/2011 | IAA with DNR–Forestry | Professional services | $46,240.00 |
| 7/3/2013 | IAA with DNR–Forestry | Professional services (2013) | $69,000.00 |
| 4/01/2014 | IAA with DNR–Forestry | Professional services (2014) | $100,230.00 |
| 2014 | Adjusted Encumbrances | Canceled tree plantings | -$8,752.00 |
| 2015 | IAA with DNR–Forestry | Professional services (2015) | $89,462.00 |
| 2016 | IAA with DNR–Forestry | Professional services (2016) | $80,900.00 |
| 2017 | Wildland fire equipment | 200 gal. Slip-on unit. | $21,403.97 |
| 2017 | IAA with DNR–Forestry | Professional services (2017) | $86,515.00 |
| 2018 | IAA with DNR-Forestry | Professional services (2018) | $82,550.00 |
| 2018 | Consultant services | Forest Management Plan writing | $4,467.08 |
| 2018 | Consultant services | Forest Management Plan writing | $2,202.15 |
| 2018 | Consultant services | Forest Management Plan writing | $2,348.63 |
| 2018 | Consultant services | Forest Management Plan writing | $1,705.54 |
| 2018 | Consultant services | Forest Management Plan writing | $1,584.49 |
| 2018 | Supplies | Forestry supplies | $452.95 |
| **TOTAL** | | | **$810,230.43** |

[a]IAA – Interagency Agreement

## Fuelwood Permits

By Tim Notch, Minnesota Department of Military Affairs

For the permit period from April 1 – December 31, there were 19 individuals that acquired fuelwood permits (10 – 5 cord; 1 – 10 cord), totaling $300.00.

In October, Sentence to Serve (STS) crew leaders returned to Camp Ripley for annual chainsaw training. The STS crew felled trees within Training Area 61 along the river that sustained insect damage in previous years.

### Insects and Diseases

By Jake Kitzmann, Minnesota Department of Military Affairs

During the 2014 – 2015 field seasons, jack pine budworm (*Choristoneura pinus*) was identified in jack pine (*Pinus banksiana*) stands in the northwestern and northeastern corners of Camp Ripley. In healthy stands these infestations are generally not fatal, and further monitoring will be performed during the coming seasons to determine if treatment is necessary. Further infestation by bark beetles has been noted in the stand in the northeast. The combined infestation has led to widespread mortality in this stand. Current infestations, however, have not spread beyond the fringes of this isolated stand. In 2016 this stand was sold and aggressive thinning of the stand occurred in 2017. The few remaining trees will be monitored in the coming years. The first case of oak wilt was identified in Morrison County in 2014. Color infrared photography was analyzed to determine the presence of oak wilt on Camp Ripley. No signs of the disease were found.

## Vegetation Management

### Prescribed Fire

By Timothy Notch, Minnesota Department of Military Affairs

Camp Ripley uses prescribed fire as a management tool to enhance the military training environment, also known as mission-scape. Prescribed fire target objectives include native prairie grass enhancement, woody encroachment prevention, seed production, brush control, fuel-hazard reduction, forest management and habitat improvement for species in greatest conservation need (SGCN). The management strategy for prescribed fire is provided within Camp Ripley's Integrated Wildland Fire Management Plan (MNARNG 2017). Two types of prescribed burns are conducted at Camp Ripley: hazard reduction and training enhancement.

### Hazard Reduction

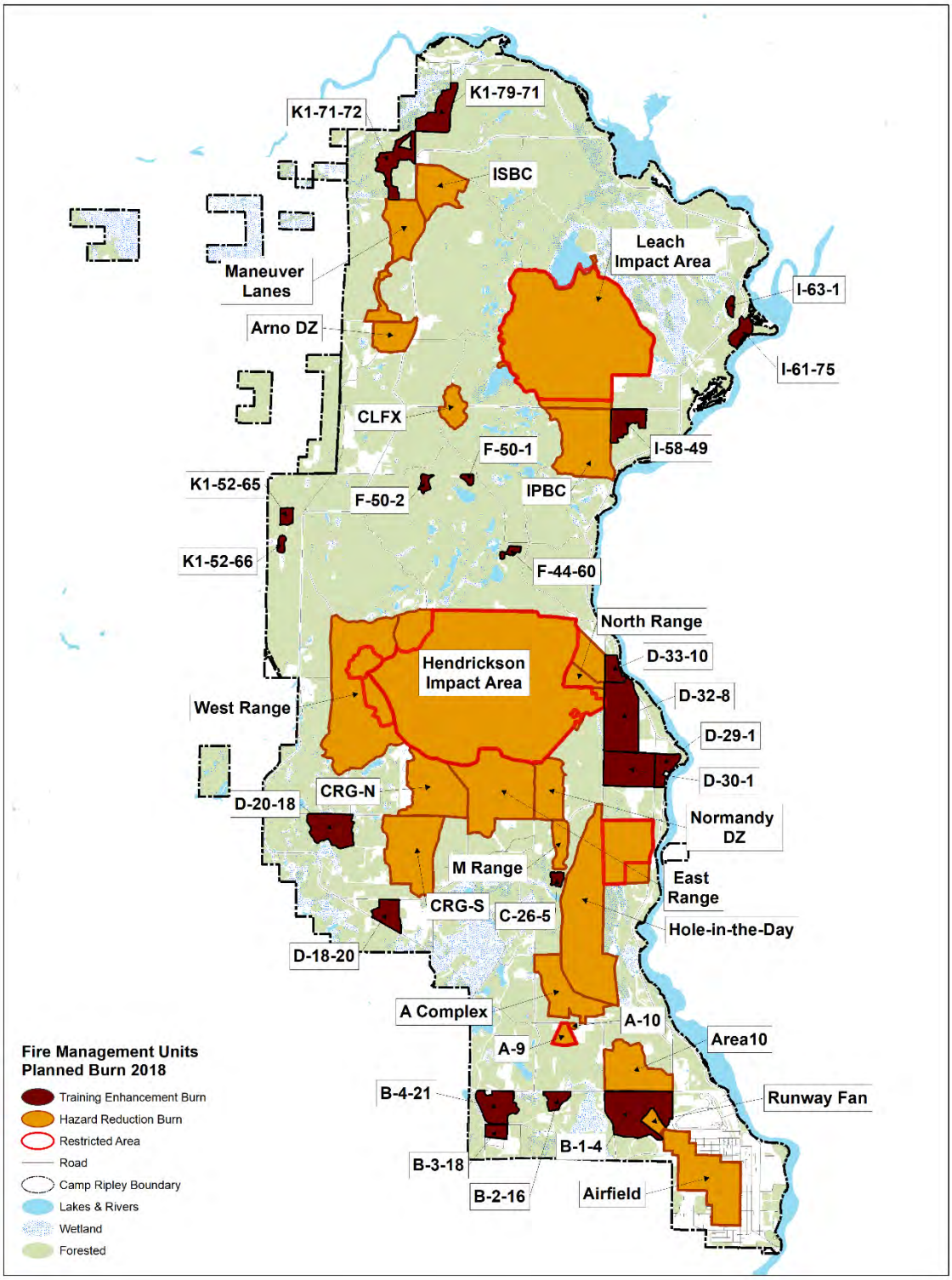
Two of the burn units on Camp Ripley are designated as impact areas. These areas are burned every spring along with 14 other firing ranges to reduce hazardous fuel loads and minimize wildfires due to military training exercises. These are categorized as hazard reduction burns and as such, receive priority in scheduling and implementation (Table 6 and Figure 3).

Table 6. Hazard reduction burns, Camp Ripley Training Center, Minnesota, 2018.

| Burn Date | Department | Rx Burn Unit | Acres |
|---|---|---|---|
| 4/24/2018 | DPW/FES/ENV | East Tank Range | 643 |
| 4/24/2018 | DPW/FES/ENV | Normandy Drop Zone | 235 |
| 4/25/2018 | DPW/FES/ENV | Hendrickson Impact Area | 3,840 |
| 4/25/2018 | DPW/FES/ENV | West Range | 1,116 |
| 4/25/2018 | DPW/FES/ENV | Center Tank Range North | 436 |
| 4/25/2018 | DPW/FES/ENV | North Range | 80 |
| 4/26/2018 | DPW/FES/ENV | Leach Impact Area | 2,705 |
| 5/01/2018 | DPW/FES/ENV | A–Ranges | 362 |
| 5/01/2018 | DPW/FES/ENV | Center Tank Range South | 503 |
| 5/02/2018 | DPW/FES/ENV | Hole-in-the-Day Marsh | 1,738 |
| 5/02/2018 | DPW/FES/ENV | M–Range | 93 |
| 5/03/2018 | DPW/FES/ENV | CLFX | 118 |
| 5/03/2018 | DPW/FES/ENV | IPBC | 503 |
| 5/10/2018 | DPW/FES/ENV | Maneuver Lanes | 394 |
| 5/10/2018 | DPW/FES/ENV | Arno Drop Zone | 158 |
| 5/14/2018 | DPW/FES/ENV | ISBC | 189 |
| 5/21/2018 | DPW/FES/ENV | Training Area 10 | 612 |
| N/A | DPW/FES/ENV | Airfield Overrun | 40 |
| **Total Hazard Mitigation Acres Burned** | | | **13,765** |

The fire team completed 17 hazard burn units for a total of 13,675 acres. The airfield overrun was the only hazard burn unit to not receive a fire treatment. The overrun received a broadcast native prairie seeding in 2016 and fire managers wanted to give the seed another season to establish before reintroducing fire to the landscape. A spring 2019 prescribed fire is planned. Some of the hazard burns started as wildfires, and fire suppression units responding completed the burns under controlled conditions.

Figure 3. Fire management units burned, Camp Ripley Training Center, Minnesota, 2018.



## Training Enhancement

Training enhancement burns (Table 7 and Figure 3) were completed by CRE with assistance from Department of Public Works (DPW), Fire and Emergency Services (FES), and DNR Forestry. Training enhancement burn units were categorized by highest use for military activities and ecological benefits. The burn rotation has been increased from a five-year fire return interval to a three-year interval. This change was necessary to ensure artillery firing points and open grasslands maintain an open status and woody encroachment is controlled. As Camp Ripley continues to expand and new ranges are developed, existing burn units have conflicted with construction of ranges. Some areas became low priority and were dropped from the fire rotation. The training enhancement burns are of particular importance to the conservation program since the reintroduction of fire is critical to native vegetation management on the installation. Nearly all of Camp Ripley is a fire dependent ecosystem and managing vegetation with fire to meet military objectives also meets ecological management goals. It is of utmost importance to manage native vegetation with an historical fire regime to promote a healthy and thriving ecosystem that can withstand the human demands of the area.

Camp Ripley consists of 11 maneuver areas divided into 80 training areas of which 70 contain designated burn units. These burn units are dynamic in respect to size and shape but are directly related to military land use. Burn plans are prepared for each burn unit, reviewed and permitted by the DNR Division of Forestry prior to execution of the burn. The CRE office partnered with FES and DPW to implement prescribed fire on these units.

Prescribed burn units in the original design were not conducive to quality management of time and resources. The units were, in some cases, combined with adjacent units to form a larger burn unit that could be managed from roadways and trails. This process eliminated the need for break installation (e.g., mineral or mowed) and better suits the need for reducing encroachment in grasslands by allowing fire to run through transition zones into forested areas. Enlarging and combining burn units into one larger unit saves money by reducing the amount of staff time for maintenance of fire breaks. Many burn units are surrounded by a road 33 feet in width which improves crew safety and time management.

All goals and objectives were achieved on completed burn units which demonstrates the effectiveness of phenological timing of the burn events**.** A total of 1,220 acres received fire treatment.

Table 7. Training enhancement burns, Camp Ripley Training Center, Minnesota, 2018.

| Burn Date | Department | Rx Burn Unit | Forested Acres | Grassland Acres | Total Acres |
|---|---|---|---|---|---|
| 4/25/2018 | ENV | F-50-1 Firing Point | 0 | 14 | 14 |
| 5/1/2018 | ENV/DPW/FES | D-21-16 Firing Point | 5 | 26 | 31 |
| 5/1/2018 | ENV/DPW/FES | D-22-17 Firing Point | 6 | 55 | 61 |
| 5/2/2018 | ENV/DPW/FES | C-26-5 Firing Point | 0 | 22 | 22 |
| 5/11/2018 | ENV/DPW/FES | D-29-1 Fort Site | 35 | 39 | 74 |
| 5/11/2018 | ENV/DPW/FES | D-30-1 Firing Point | 51 | 191 | 242 |
| 5/15/2018 | ENV/DPW/FES | D-18-20 Firing Point | 66 | 22 | 88 |
| 5/17/2018 | ENV/DPW/FES | D-33-10 Firing Point | 26 | 32 | 58 |
| 5/17/2018 | ENV/DPW/FES | D-32-8 Firing Point | 122 | 204 | 326 |
| 5/18/2018 | ENV/DPW/FES | D-20-18 Firing Point | 72 | 105 | 177 |
| 5/22/2018 | ENV/FES | B-4-21 Firing Point | 6 | 11 | 17 |
| 5/22/2018 | ENV/DPW/FES | B-2-16 Firing Point | 7 | 39 | 46 |
| 8/13/2018 | ENV/DPW/FES | I-61-75 Jack Pine regeneration | 52 | 0 | 52 |
| 8/22/2018 | ENV/DNR | I-63-1 Exclosure | 0 | 12 | 12 |
| N/A | | B-1-4 Firing Points | | | 250 |
| N/A | | F-44-60 Firing Point | | | 18 |
| N/A | | F-50-2 Firing Point | | | 21 |
| N/A | | K1-52-66 Firing Point | | | 27 |
| N/A | | K1-52-65 Firing Point | | | 29 |
| N/A | | DNR TA 70 Jack Pine regeneration | | | 44 |
| N/A | | DNR TA 72 Jack Pine regeneration | | | 42 |
| N/A | | DNR TA 64 Jack Pine | | | 20 |
| **Total Training Enhancement Acres Burned** | | | **448** | **772** | **1,220** |

## Invasive Species

By Jason Linkert, Minnesota Department of Military Affairs

Invasive species are non-native species that harm economic, environmental, or human health. These species are a threat to the ecological function of areas around the world due to their capability to change the biotic and abiotic characteristics of their environment (U.S. Department of Agriculture 2009). The MNARNG is required by state and federal regulations to prevent the introduction of invasive species; detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; monitor invasive species populations accurately and reliably; provide for restoration of native species and habitat conditions in ecosystems that have been invaded; conduct research on invasive species and develop technologies to prevent

introduction and provide for environmentally sound control of invasive species; and promote public education on invasive species and the means to address them.

An interagency agreement was established between St. Cloud State University (SCSU) and the Minnesota Department of Military Affairs for invasive species management. Graduate and undergraduate interns work closely with CRE in combating terrestrial and aquatic invasive species on Camp Ripley.

Twenty-five terrestrial invasive plant species have been identified at Camp Ripley (Table 8). Three of these species, leafy spurge (*Euphorbia esula*), common tansy (*Tanacetum vulgare*) and spotted knapweed (*Centaurea maculosa*) are considered prohibited noxious weeds and are the priority for control treatments due to their ecological impact on native biodiversity (Figure 4). Additional invasive species targeted for treatment included European buckthorn (*Rhamnus cathartica*), baby's breath (*Gypsophilia paniculata*), plumeless thistle (*Carduus acanthoides*), bull thistle (*Cirsium vulgare*), Canada thistle (*Cirsium arvense*) and Siberian elm (*Ulmus pumilla*).

Figure 4. Terrestrial invasive plant species, Camp Ripley Training Center, Minnesota, 2018.

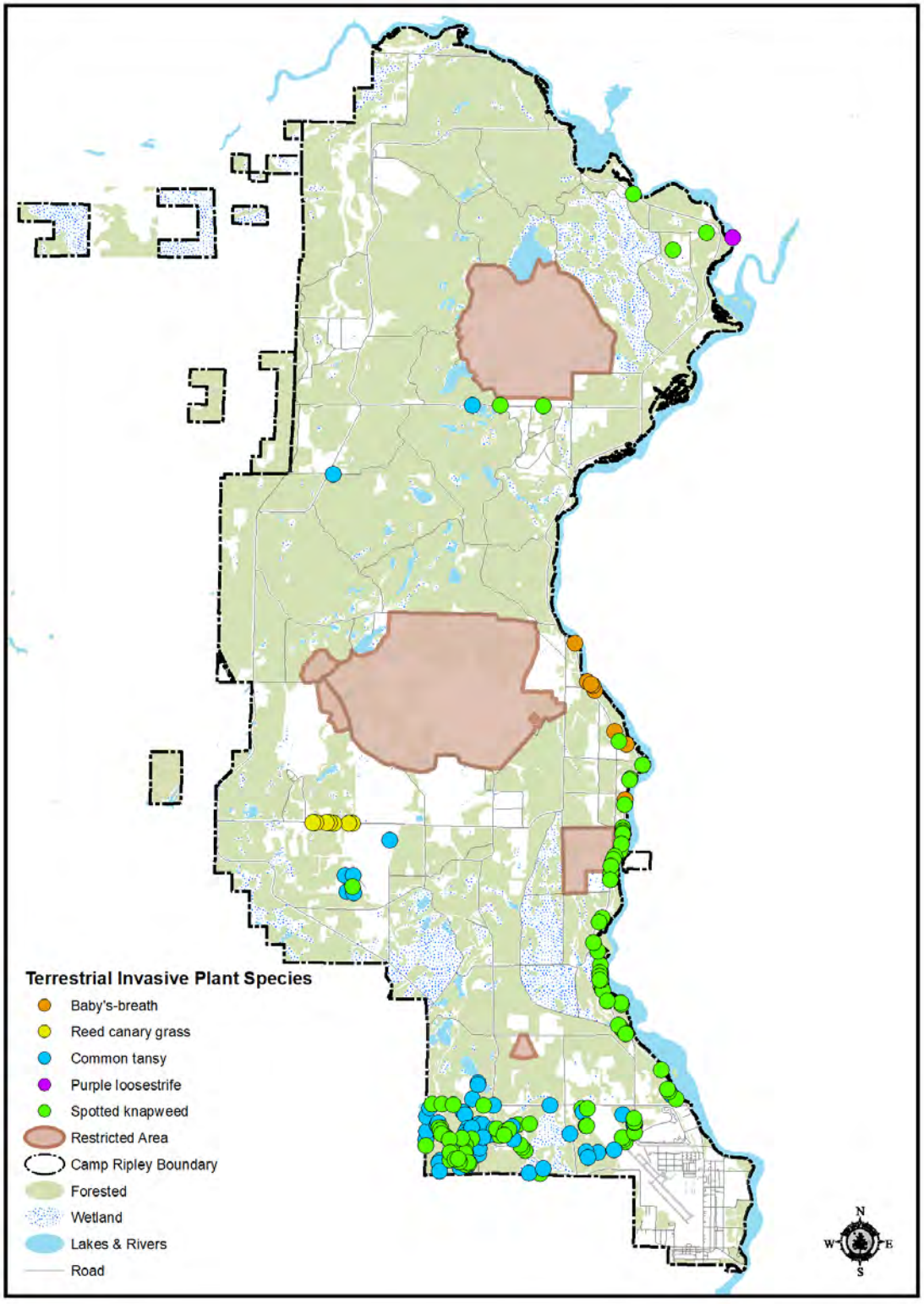


Table 8. Invasive plant species, Camp Ripley Training Center, Minnesota.

| Family | Scientific Name | Common Name | Minnesota Department of Agriculture Noxious Weed Listing |
|---|---|---|---|
| Brassicaeae | *Berteroa incana* | Hoary alyssum | Not currently listed |
| Poaceae | *Bromus inermis* | Smooth brome | Not currently listed |
| Asteraceae | *Carduus nutans* | Musk thistle | Prohibited noxious weed |
| Asteraceae | *Carduus acanthoides* | Plumeless thistle | Prohibited noxious weed |
| Asteraceae | *Centurea maculosa* | Spotted knapweed | Prohibited noxious weed |
| Asteraceae | *Chrysopsis villosa var. foliosa* | Golden aster | Not currently listed |
| Asteraceae | *Cirsium arvense* | Canada thistle | Prohibited noxious weed |
| Asteraceae | *Grindelia squarrosa* | Gum weed | Not currently listed |
| Asteraceae | *Cirsium vulgare* | Bull thistle | Not currently listed |
| Asteraceae | *Tanacetum vulgare* | Common tansy | Prohibited noxious weed |
| Caryophyllaceae | *Gypsophilia paniculata* | Baby's breath | Not currently listed |
| Caryophyllaceae | *Euphorbia cyparissias* | Cypress spurge | Not currently listed |
| Euphorbiaceae | *Euphorbia esula* | Leafy spurge | Prohibited noxious weed |
| Guttiferae | *Hypericum perforatum* | Saint John's wort | Not currently listed |
| Fabaceae | *Melilotus alba* | White sweet clover | Not currently listed |
| Fabaceae | *Melilotus officinalis* | Yellow sweet clover | Not currently listed |
| Poaceae | *Phalaris arundinacea* | Reed canary grass | Not currently listed |
| Poaceae | *Phragmites australis* | Common reed | Prohibited noxious weed |
| Rhamnaceae | *Rhamnus cathartica* | Buckthorn | Restricted noxious weed |
| Rhamnaceae | *Rhamnus frangula* | Glossy buckthorn | Restricted noxious weed |
| Caryophyllaceae | *Saponaria officinalis* | Bouncing bet | Not currently listed |
| Anacardiaceae | *Toxicodendron radicans* | Poison ivy (native) | Specially regulated noxious weed |
| Ulmaceae | *Ulmus pumila* | Siberian elm | Not currently listed |
| Lythraceae | *Lythrum salicaria* | Purple loosestrife | Prohibited noxious weed |
| Euphorbiaceae | *Euphorbia cyparissaias* | Cypress spurge | Not currently listed |
| Apiaceae | *Daucus carota* | Queen Anne's lace | Not currently listed |
| Iridaceae | *Iris pseudacorus* | Yellow iris | Not currently listed |

## Selective Invasive Plant Management

Extensive search and treatment of common buckthorn (*Rhamnus cathartica*) and glossy buckthorn (*Rhamnus frangula*) commenced in cantonment along with training areas downrange to identify seed-bearing female trees (Figure 5). A basal bark treatment was made by mixing a bark oil with the herbicide triclopyr and applied to the root collar. This treatment proved to be the most effective at removing isolated individual plants while being the least labor intensive in comparison with cut stump treatments. A total of two acres received treatment in Training Areas 2, 8, and 12.

Follow up treatment will be necessary to ensure all populations have been removed and no individual trees survived.

To preserve native common milkweed (*Asclepias syriaca*) populations planted near Camp Ripley's renewable energy generation facility, SCSU interns mechanically removed 0.25 acres of spotted knapweed (*Centurea maculosa).* This effort was made to preserve soil integrity and keep native flora biodiversity uninhibited by chemical applications. To promote native biodiversity, SCSU interns gathered and allocated common milkweed seeds from high diversity stands within cantonment.

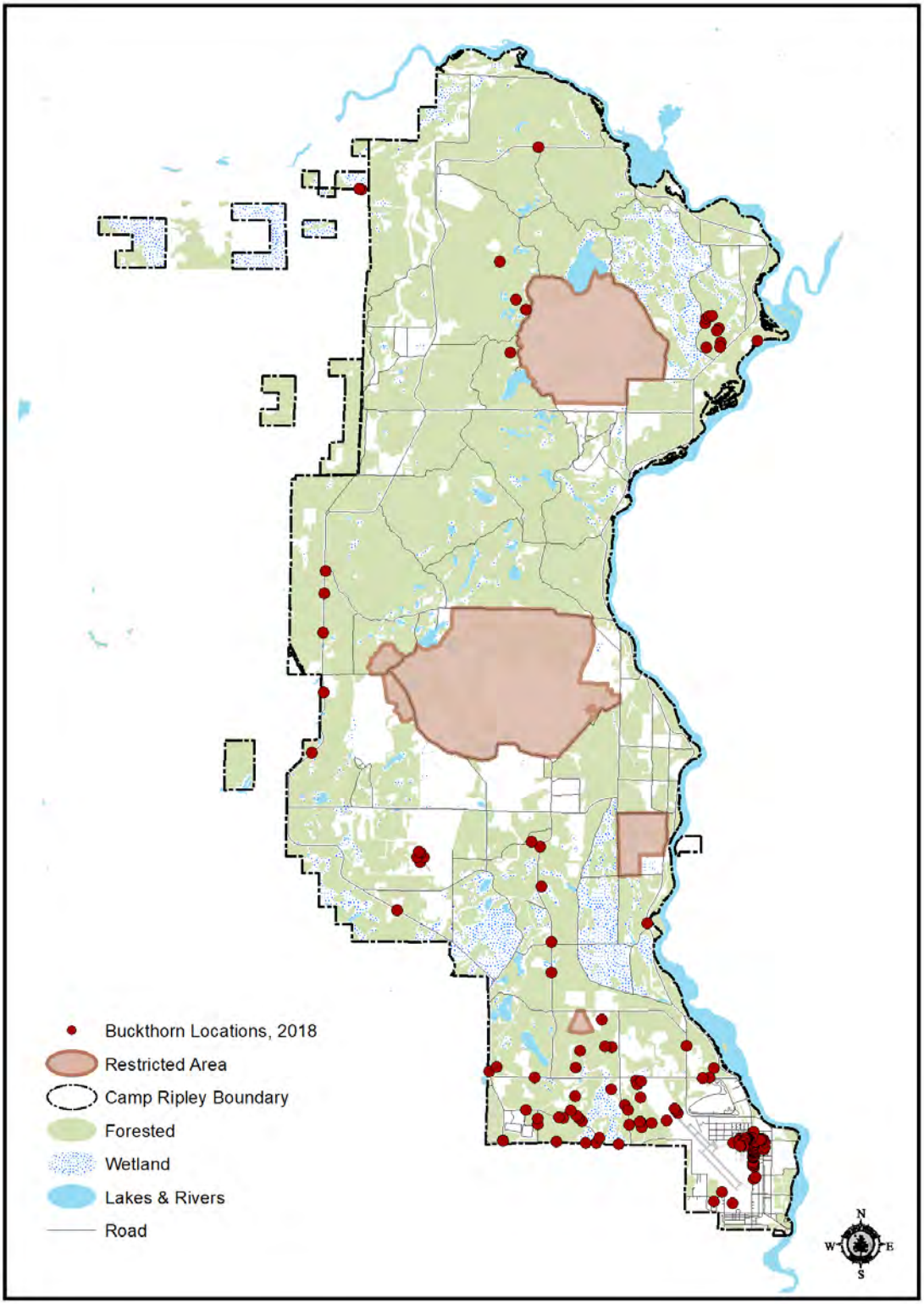
In an effort to maintain aesthetic and ecological integrity of the newly established Ruffed Grouse Management Area, SCSU interns treated small populations of spotted knapweed (*Centurea maculosa*) within entry areas and along wooded borders. Follow up treatment will be required on the recently installed trail network to control woody encroachment and prevent invasive populations from establishing.

An effort was made to control reed canary grass (*Phalaris arundinacea*). Reed canary grass is a prolific wetland invader and displaces and outcompetes native vegetation. A lowland prairie was identified as a test area to conduct research on reed canary management located on Minnesota Department of Military Affairs lands outside of the Camp Ripley installation boundary. The site received a mowing in late summer followed by a fall herbicide application of glyphosate prior to winter freeze up. A spring prescribed burn is planned followed by a summer mowing and fall 2019 herbicide application to determine if this management technique is effective at controlling reed canary grass.

Leafy spurge (*Euphorbia esula*) was identified in Training Area 4 and treated with triclopyr to prevent immediate spread. Follow up management practices will continue to monitor and control further spread. Leafy spurge treated in 2017 in cantonment was reassessed for regrowth and spread.

In response to a request from Range Control, SCSU interns treated areas to control native poison ivy (*Toxicodendron radicans*) in locations which posed a threat to the health and safety of military personnel during their training. The A-13 Expert Medical Field Badge Litter Obstacle Course was treated with the herbicide triclopyr. All exterior barrier gates and down-range propane tanks were treated with triclopyr to control the threat of poison ivy. In addition, SCSU interns treated poison ivy on the White Pine Walking Trail to reduce the risk to visiting school groups.

Figure 5. Buckthorn treatment locations, Camp Ripley Training Center, Minnesota, 2018.



## Large-Scale Invasive Plant Management

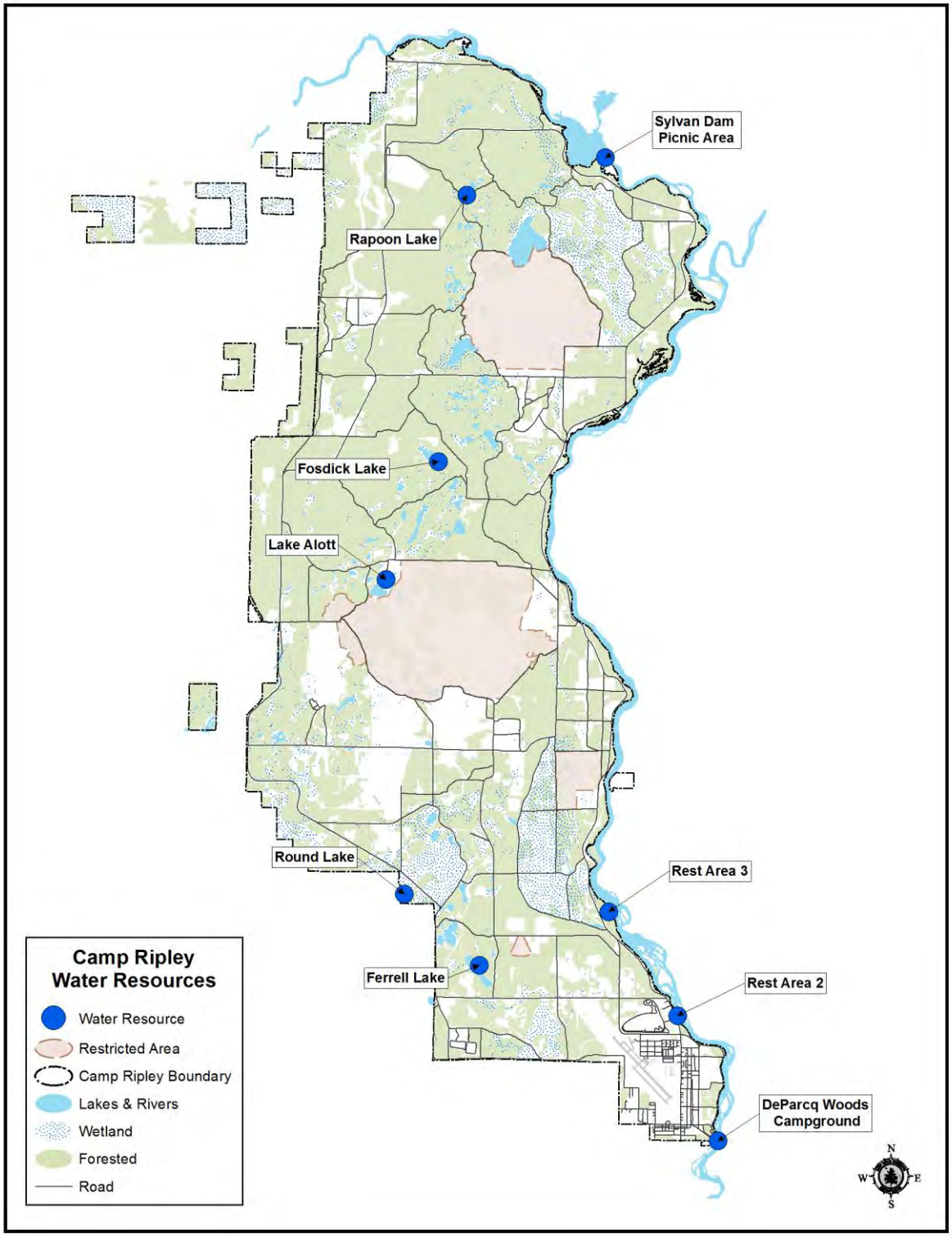
Large scale invasive plant management included the treatment of 49 acres of spotted knapweed (*Centaurea maculosa*) and common tansy (*Tanacetum vulgare*). A tractor-mounted boom sprayer mixed with the selective herbicides metsulfuron-methyl and aminopyralid coupled with a surfactant was foliar applied by CRE and SCSU interns. Treatments were streamlined by tank mixing herbicides allowing multiple species to be treated with one tank mix per day. High priority areas were targeted from areas that received the highest troop use and presented the highest risk of infestation. Roadways and ditches were the primary target areas on Cassino, Normandy, East and West Boundary roads as these presented the highest risk of spread. Center Range south was also a target area. Field habitats with heavy tank traffic where all-terrain vehicle access was limited were treated utilizing the tractor mounted boom sprayer.

## Water Resources

By Jake Kitzmann, Minnesota Department of Military Affairs

Camp Ripley is home to an outstanding array of water bodies including small inland lakes, wetlands and streams, which make up 1,054 acres of Camp Ripley's 53,000-acre footprint (Figure 6). Eighteen miles of Mississippi River frontage and 12 miles of Crow Wing River frontage also form the eastern and northern borders of Camp. Most of these waters are not subject to active management by CRE, however water control structures and mitigation have been conducted at some sites and others are managed for recreational access.

Figure 6. Water resources, Camp Ripley Training Center, Minnesota.



## Miller Lake

Miller Lake is a 27-acre basin with a 1,405-acre watershed that drains via Broken Bow Creek into the Mississippi River. Miller Lake's culvert (#376) was replaced in November 2012 and a water control structure was added. CRE maintained the water level control system in accordance with the plan approved by the DNR Fish and Wildlife Division and the DNR Nongame Wildlife Program (MNDNR 2013a). The managed water level has been maintained at approximately 1211.95 feet in elevation. Between 2012 and the fall of 2014 beaver activity had become an issue. Beavers had raised the water levels to about 20 inches above optimal levels. No nuisance beaver activity was noted in Miller Lake in 2018.

## Mississippi River

Four picnic and camping areas are maintained along the river which allow for access to the excellent fishing opportunities found in the Mississippi. This pristine stretch of river is home to a number of popular game fish species including muskellunge (*Esox masquinongy*), northern pike (*Esox lucius*), walleye (*Sander vitreus*), and small mouth bass (*Micropterus dolomieu*).

## Lake Alott

This 40-acre lake located in Training Area 36 has a fishing access with boat ramp and dock maintained on the north side. Small boats are stored at this landing for use by soldiers. With a maximum depth of 30 feet, Lake Alott is home to a number of popular game fish species including northern pike, walleye, bluegill (*Lepomis macrochirus*), and black crappie (*Pomoxis nigromaculatus*).

## Fosdick Lake

This 26-acre lake located in Training Area 50 has a fishing access with a dock maintained on the north east side. With a maximum depth of about 10 feet, Fosdick is home to a number of popular game fish species including walleye, largemouth bass (*Micropterus salmoides*), and black crappie.

## Round Lake

This 127-acre lake located on the western edge of Camp Ripley has a fishing access with a boat ramp and a dock maintained on the east side. Boats and camp sites are also maintained at this land site for use by soldiers. There is also a public water access maintained by the DNR on the western side of the lake. With a maximum depth of about 19 feet, Round is home to a number of popular game fish species including walleye, muskellunge, northern pike, largemouth bass, and black crappie.

### Rapoon Lake

This 16-acre lake located in Training Area 75 has a fishing access on the north east side. With a maximum depth of about 24 feet, Rapoon is home to a number of popular game fish species including walleye, muskellunge, and smallmouth bass.

### Ferrell Lake

This 51-acre lake located in Training Area 5 has a fishing access with boat ramp and dock maintained on the south west side. Small boats are stored at this landing for use by soldiers. With a maximum depth of about 10 feet, Ferrell is home to a number of popular game fish species including northern pike, walleye, bluegill, and black crappie.

## Wildlife

By Nancy J. Dietz and Brian J. Dirks, Minnesota Department of Natural Resources

### Species in Greatest Conservation Need

"Minnesota defines species in greatest conservation need (SGCN) as native animals, nongame and game, whose populations are rare, declining or vulnerable to decline and are below levels desirable to ensure their long-term health and stability. Also included are species for which Minnesota has a stewardship responsibility. Stewardship species are those for which populations in Minnesota represent a significant portion of their North American breeding, migrating or wintering population, or species whose Minnesota populations are stable, but whose populations outside of Minnesota have declined or are declining in a substantial part of their range" (MNDNR 2015a).

One of the federal requirements of the Comprehensive Wildlife Conservation Strategy is to manage SGCN by developing a wildlife action plan. *Minnesota's Wildlife Action Plan, 2015 – 2025* (MNDNR 2015a) is Minnesota's response to the congressional mandate. The goal of the wildlife action plan is to: 1) ensure the long-term health and viability of Minnesota's wildlife, with a focus on species that are rare, declining or vulnerable to decline; 2) enhance opportunities to enjoy SGCN and other wildlife and to participate in conservation; and 3) acquire the resources necessary to successfully implement the Minnesota Wildlife Action Plan. Additional surveys, monitoring and research will be directed toward identifying other SGCN species on Camp Ripley, and management or conservation actions that could be implemented to benefit these species.

Minnesota's Wildlife Action Plan uses two approaches to meet goal one above, habitat and species. The habitat approach is the most comprehensive and "emphasizes sustaining and enhancing terrestrial and aquatic habitats for SGCN" (MNDNR 2015a). To implement the habitat approach the Plan uses a Wildlife Action Network "composed of terrestrial and aquatic habitat cores and corridors to support biological diversity and ecosystem resilience with a focus on SGCN" (MNDNR 2015a). To develop the network, the analysis mapped habitats containing viable or persistent populations and

species richness hotspots of SGCN. While the Wildlife Action Network is a broad system to guide conservation efforts, a scoring system was developed to identify conservation focus areas. A large majority of Camp Ripley received a Wildlife Action Network score of medium-high to high (Figure 7) similar to locations in the Boundary Waters Canoe area and the Northwest Angle of Minnesota (Figure 8). Integrating Minnesota's Wildlife Action Plan information with the Camp Ripley Integrated Natural Resources Management Plan can contribute to ongoing conservation actions that decrease the risk of future species listings.

Of the over 2,000 known native wildlife species in Minnesota, 346 species from all major taxonomic groups meet the definition of species in greatest conservation need. All federal and state endangered, threatened and special concern species are included on the SGCN list. Five taxonomic groups have one-third or more of their total species found in Minnesota as SGCN, they are mammals (38%), reptiles (50%), amphibians (36%), tiger beetles (46%) and mussels (60%) (MNDNR 2015a). One hundred and one SGCN species have been identified on Camp Ripley, including 65 bird species of which 36 are songbirds (Appendix A).

Figure 7. Wildlife Action Network score, Camp Ripley Training Center, Minnesota, 2018.

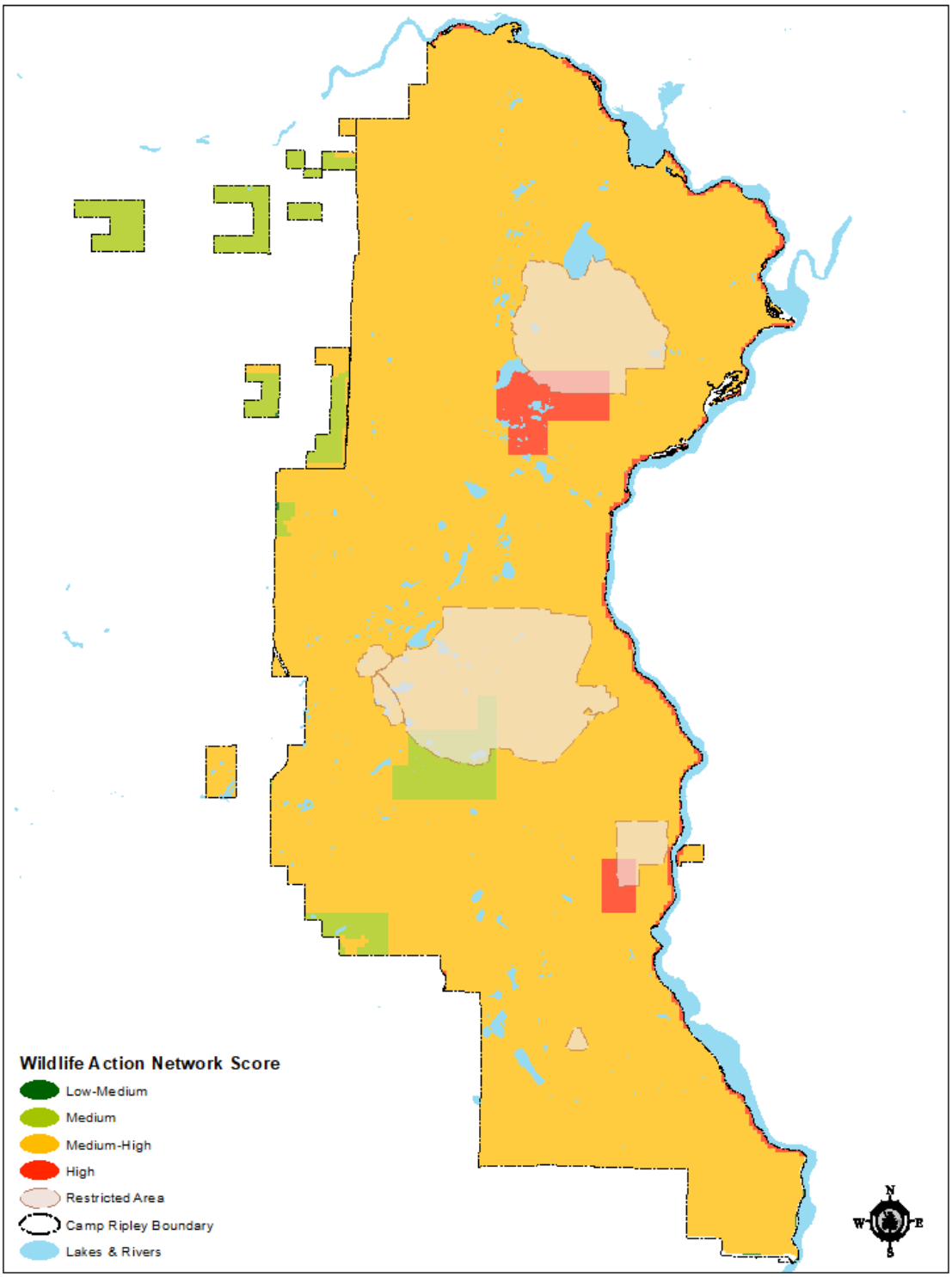
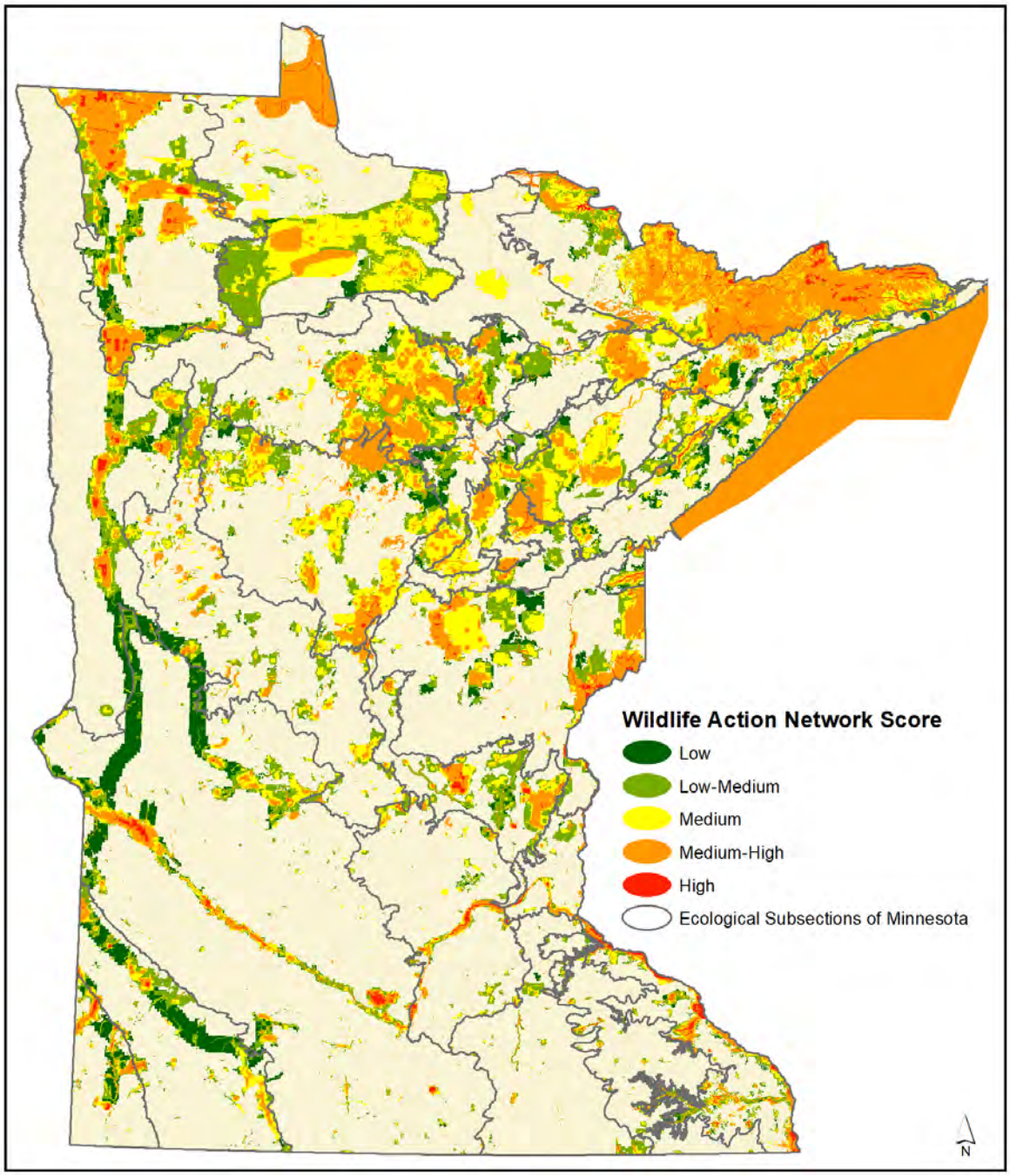


Figure 8. Minnesota's Wildlife Action Network score, 2018.




"The Wildlife Action Network is composed of mapped terrestrial and aquatic habitats, buffers, and connectors that represents a diversity of quality habitats that support Species in Greatest Conservation Need (SGCN). Scores are based on five scalable metrics: SGCN population viability scores, SGCN richness, spatially prioritized MN Biological Survey Sites of Biodiversity Significance, ranks of Lakes of Biological Significance, and Stream Indices of Biological Integrity (IBI). Lower scores (green) in a given area indicate the metric scores for any of these five components were either relatively low or zero, while high scores (red) indicate that multiple metrics of high scores overlap. For example, a red area could indicate several good or outstanding SGCN populations and/or high SGCN richness (including species that did not have population maps available) along with a high score from another prioritization layer. The area in the northeastern Minnesota delineating a portion of Lake Superior represents Minnesota's managed area of the lake" (MNDNR 2015).

**The past 25 years of Camp Ripley Training Center's SGCN observations were NOT included in the development of the Wildlife Action Network.**

## Birds

### Christmas Bird Count

The Christmas Bird Count (CBC) has been coordinated by the National Audubon Society since 1900, and is the oldest continuous nationwide wildlife survey in North America (Sauer et al. 2008). Counts occur within predetermined 15-mile diameter circles located across North America, Mexico and South America. The northwest portion of Camp Ripley is within one of these circles (CBC census code: MNPL). Each count is conducted during a single calendar day within two weeks of Christmas (December 14 – January 5). For example, the 2018 CBC was scheduled to occurr on January 1, 2019. The Pillager CBC was started in 1999, and the census has occurred 19 times (Minnesota Ornithologists' Union 2018a). CBC data is primarily used to track winter distribution patterns and population trends of various bird species. The Pillager CBC did not occur due to recent winter storms, making roads inaccessible, and dangerous wind chills on the scheduled survey date.

### Breeding Bird Monitoring

By Kent Montgomery, Central Lakes College, and Nancy J. Dietz, Minnesota Department of Natural Resources

Camp Ripley provides important breeding and migratory habitat for 65 birds that are species in greatest conservation need (SGCN). Thirty-two SGCN birds including water birds, raptors and songbirds are known to breed on Camp Ripley. Of these SGCN birds 16 are often heard during point count surveys.

Breeding bird surveys have been conducted on permanent plots throughout Camp Ripley since 1991. The full breeding bird survey includes 90 plots that are surveyed as part of long-term population monitoring. The number of plots surveyed each year varies according to training, weather and survey strategy. Development of new ranges on Camp Ripley along with increased military and civilian training can limit access to most permanent survey points. Additionally, certain plots are no longer surveyed due to complete habitat alterations such as gravel pit expansion or development, and installation or expansion of military training ranges and parking lots.

The breeding bird survey documented 991 individual birds of 70 species on 90 survey plots (Figure 9 and Table 9). Nine of the most common species recorded during breeding bird surveys were ovenbird (*Seiurus aurocapillus*), red-eyed vireo (*Vireo olivaceus*), veery (*Catharus fuscescens*) (SGCN), American redstart (*Setophaga ruticilla*), eastern wood-pewee (*Contopus virens*) (SGCN), common yellowthroat (*Geothlypis trichas*), chestnut-sided warbler (*Setophaga pensylvanica*), song sparrow (*Melospiza melodia*) and scarlet tanager (*Piranga olivacea*). Note that two of these most common Camp Ripley species are also SGCN.

Figure 9. Songbird survey plots, Camp Ripley Training Center, Minnesota.

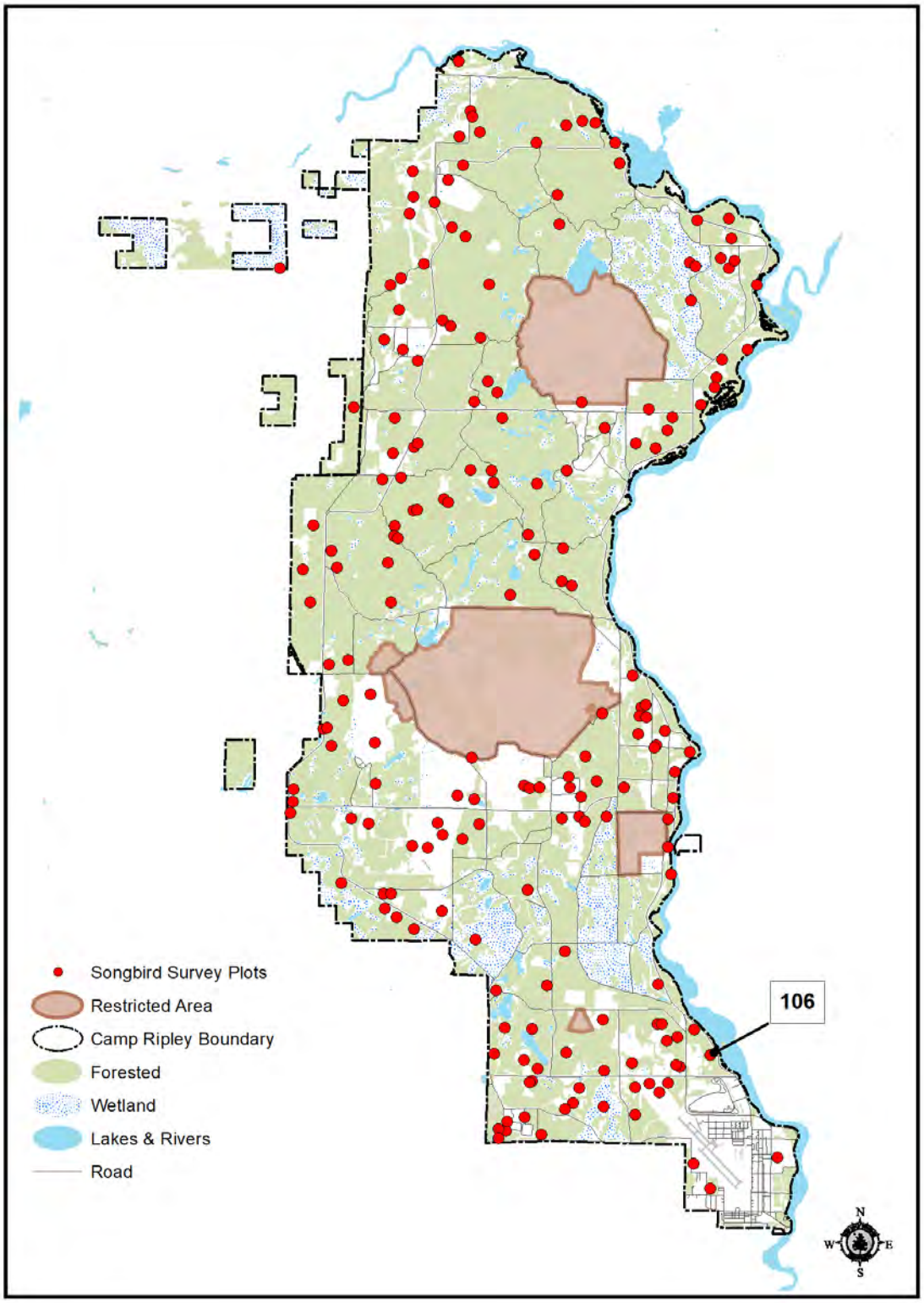


Table 9. Songbird survey data, Camp Ripley Training Center, Minnesota, 2000 – 2014 and 2017 – 2018.

| Year | Field Surveyor/s | Number of Permanent Plots Surveyed | Total Number of Birds Documented | Total Number of Species Documented | Average Number of Birds per Plot | Average Number of Species per Plot |
|---|---|---|---|---|---|---|
| 2000 | Dirks/Brown | 92 | 1,002 | 66 | 10.89 | 6.43 |
| 2001 | Dirks/Brown | 31 | 316 | 46 | 10.19 | 5.77 |
| 2002 | Dirks/Brown/DeJong | 30 | 258 | 42 | 8.6 | 5.83 |
| 2003 | Dirks/Brown/DeJong | 90 | 823 | 68 | 9.14 | 5.37 |
| 2004 | Dirks/Brown/ Burggraff | 107 | 1,129 | 64 | 10.55 | 6.14 |
| 2005 | Dirks/Brown/DeJong | 89 | 897 | 61 | 10.08 | 6.20 |
| 2006 | Dirks/Brown/DeJong | 88 | 802 | 64 | 9.11 | 5.84 |
| 2007 | Dirks/Brown/DeJong | 91 | 994 | 71 | 10.92 | 7.02 |
| 2008 | Dirks/Brown | 89 | 875 | 70 | 9.83 | 6.60 |
| 2009 | Dirks | 57 | 563 | 63 | 9.87 | 7.26 |
| 2010 | Dirks | 11 | 122 | 25 | * | * |
| 2011 | Dirks | 42 | 383 | 51 | 9.12 | 6.45 |
| 2012 | Dirks | 6 | 66 | 16 | * | * |
| 2013 | Dirks | 61 | 688 | 68 | 11.28 | 8.18 |
| 2014 | Dirks | 8 | 95 | 23 | * | * |
| 2017 | Montgomery | 90 | 994 | 76 | 11.04 | 8.23 |
| 2018 | Montgomery | 90 | 991 | 70 | 11.01 | 7.83 |

*Not calculated due to low number of plots surveyed in 2010, 2012 and 2014 due to plot access limitations. No breeding songbird surveys were conducted in 2015 – 2016.

### Golden-Winged Warbler (*Verminvora chrysoptera*)

Camp Ripley's long-term breeding bird monitoring is helpful in determining population trends for species of concern such as SGCN and other species considered for federal Endangered Species Act listing, such as the golden-winged warbler (*Vermivora chrysoptera*) (Figure 10). Due to this warbler's population decline, in February 2010, the U.S. Fish and Wildlife Service (USFWS) was petitioned to list the golden-winged warbler as threatened or endangered under the Endangered Species Act. The USFWS has reviewed the petition and issued a "positive finding" that triggers a thorough review of all available information to determine if the golden-winged warbler status warrants protection (USFWS 2019f). Its population decline include habitat loss on the breeding and wintering grounds, and hybridization with the closely related blue-winged warbler (*Verminvora pinus*) (Pfannmuller et al. 2017e). As a long-distance migrant, golden-winged warblers spend the winter in Central and northern South America. Eighty percent of the global breeding population resides in the forests surrounding the Great Lakes. Minnesota was estimated to support 47% of the continental population in 2013 (Pfannmuller et al. 2017e). Population trends on the Chippewa and Superior National Forests were stable from 1995 – 2016 (Bednar et al. 2016; Pfannmuller et al. 2017e). Golden-winged warblers have been slightly increasing on Camp Ripley's point count surveys

since 2000 (Figure 10) and incidental, auditory observations have increased throughout Camp Ripley in the past 10 years.

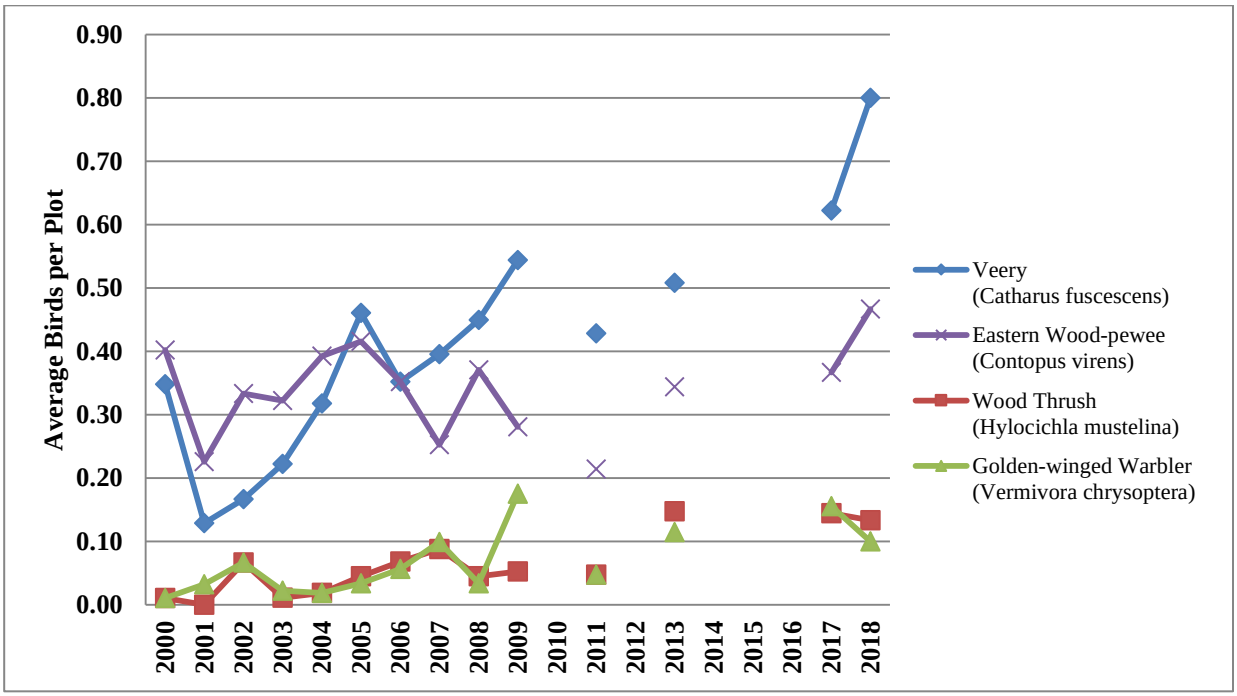
Breeding ground habitat initially had been characterized as early successional or open shrubby areas. While early successional habitat is an important component for breeding of golden-winged warblers, recent research has demonstrated that later successional forests are used throughout the breeding season for nesting, foraging and raising young. Adult golden-winged warblers include later successional forests in territories and home ranges (Streby et al. 2012). A more appropriate description of breeding habitat is "diverse forest obligate or dynamic forest specialist" (Streby et al. 2016). In Minnesota, golden-winged warbler habitat has a strong association with lowland shrubs and sedge wetlands followed by open wetlands and regenerating forest stands (Niemi et al. 2016; Pfannmuller et al. 2017e) in the National Forest Bird Monitoring Program. The Minnesota Breeding Bird Atlas surveys demonstrated strong habitat associations with shrub wetlands followed by northern hardwoods and a wide variety of other forest and wetland habitats (Pfannmuller et al. 2017e).

Camp Ripley has a mixed population of golden-winged warblers, blue-winged warblers and hybrids. The genetic hybridization of golden-winged warblers with blue-winged warblers, has contributed to golden-winged warbler population declines and was examined on Camp Ripley in 2010 by a graduate research student from Michigan Tech University. Of 46 golden-winged warblers tested, 6.5% (n=3) were cryptic hybrids (genetically introgressed [movement of a gene from one species into the gene pool of another by repeated backcrossing of a hybrid with one of its parents] with blue-winged warblers). Two tested blue-winged warblers were both pure blue-winged warbler. Three Brewster's warblers, a first generation hybrid of blue-winged and golden-winged warblers, were also tested. Two Brewster's had golden-winged warbler mothers and one had a blue-winged warbler mother. It is not surprising that some golden-winged warblers were cryptic hybrids. The surprising result is that this introgression rate is lower than some other places in Minnesota, such as Rice Lake National Wildlife Refuge and the Superior National Forest, where the introgression rate is higher and where blue-winged warblers are very rarely found, or not found at all. Also in other places where the two species are sympatric (occupying the same geographic area), the introgression rate tends to be higher, closer to 10 – 15% of the population. If blue-winged warblers are relatively new arrivals at Camp Ripley, this may explain the relatively low introgression rate compared to other sympatric populations.

Recently researchers discovered that wintering ground deforestation is a significant problem causing breeding ground population declines. Golden-winged warbler breeding areas occur in two distinct areas — the Great Lakes and Appalachian Mountains. The Appalachian Mountain population has declined by 98%, while the Great Lakes population is stable (Figure 11). These two populations have distinct wintering grounds. The Great Lakes population winters in Central America, while the Appalachian Mountain population winters in northern South America; thereby leading to isolation and segregation of populations (Kramer et al. 2018). Deforestation in South America occurs at a rate of three to one of that in Central America. Because of these significant winter habitat losses,

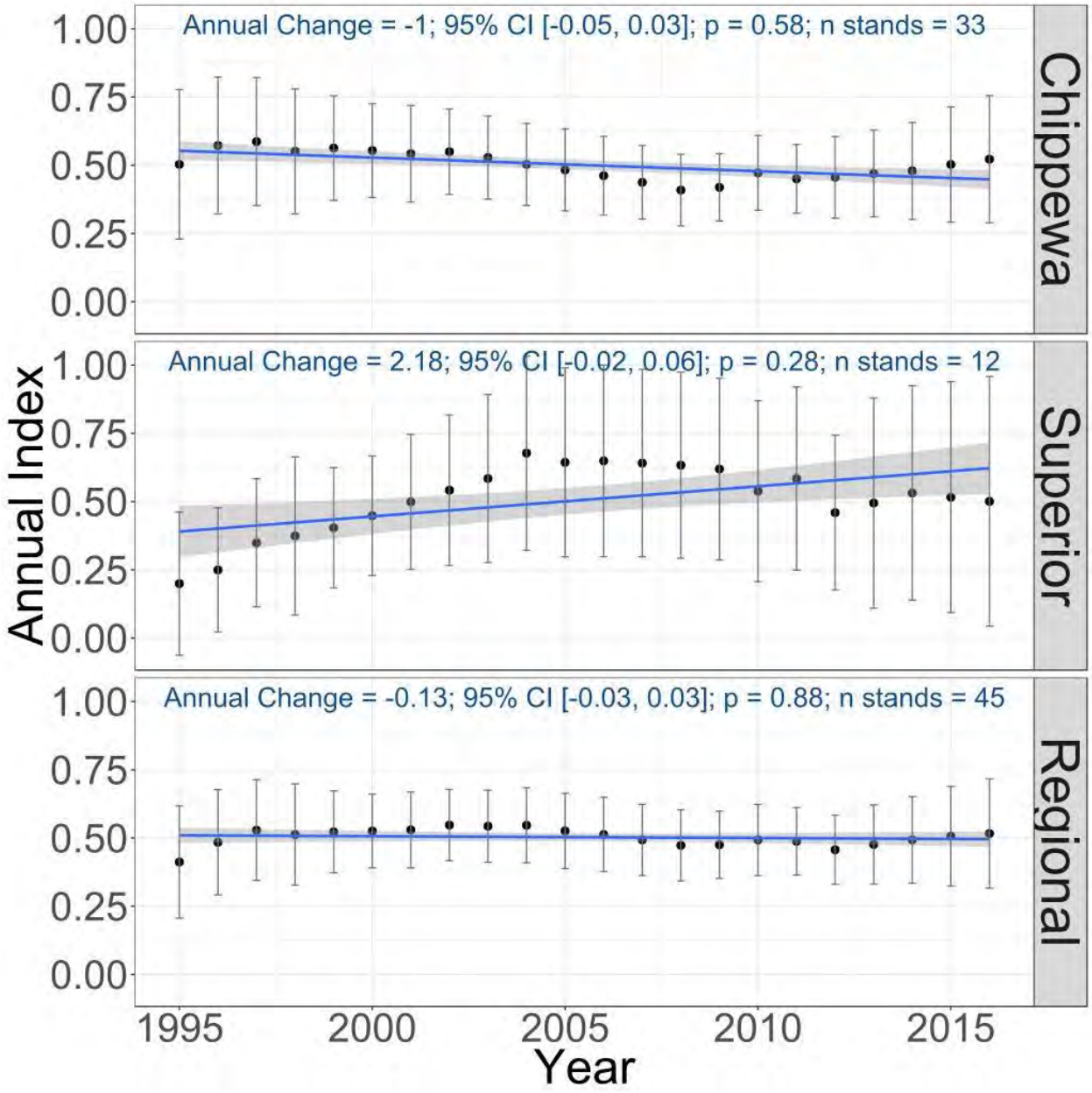
researchers recommend that conservation management should shift to a strategy of winter habitat management and to a lesser extent to breeding habitats (John 2018).

Figure 10. Selected songbirds of greatest conservation need, Camp Ripley Training Center, Minnesota, 2000 – 2013*, 2017 – 2018.




*In 2001 and 2002 only 31 and 30 plots were surveyed, respectively.

Figure 11. Golden-winged warbler population trends in the Chippewa and Superior National Forests, Minnesota, and regional trend, 1995 – 2016 (Bednar et al. 2016).




Cerulean Warbler (*Setophaga cerulean*)

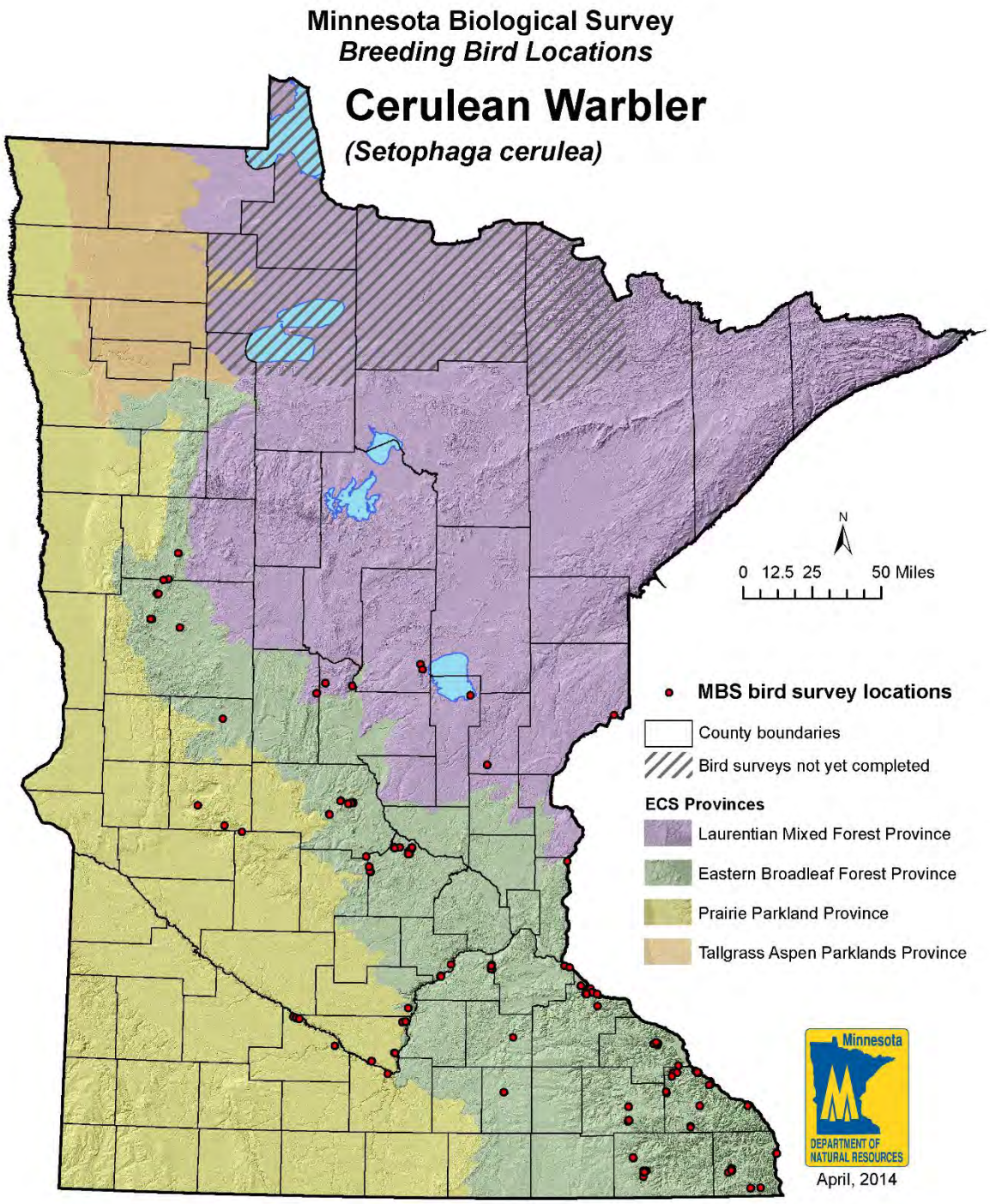
Janssen (1987) considered the cerulean warbler a rare southeastern Minnesota summer resident. It was listed as a state species of special concern in 1984 and is a SGCN in Minnesota (MNDNR 2015a). Recently cerulean warblers have bred in southeastern and central Minnesota with occasional occurrences in the past in Morrison County (Figure 12). Their distribution in Minnesota is localized and patchy but they have occurred recently in neighboring counties. They were documented on Camp Ripley in 2001, when a male cerulean warbler was documented on breeding

bird survey plot #9 in the northeastern portion of Camp Ripley (northern edge of Training Area 65) (Dirks and DeJong 2002); and again in June 2018, on breeding bird survey plot #106 (Figure 9, pg. 40) located in Training Area 11.

Habitats include tall, contiguous, mature deciduous trees with 85% canopy cover, relatively little undergrowth and scattered forest openings (Rosenberg et al. 2000) in both lowland forests and mesic upland deciduous forest (MNDNR 2018c). This forest bird nests high in the canopy of deciduous trees (Pfannmuller 2017c). A majority of occupied habitat records in the Upper Midwest are in forests larger than 988 acres (Rosenberg et al. 2000). Cerulean warblers are sensitive to fragmentation in their breeding habitat, which continues to be a threat In Minnesota (MNDNR 2018d; Bessken 2000) and causes lower reproductive success (Buehler et al. 2008). Cerulean warblers are a long-distance migrant that winter in northern South America (MNDNR 2018c).

Populations of cerulean warblers are either stable or significantly declining in every state within its range. The population has had a cumulative decline of 72% since 1970, the steepest decline of any North American songbird (Rosenberg et al. 2016). Threats include loss of habitat on the breeding and winter range. Its mature forest habitat is threatened by timber harvest, even-aged forest management (MNDNR 2018c), agriculture, and conversion of forest to other land uses.

Figure 12. Cerulean warbler (*Setophaga cerulean*) breeding bird locations, Minnesota.



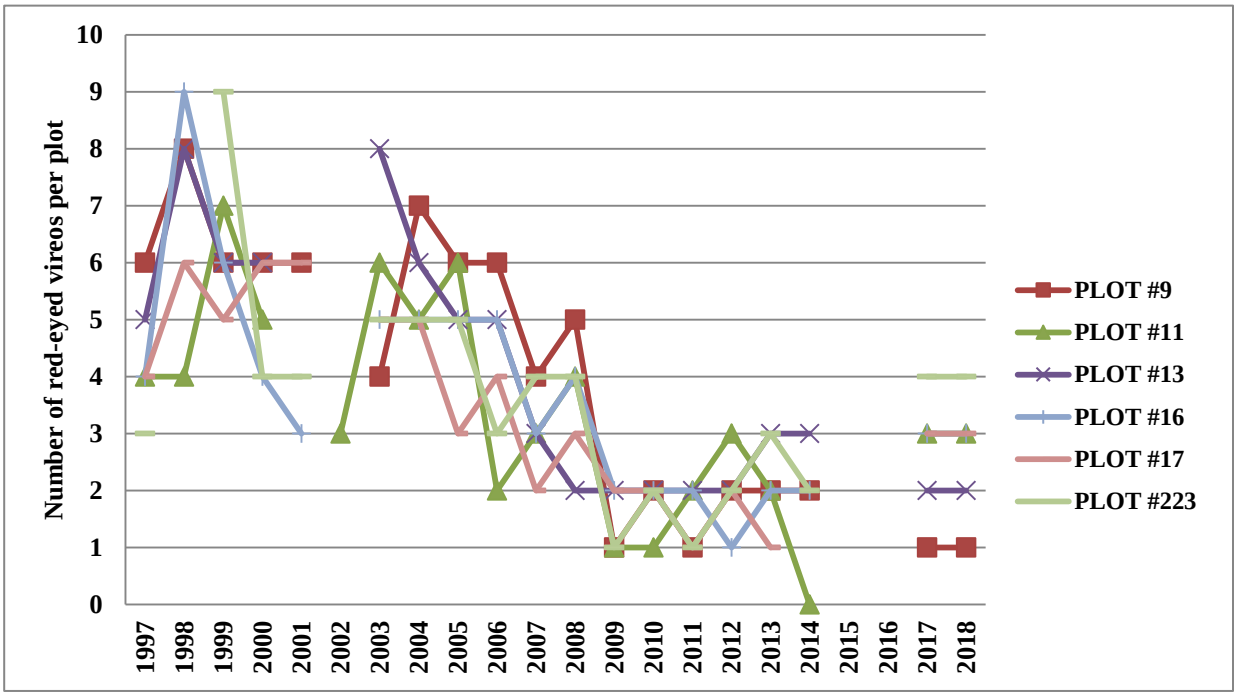

Note: This map displays only information collected by Minnesota Biological Survey.

## Red-Eyed Vireo (*Vireo olivaceus*)

In the past, we focused on red-eyed vireos populations because they had been much more numerous than any other species detected on survey plots. However, the number of red-eyed vireos per plot and the total number on all plots have continued to decline (by more than 70%) since 2000. Six plots identified in previous years as being undisturbed sites (e.g., no prescribed fire nor timber harvest) with high numbers of red-eyed vireos were surveyed. The number of red-eyed vireos on the six surveyed plots has also dropped, from a total of 30 – 33 through 2005 to nine in 2009, 2011 and 2014, 12 in 2012, 13 in 2013, and 16 in 2017 and 2018. This drop is very noticeable in the field when counts changed from 4 to 8 red-eyed vireos on each plot in prior years, to 1 to 4 on each plot (Figure 13). Although red-eyed vireos are not a SGCN nor special concern species, the change in numbers is concerning because the federal Breeding Bird Survey in Minnesota, 1967 – 2015, indicated a nonsignificant stable population trend but tending toward an increase (Pfannmuller et al. 2017f). In addition, other species that use similar habitat, such as ovenbirds, have shown large increases on Camp Ripley during the same time period (Figure 14).

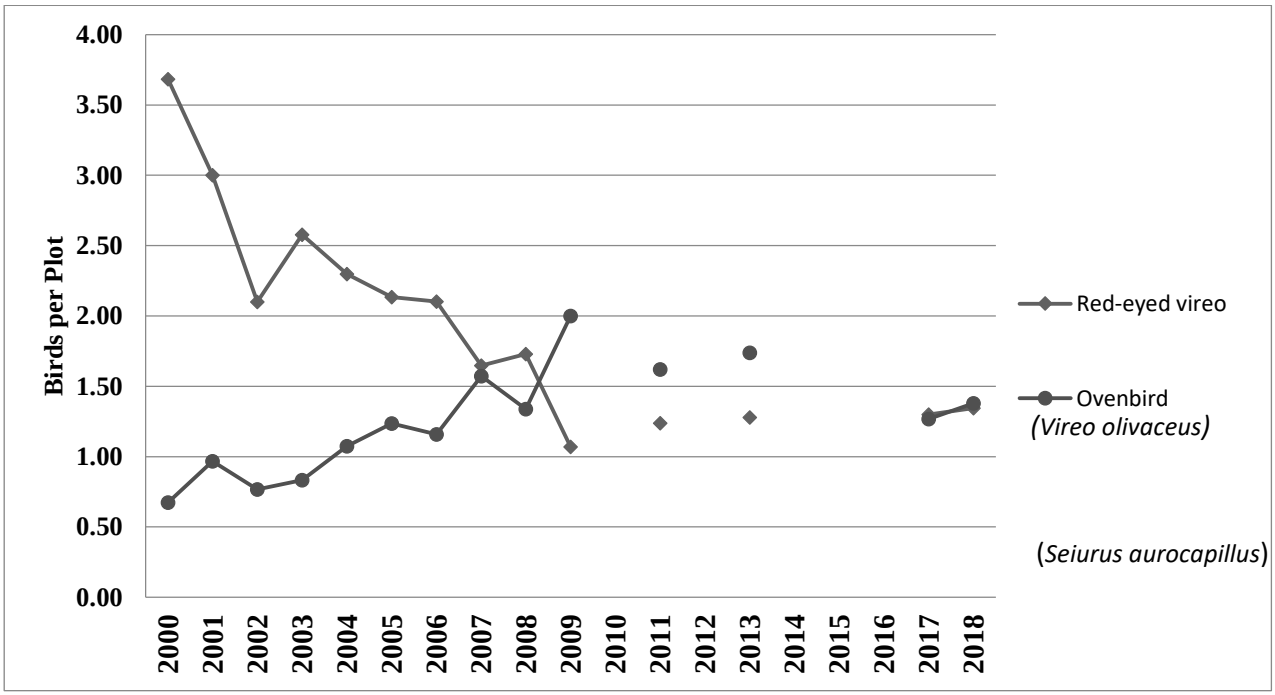
Population trends for red-eyed vireo in Minnesota's Chippewa National Forest have been stable; however, in the Superior National Forest from 1995 – 2015 the population has significantly decreased ($p < 0.01$) at 0.52% per year (Figure 15). The downward population trend was most pronounced in 2004 – 2015, while Camp Ripley's downward population trend began in 1998 (Figure 14) Red-eyed vireos were the most abundant species in mature oak forests in the Chippewa National Forest.

Figure 13. Red-eyed vireos (*Vireo olivaceus*) per plot, Camp Ripley Training Center, Minnesota, 1997 – 2014*, 2017 – 2018.



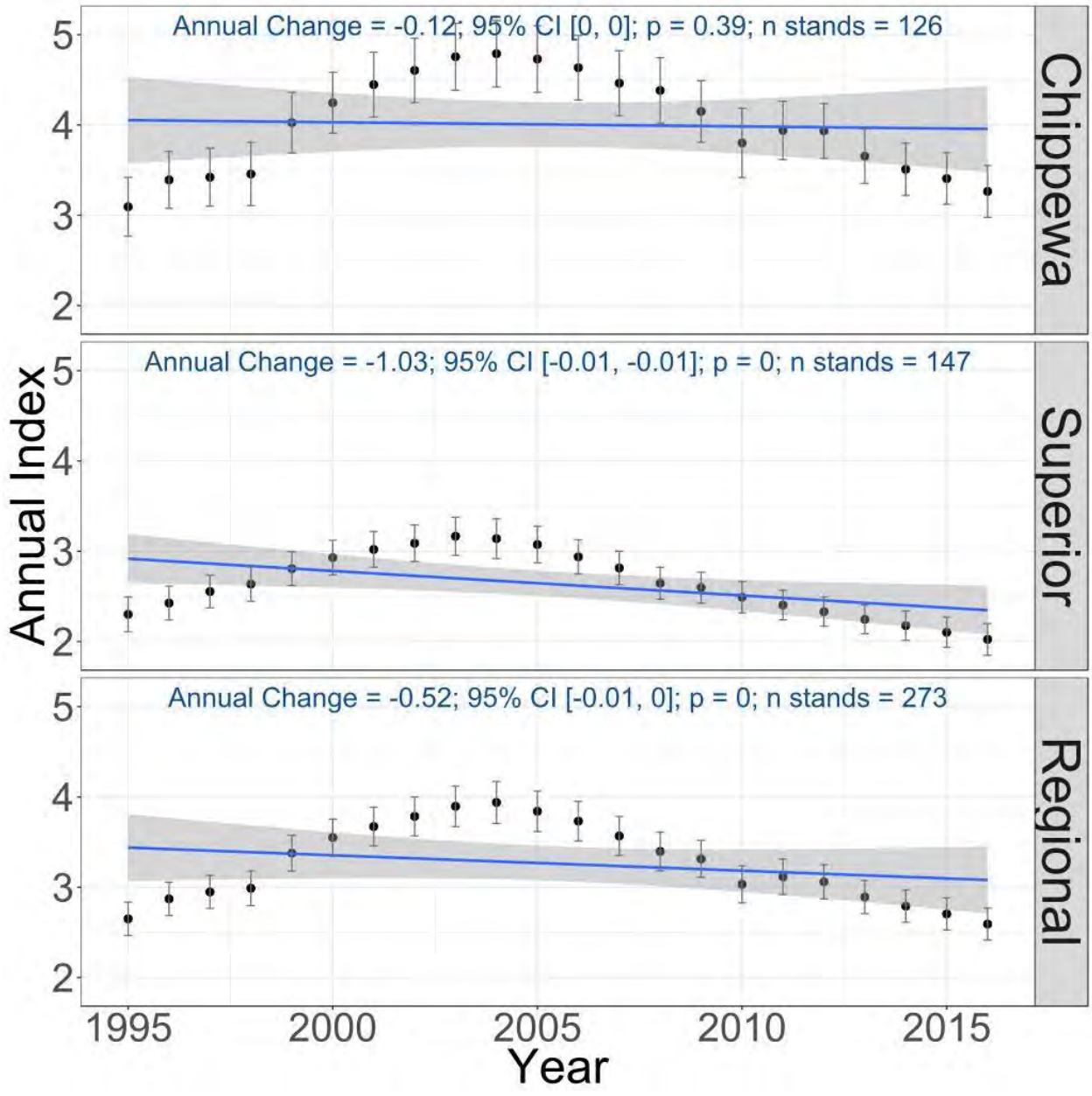

*In 2001 and 2002 only 31 plots were surveyed, respectively.

Figure 14. Selected songbird average birds per plot, Camp Ripley Training Center, Minnesota, 2000 – 2003, and 2017 – 2018.*




* In 2001 and 2002 only 31 and 30 plots were surveyed, respectively.
* In 2010, 2012 and 2014 only 11, 6 and 8 permanent plots were surveyed, respectively; therefore the data is not included.

Figure 15. Red-eyed vireo population trends in the Chippewa and Superior National Forests, Minnesota, and regional trend, 1995 – 2015 (Bednar et al. 2016).




The effects of prescribed fire management activities in selected training areas were identified as one of the possible causes for the declines on Camp Ripley. Red-eyed vireos utilize vegetation in the shrub layer (up to five meters in height) in forested areas for nesting and feeding. The reduction in shrub densities in fire-treated areas or other areas managed for shrub reduction (e.g., land navigation training sites) may reduce feeding or nesting opportunities for this species.

To investigate the effect of shrub management on this species, additional surveys were conducted at The Nature Conservancy's (TNC) Lake Alexander Preserve (Preserve) that is an

analogous landscape adjacent to the western boundary of Camp Ripley. TNC personnel utilize prescribed fire to achieve ecological management outcomes at the Preserve.

Twelve breeding bird survey plots were established and sampled at the Preserve using the same procedures as those used at Camp Ripley. All selected Preserve plots have experienced prescribed fire in the past. Red-eyed vireo densities across all forested Preserve plots averaged 2.85 birds per plot (n=12, SD = 0.90), whereas densities across all forested sites at Camp Ripley averaged 1.68 birds per site (n=71, SD =1.68). When plots at Camp Ripley were restricted to those with past fire activity (training areas with scheduled prescribed fire activities), average densities dropped to 0.75 birds per plot (n=20, SD = 0.91).

In an attempt to assess the immediate effects of fire upon red-eyed vireos, the analysis was further limited to sites at either location that had been affected by fire in 2018 (i.e., leaf litter consumed by fire, shrubs heat-killed, etc.). With these restrictions in place, Camp Ripley densities averaged 1.63 birds per plot (n=8, SD = 0.74) and Preserve red-eyed vireo densities averaged 3.33 birds per site (n=3, SD =0.58). At both locations, densities increased with recent burn activity, although the small sample size limits the application of these results. Furthermore, the consistently higher densities at the Preserve suggest that although fire management may affect red-eyed vireo densities on Camp Ripley, other factors may be at work to account for the recent decline in population.

Long-term monitoring will continue on Camp Ripley to monitor songbird population trends and to determine if this is a permanent drop in the number of red-eyed vireos nesting on Camp Ripley or a natural fluctuation or population adjustment from an unusually high number in the 1990s.

### Trumpeter Swan (*Cygnus buccinator*)

Trumpeter swans were a common breeding bird in western Minnesota until the mid-1800s; the last historical record of breeding in the wild was in 1885. Trumpeter swans were considered extirpated in the state. However, reintroduction and recovery efforts, including listing the species as state threatened in Minnesota in 1996, have resulted in more than 17,000 trumpeter swans in Minnesota during the nesting season in 2015 (MNDNR 2018). Due to population increases, trumpeter swans are now a special concern species, a SGCN, and are monitored each year (Dirks et al. 2010) through aerial flights and ground observations by field personnel.

Table 10. Trumpeter swan production, Camp Ripley Training Center, Minnesota, since 1990.

| Year | Cygnets Raised |
|---|---|
| 1990 | 2 |
| 2009 | Unknown |
| 2010 | 4 |
| 2011 | 1 |
| 2012 | 8 |
| 2013 | 4 |
| 2014 | 8 |
| 2015 | 5+ |
| 2016 | Unknown |
| 2017 | 10 |
| 2018 | 12 |
| **Known Total** | **49** |

The first record of trumpeter swans breeding on Camp Ripley occurred in 1990 when an active nest was located in a wetland north of Normandy Road (Dorff and Nordquist 1993). Trumpeter swans have continued to be documented at various lakes throughout Camp Ripley (1991, 1992, 2009 – 2018) but successful reproduction had not been documented in more than 10 years until 2010. In late-June and late-July 2018, breeding pairs were observed on Miller Lake (n=3 cygnets), Goose Lake (n=3 cygnets), Cody Pond (n=3 cygnets) and Mud Lake (n=3 cygnets) (Table 10). No pairs were observed on Mud Lake, Ferrell Lake, Frog Lake, Fosdick Lake, Rapoon Lake, Marne Marsh, Lookout Lake and F Range pond, or the unnamed pond on the south side of Cassino Road.

### Osprey (*Pandion haleaetus*)

No ospreys were observed using the Crow Wing River nest platform which was established in 2011. A bald eagle (*Haliaeetus leucocephalus*) pair (Pusan) established a nest in a neighboring tree in the fall of 2014, so it is unlikely that an osprey pair will use the platform in close proximity to an active bald eagle nest. The nest blew down from the platform on Sylvan Reservoir in 2013. In 2014 – 2018, ospreys did not nest on the Sylvan Reservoir platform but nested on the Sylvan Dam platform and raised two young in 2014 – 2015 and one in 2016 – 2018.

### Red-shouldered Hawk (*Buteo lineatus*)

#### Population Survey

The red-shouldered hawk is uncommon in Minnesota and has declined markedly in the northern states since the 1940s. Work in Iowa suggests that the main causes of the population decline are habitat reduction and fragmentation (Bednarz and Dinsmore 1982). The red-shouldered hawk is listed as a state special concern species and a SGCN (MNDNR 2015a). “In 1992, *The Generic Environmental Impact Statement on Timber Harvesting and Forest Management in Minnesota* put special emphasis on the red-shouldered hawk because of the projected population declines under all timber harvesting scenarios for the next 50 years. This decline is anticipated due to the loss of large contiguous stands of mature hardwoods throughout the state” (MNDNR 2019).

In 2004 and 2005, a University of Minnesota graduate student conducted a red-shouldered hawk study on Camp Ripley (Henneman 2006). The 2009 – 2010 surveyd used a subset (2009, n=64; 2010, n=81) of the same call-broadcast points used in 2005 by Henneman (2006) (n=130). A subset of call points was selected in 2009 – 2010, 2014 and 2018 due to staff constraints to complete the full call broadcast survey (n=130) conducted during 2004 – 2005. Call point subset selection criteria in 2009 – 2010 were: 1) positive response points during 2004 and 2005 (Dirks and Dietz 2010), and 2) points selected were close to existing roads or trails. In 2009 and 2010, surveying only sites that were occupied in 2004 and 2005 likely increased the overall apparent occupancy.

In 2010, the subset of sampled points included all points sampled in 2009 plus four more call points that were added south of Normandy Road. Due to habitat differences fewer red-shouldered hawks reside south of Lake Alott Road. In 2009, only 13 call points (20%) were south of Lake Alott Road (Figure 34 in Dirks and Dietz 2010) whereas 24 points (27%) were in 2004 (Figure 32 in Dirks and Dietz 2010), 46 points (35%) were in 2005 (Figure 33 in Dirks and Dietz 2010), and 30 points (35%) were in 2014 and 2018. In 2005, 2014 and 2018 the same proportion of southern call points were surveyed. Therefore, call point selection bias that occurred in 2009 and 2010 has been resolved and the stratified, random sample of call points in 2014 and 2018 is comparable to the 2005 data.

The call point subset in 2014 and 2018 was a stratified, random sample of 2005 call points (Figure 16). Survey techniques used in 2009 – 2010, 2014 and 2018 were described in Henneman (2006), with two exceptions. To minimize staff time and increase the number of call points surveyed, all calls were broadcast from the nearest roadway rather than to walk to the specific 2004 or 2005 point location. In addition, once a red-shouldered hawk responded at a survey call point that point was considered occupied and sampling ceased. The call point identification numbers for 2009 – 2010, 2014 and 2018 are the same as used by Henneman (2006).

In 2014, a total of 85 call-broadcast points were sampled from April 2 to May 15 (pre-incubation period). In 2018, a total of 84 call-broadcast points were sampled from March 27 to May 11 (pre-incubation period). Sixty-three (74%) and 67 (79%) points in 2014 and 2018 (Figures 17 and 19), respectively, were included in the analysis because either a positive response was recorded or they were sampled ≥4 times (Table 11). Sixty-nine and 47% of these call-broadcast points were occupied in 2014 and 2018, respectively (Table 11). The 47% apparent occupancy installation-wide for red-shouldered hawks in 2018 (n=89) (Figure 19) at Camp Ripley was a 28% decline from 2005 (n=130) (Figure 16) and a 31% decline from 2014 (n=81) (MNDNR and MNARNG 2015) (Figure 17). However, call points in 2018 (Figure 19) were challenging to complete due to deep snow cover late into April, making trails impassible by vehicle. Although some interior call points were accessed via snowmobile, not all interior call points were adequately surveyed in 2018, which may have contributed to the lower apparent occupancy rate.

Table 11. Red-shouldered hawk call-broadcast surveys, Camp Ripley Training Center, Minnesota, 2004, 2005, 2009 – 2010, 2014 and 2018.

| Year | No. of call broadcast stations | No. of call broadcast stations sampled ≥4 times | No. of stations with ≥ 1 red-shouldered hawk detection | Apparent Occupancy |
|---|---|---|---|---|
| 2004[a] | 90 | 80[b] | 65[b] | 72.2%[c] |
| 2005[a] | 130 | 80[b] | 87[b] | 66.9%[c] |
| 2009 | 64[d] | 15 | 49[f] | 80.0%[e] |
| 2010 | 81[f] | 24 | 64[f] | 79.0%[e] |
| 2014 | 85[f] | 22 | 44[f] | 69.8%[e] |
| **2018** | **84[f]** | **38** | **32[f]** | **47.8%[e]** |

[a]Dirks, B. and J. DeJong. 2006 and Henneman 2006.
[b] In 2004/2005, positive response call points were sampled up to five times.
[c]Modeled occupancy (Presence software).
[d]In 2009 and 2010, sampled a subset of positive response call points from 2004/2005; and positive response call points were considered occupied territories and sampling ceased.
[e]Apparent occupancy
[f]Stratified, random sample of 2005 call points; and positive response call points were considered occupied territories and sampling ceased.

However, the northwest area of Camp Ripley (Figure 18) (call points #1, #7, #13, #14, #27, #31, #37, #97, #101 and #107) was occupied by red-shouldered hawks in 2005 (Figure 16) but not occupied in 2014 (Figure 18, n=12) and only the four fringe contiguous, mature forest points were occupied in 2015 (Figure 18, n=17). Overall the northwest area had its highest occupancy in 2005 (64.7%), 2009 (75%) (Dietz and Dirks 2010), and 2010 (72.7%) (Dietz and Dirks 2011) and had significant declines in 2014 (0%), 2015 (23%) and 2018 (n=13, 15%) (Table 11 and Figures 16 – 18).

Potential factors contributing to the decline are decreases in summer or winter habitat, increased mortality, or a decrease of recruits into the population. However, since 2008, several Camp Ripley range improvement projects have caused long-term conversion of about 1,100 acres of mature deciduous forest habitats to either grassland or savannah habitats, primarily in the northwest portion of Camp (e.g., Infantry Squad Battle Course, maneuver lanes) (Figures 11 – 13 in MNDNR and MNARNG 2016). From 1999 – 2003 a timber harvest moratorium occurred installation-wide due to a white-tailed deer study. In addition, no forest harvest occurred in the northwest in 2005. When comparing forest habitat conditions (Figures 11 – 13 in MNDNR and MNARNG 2016), they demonstrate the significant alteration in contiguous forest cover in the northwest area from 2000 to 2015. Forestry practices have added to the impact of habitat alteration. While some forestry practices such as pine thinning adjacent to Morrison County Road 1 have had little impact to red-shouldered hawk habitat due to the forest canopy cover being maintained; forestry practices adjacent to the Infantry Squad Battle Course range development have added to the impact to red-shouldered hawk habitat declines. In addition, a summer storm tree blowdown event in September of 2014 also caused habitat changes in this area.

Figure 16. Red-shouldered hawk call-broadcast response and sample locations, Camp Ripley Training Center, Minnesota, 2005.

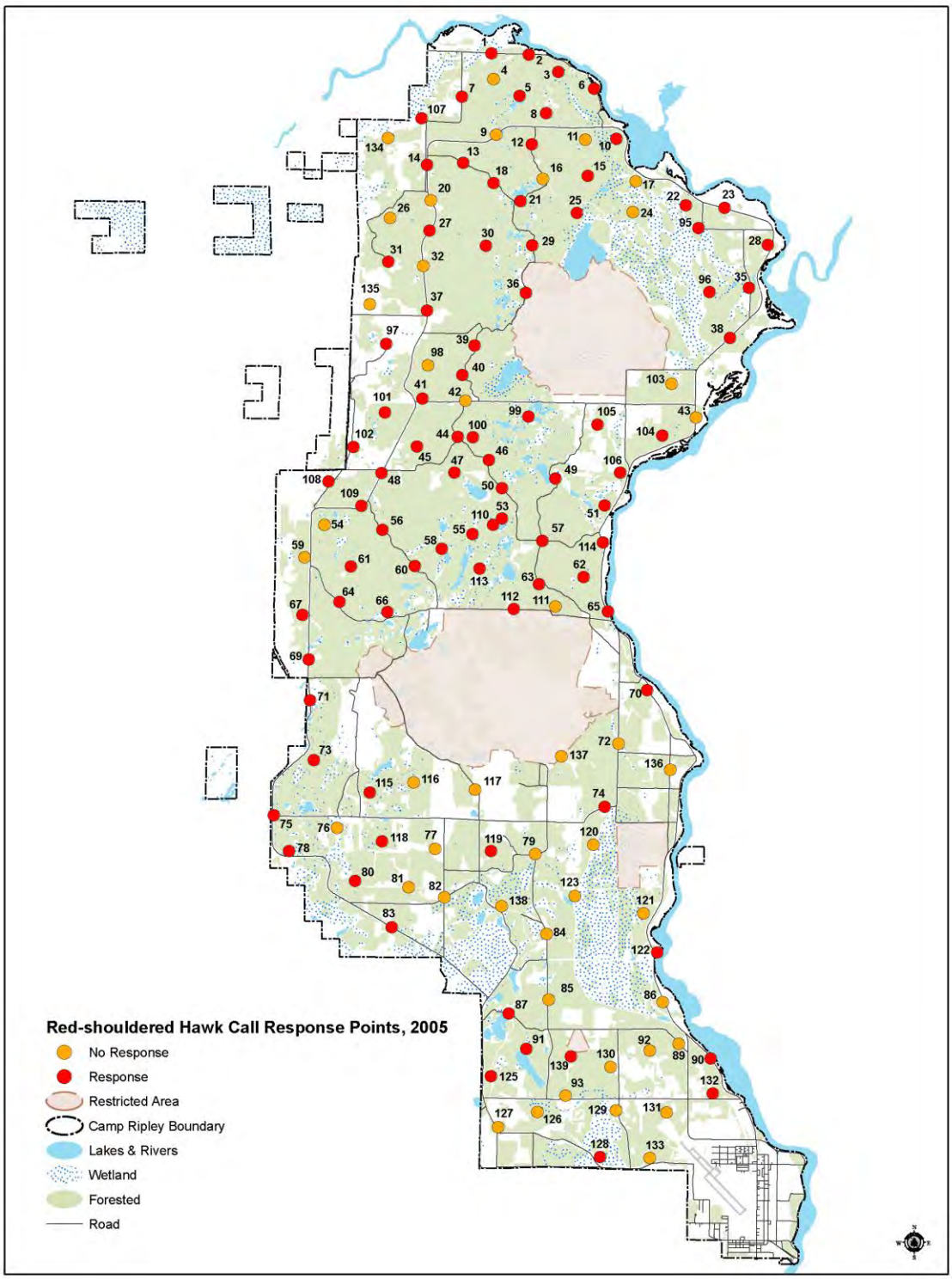


Figure 17. Red-shouldered hawk call-broadcast response and sample locations, Camp Ripley Training Center, Minnesota, 2014.

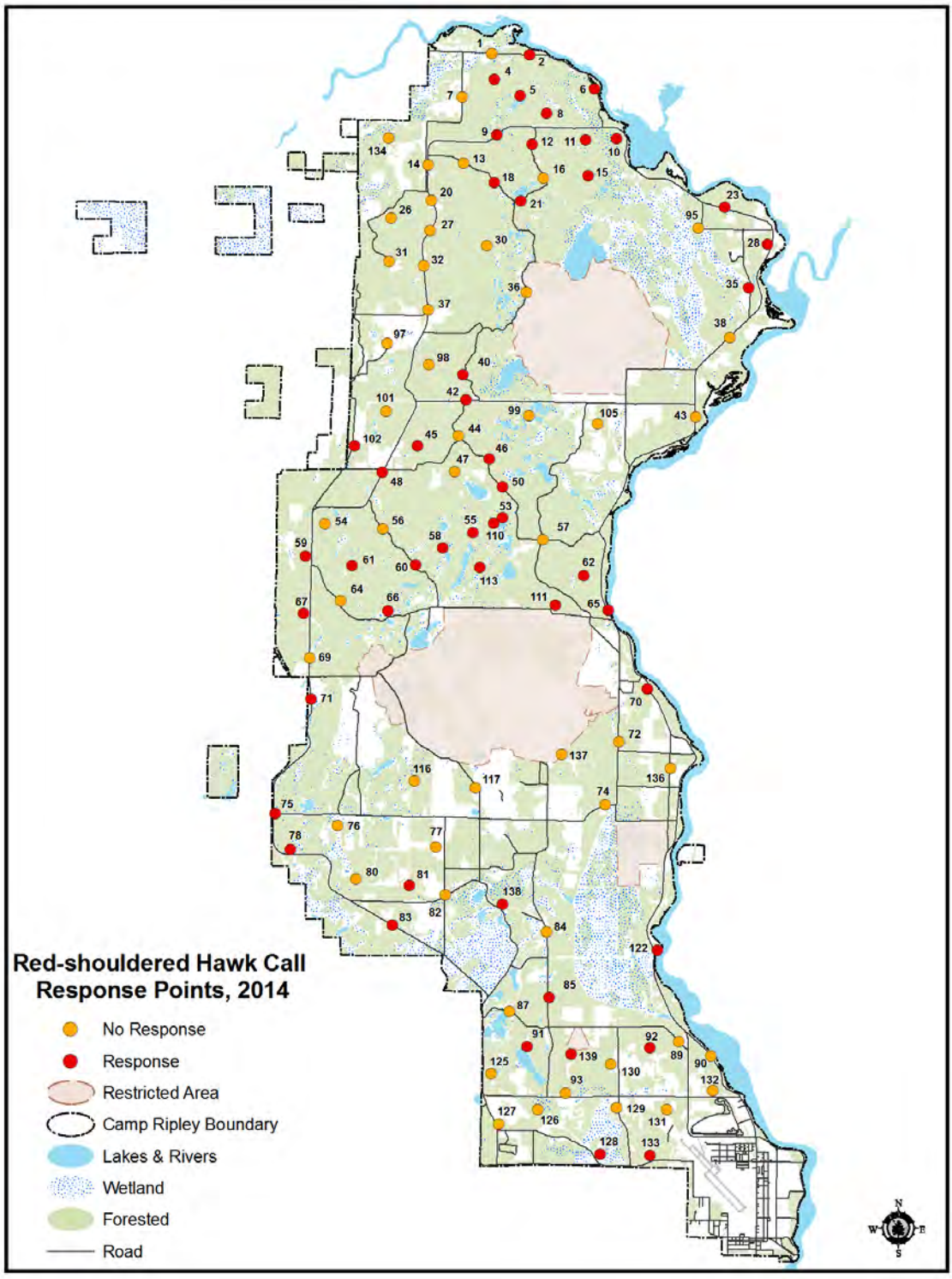


Figure 18. Red-shouldered hawk survey focus area, call-broadcast response and sample locations, Camp Ripley Training Center, Minnesota, 2014 – 2015.

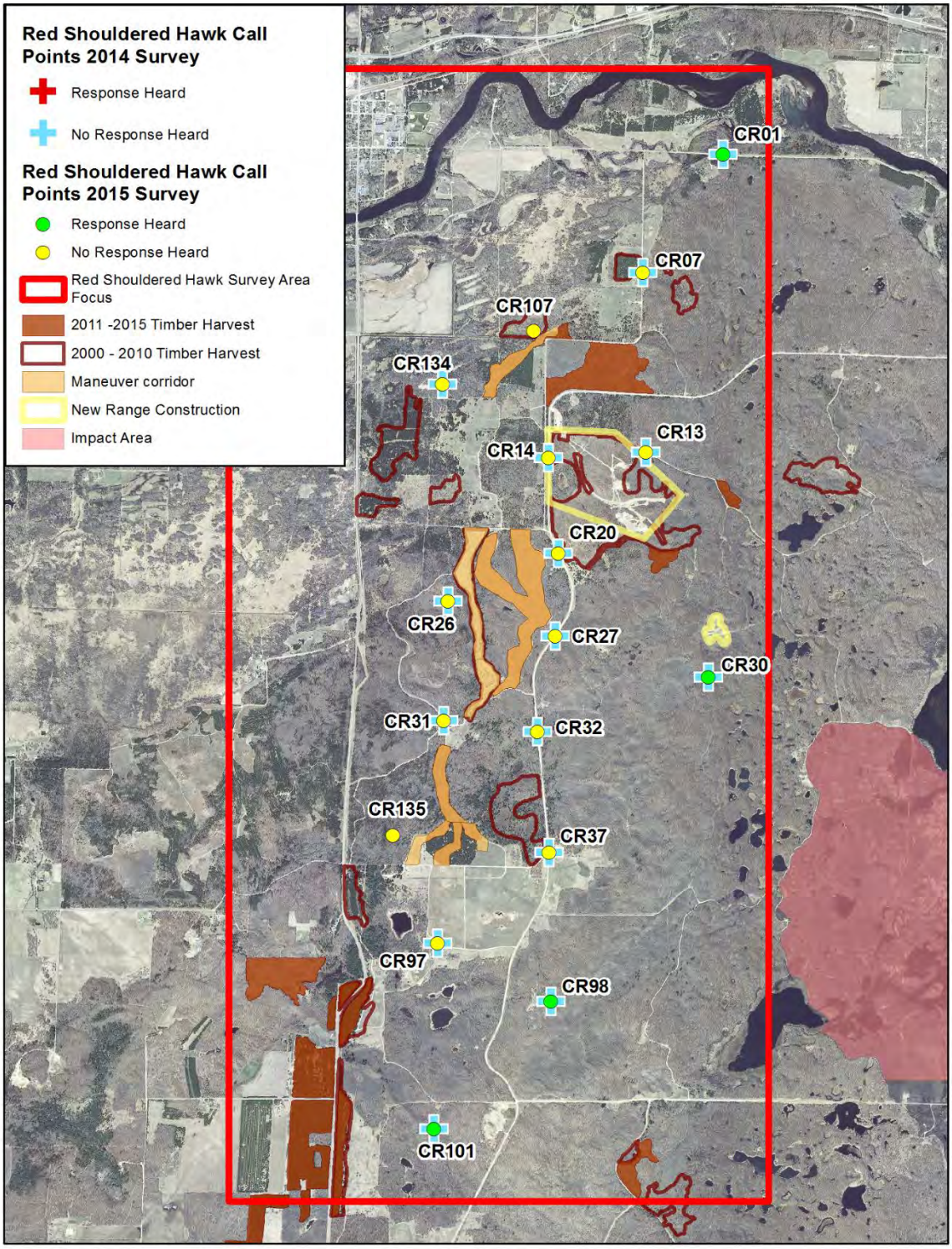
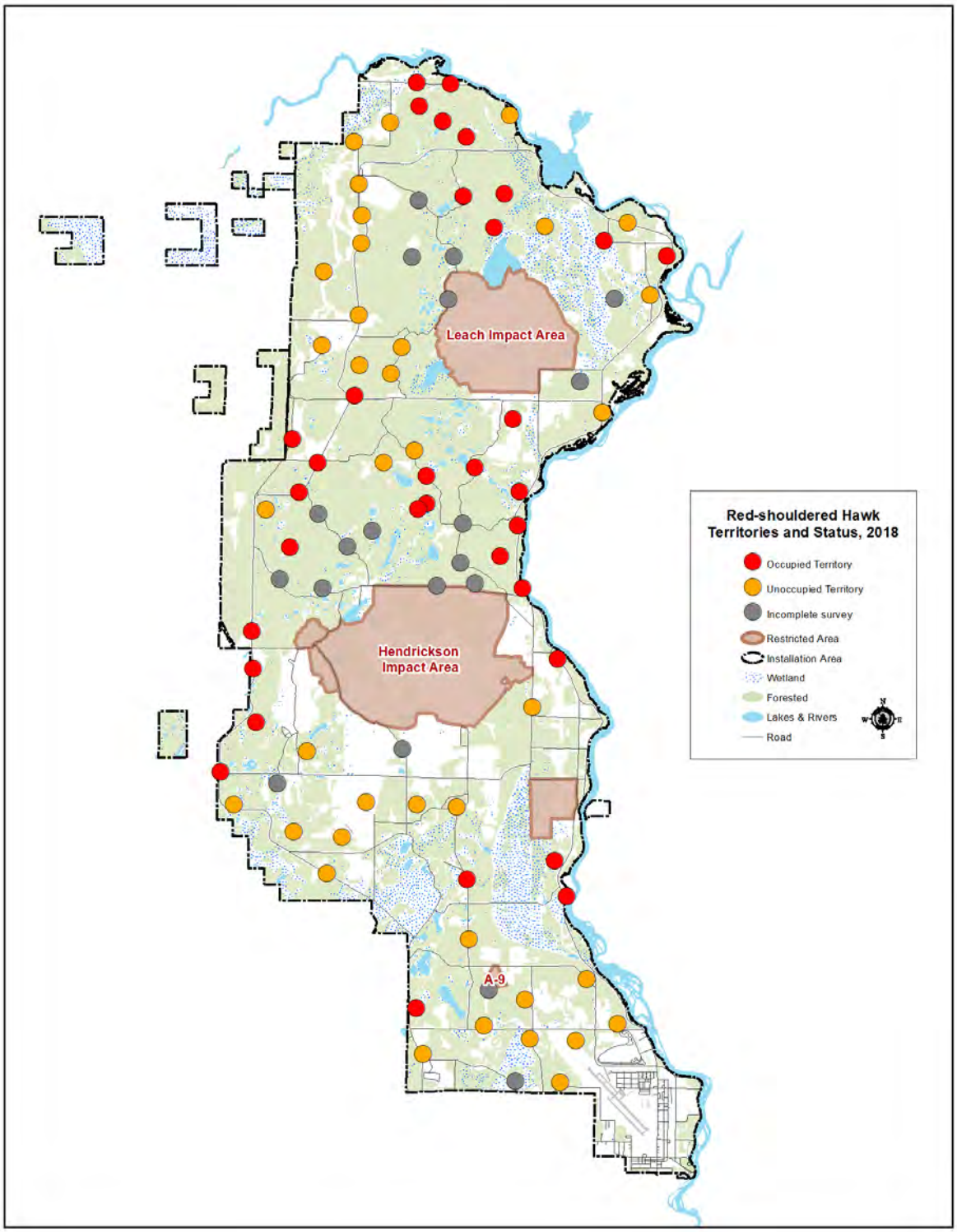


Figure 19. Red-shouldered hawk call-broadcast response and sample locations, Camp Ripley Training Center, Minnesota, 2018.



The cumulative effects of range development, forestry practices and storm damage have caused significant changes in contiguous forest habitats for red-shouldered hawks in the northwest portion of Camp and are definitely a contributing factor to the decline of hawk occupancy. This area continued to be unoccupied by red-shouldered hawks in 2018 (Figure 19). Habitat changes from contiguous, mature deciduous forest (>70% canopy closure, >50 years old and 80 square feet per acre basal area of large trees) to young or non-forest habitats do not promote nesting or occupancy by red-shouldered hawks (Henneman 2006). In addition, as forest habitats become fragmented red-shouldered hawks may occupy some areas but recruitment is decreased significantly by increased predation (Crocoll and Parker 1989); altering food resources, hunting behavior or efficiency (Crocoll 1994); or being displaced by competition with red-tailed hawks. Timber harvesting frequency, method, extent, time of year and type of habitat are some of the factors that determine the effect on the red-shouldered hawk. Future forest management should avoid large (> 37 acres assuming the percent mature forest and canopy closure is met) clear-cut with reserves, shelterwood or seed tree cutting and continue the use of forestry practices such as selective thinning, group selection, single tree and light-selection cuts that preserve the character of the forest. Or, it may be possible to use small areas (< 10 acres) of intense timber harvest, within areas of greater than 50% of the landscape with mature forests providing that these cuts do not exceed 15% of the forested area. A critical red-shouldered hawk nest site characteristic in a mature deciduous forest is 70% or greater forest canopy closure. And, a sufficient extent of mature forests needs to be maintained near wetland openings (Perry 1996), as red-shouldered hawks frequently hunt from a perch that overhangs shallow water or wetlands (Welch 1987; Jacobs and Jacobs 2002). No harvest should occur within 50 feet of wetlands and ephemeral pools to improve foraging conditions and productivity (Welch 1987; Jacobs and Jacobs 2002).

Population monitoring surveys should continue every 4 – 5 years to examine long-term trends of Minnesota's largest population of red-shouldered hawks. Future call-broadcast surveys should continue to use a stratified, random sample with 35% of selected call points south of Lake Alott Road similar to the sampling effort in 2005, 2014 and 2018. However, due to challenging survey conditions in 2018 the red-shouldered hawk call-point survey will be conducted again in 2019.

### Bald Eagle (*Haliaeetus leucocephalus*)

In the lower 48 states, Minnesota has the most nesting pairs of bald eagles at approximately 1,300 (USFWS 2018a). Bald eagles are protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. Both of these acts prohibit killing, selling or otherwise harming or disturbing eagles, their nests or eggs. The U.S. Fish and Wildlife Service (USFWS) released Bald Eagle Management Guidelines for people who are engaged in recreation or land use activities around bald eagles. These guidelines provide information and recommendations regarding how to avoid disturbing bald eagles. Camp Ripley will continue to monitor and protect primary or alternate bald eagle nests with no disturbance buffers during breeding and nesting seasons as required by the National Guard Bureau's Eagle Policy Guidance (Dirks and Dietz 2009), Bald and Golden Eagle Protection Act (USFWS 2018b), and Bald Eagle Management Guidelines (USFWS 2019d).

Bald eagles are closely monitored at Camp Ripley (Dirks et al. 2010). Since 1991, two to eleven territories have been monitored within Camp Ripley, fledging from one to 10 young annually (Table 12). Territory size is variable but are spaced apart to ensure sufficient food resources for chicks and to raise young with minimal disturbance from other eagles. Eagle pairs can have more than one nest within a territory.

Table 12. Bald eagle territories and fledglings, Camp Ripley Training Center, Minnesota, 1991 – 2018.

| Year | Number of Occupied Territories | Number of Young Fledged |
|---|---|---|
| 1991 – 1992 | 4 | ? |
| 1993 | 2 | 4 |
| 1994 | 3 | 5 |
| 1995 | 3 | 4 |
| 1996 | 3 | 4 |
| 1997 | 3 | 6 |
| 1998 | 2 | 4 |
| 1999 | 3 | 3 |
| 2000 | 4 | 8 |
| 2001 | 4 | 8 |
| 2002 | 2 | 1 |
| 2003 | 3 | 4 |
| 2004 | 3 | 4 |
| 2005 | 5 | 5 |
| 2006 | 6 | 1* |
| 2007 | 5 | 9 |
| 2008 | 5 | 5 |
| 2009 | 4 | 2* |
| 2010 | 6 | 3 |
| 2011 | 7 | 4 |
| 2012 | 6 | 5 |
| 2013 | 7 | 6 |
| 2014 | 6 | 6* |
| 2015 | 9 | 9 |
| 2016 | 9 | 5* |
| 2017 | 10 | 7* |
| **2018** | **9** | **10** |

*Not all active nests checked for nest success due to military training.

In late March, bald eagles occupied nine territories throughout Camp Ripley (Figure 20). In addition to recent new nests, Pusan and Frog Lake, that were discovered in 2015 and Lake Alott discovered in April 2016, two additional nests were discovered in 2017, West Range and Fort Ripley. In 2018, Prentice Pond, Mud Lake, East Boundary, Lake Alott and Tamarack Lake nests each fledged one chick. Pusan fledged two chicks and North Range three chicks. The Fort Ripley and West Range territories were occupied but unsuccessful. Rest Area 3 and Frog Lake nests were not occupied.

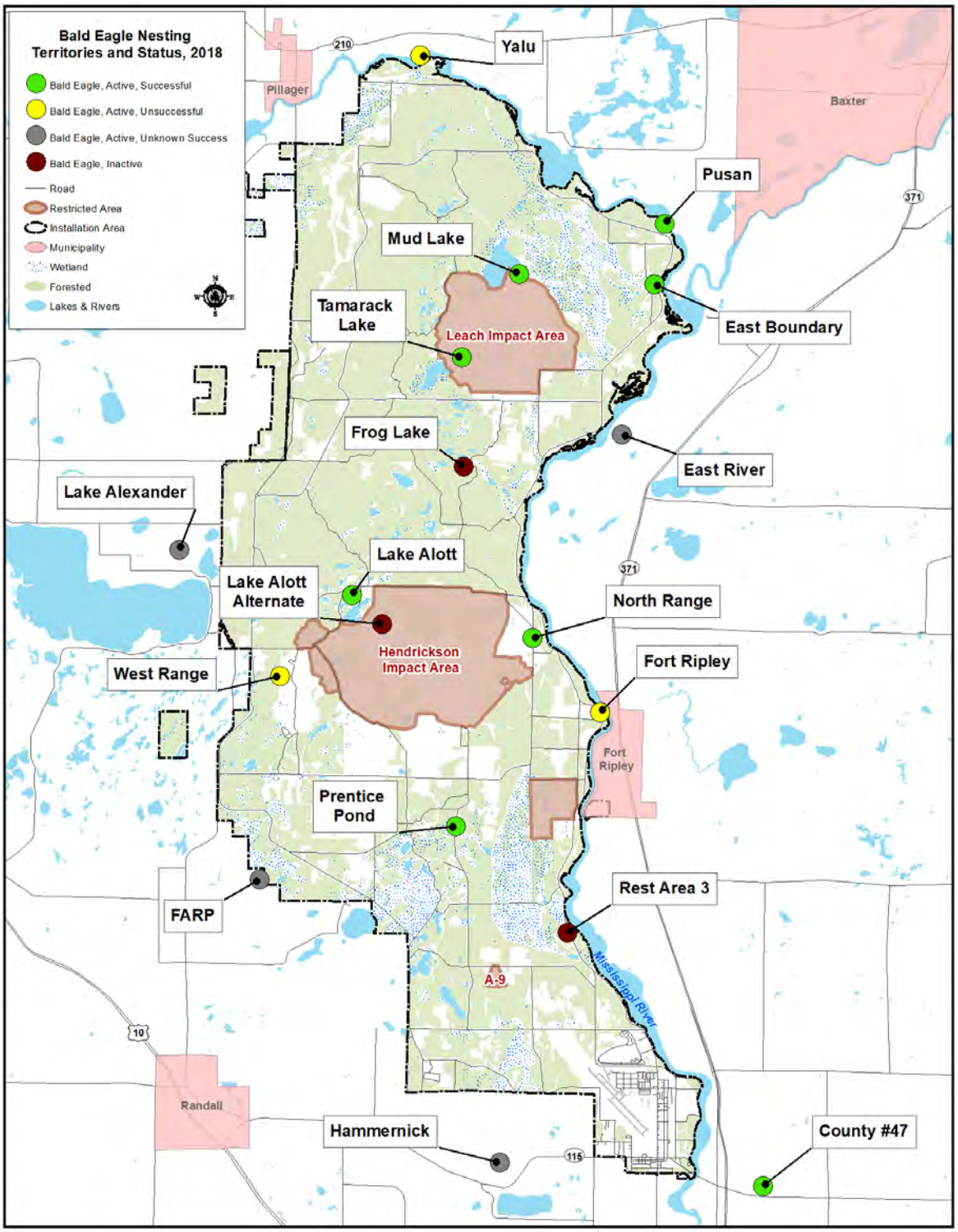
Bald eagle productivity on Camp Ripley was 1.11 eaglets per occupied territory. Average productivity in years of known territory occupancy and eaglet production from 1993 to 2018 is 1.06. No disturbance buffers of 200 meter horizontal and 300 meter above ground level have been implemented from 1993 to 2018. The 2018 Camp Ripley bald eagle nest productivity and the long-term productivity is lower than the average productivity in the Mississippi Flyway Eagle Management Unit of 1.33 eaglets per year (USFWS 2018a).

Due to aircraft maneuver training needs during the active bald eagle nesting season, the MNARNG applied for a USFWS bald eagle programmatic disturbance permit for all nests on Camp Ripley. This was requested by MNARNG helicopter pilots due to the 200-meter horizontal and 300-meter above ground level no disturbance buffers around eagle nests, conflicts with range safety danger zones, and aircraft restrictions that do

not allow flying low level maneuvers (less than 1,000 feet) off the installation. The USFWS determined that a permit was not necessary and their guidance (annual INRMP stakeholder meeting USFWS, February 15, 2019) was to remove both horizontal and vertical disturbance buffers, as bald eagles on Camp Ripley are likely accustomed to the ground and aerial disturbances. Monitoring of bald eagle nest territories will continue to determine if removal of no disturbance buffers causes significant impacts to productivity.

Six eagle territories within one mile of the Camp Ripley boundary were also monitored. The Yalu territory was occupied but unsuccessful. The Yalu territories' Camp Ripley nest fell in 2014 but was rebuilt on the north side of the Crow Wing River in 2015. The Hammernick nest was rebuilt in the fall 2014. The nest fell during the winter of 2015 but was rebuilt in a different nest tree during 2016. A new nest, FARP, was discovered off the southwest corner of Camp Ripley in 2018. The County 47 nest fledged two eaglets. The Hammernick, East River, FARP and Lake Alexander territories were occupied but productivity was unknown. From 2009 to 2016, off post average productivity in years of known territory activity and fledging production was 1.18 chicks per active territory.

Figure 20. Bald eagle nesting territories and status, Camp Ripley Training Center, Minnesota, 2018.



## Golden Eagle (*Aquila chrysaetos*)

Golden eagles in North America are primarily found in Western States and Western Canada. Golden eagles are protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. Both of these acts prohibit killing, selling or otherwise harming or disturbing eagles, their nests or eggs. Golden eagles do not breed in Minnesota, the nearest population of breeding golden eagles is found in Western North Dakota. Golden eagles have been known to use the state for fall migration needs (annually fall counts record 115 – 200 golden eagles at Hawk Ridge Bird Observatory, Duluth, Minnesota) but had not been thought off as a regular winter visitor in the state. However, recent surveys by the National Eagle Center in Wabasha, Minnesota have discovered a regular winter population between 130 – 150 golden eagles along the Mississippi River valley in southeast Minnesota (National Eagle Center 2017).

### Winter Survey

In 2010, the National Eagle Center began a wintering golden eagle survey in the blufflands region along the Mississippi River in Minnesota, Wisconsin and Iowa. The project was implemented to document regular wintering populations of golden eagles. Golden eagles were previously not considered regular winter inhabitants of the region. Camp Ripley was added as a survey area in 2016. The survey occurred on January 16, 2016, January 21, 2017 and January 20, 2018. The primary survey observers in 2016 were Brian Dirks, DNR Animal Survey Coordinator, and Dr. William Faber, Central Lakes College natural resources instructor, with two additional volunteer observers. Camp Ripley's DNR researchers conducted the survey in 2017 and 2018. In 2016 – 2018, no golden eagles were observed (Table 13).

### Migration Tracking Project

The National Eagle Center implemented the Golden Eagle Project to: 1) understand habitat needs and prey requirements of golden eagles using the blufflands of Southeast Minnesota, Western Wisconsin and Northeast Iowa, 2) determine breeding origins and migration patterns for this population of golden eagles, 3) encourage conservation of critical winter habitats in the blufflands region, and 4) to educate the public about golden eagles (National Eagle Center 2017).

In 2012, Camp Ripley's DNR researchers used road-killed deer at baited, remote camera stations to aid in estimating winter gray wolf populations. DNR researchers recorded multiple golden eagles at bait stations in February and March. In subsequent years, staff continued to record golden eagles at bait stations. Camp Ripley's DNR researchers worked with the DNR Nongame Wildlife Program, Audubon Minnesota and the National Eagle Center to participate in the Golden Eagle Project and to set aside a solar, satellite, backpack transmitter for use on a Camp Ripley wintering golden eagle. In 2015, three baited remote camera stations were used to determine golden eagle presence on Camp Ripley; once a golden eagle began to feed regularly at a station trapping began. On March 10, 2015, a remotely triggered bow-net trap was used to capture a sub-adult female

golden eagle (4 year old; #54 – Ripley). An Argos/GPS solar powered, backpack transmitter (Microwave Telemetry) was fit to the eagle by Mark Martell, Audubon Minnesota.

The transmitter was programmed to take multiple GPS locations every day which provides more accurate locations than the backup satellite (Argos) locations. The Argos system is used to relay downloads of the GPS locations. On her spring 2017 migration, Ripley left her winter area on March 4 and traveled from Minnesota to Nunavut Territory, Canada, arriving at her summer habitat on April 8. She spent approximately 188 days at her summer habitat, then began her fall migration on October 12 returning to Camp Ripley area on December 10. She spent several days on Camp Ripley then moved southwest of Camp for the winter. Her northern migration, an 1,800-mile journey to her summer habitat, took about 36 days and her southern migration back to her winter habitat in Minnesota took 60 days (Figure 21).

Table 13. Golden eagle wintering survey, Camp Ripley Training Center, Minnesota, since 2016.

| Species | Scientific Name | Year | | |
|---|---|---|---|---|
| | | 2016 | 2017 | 2018 |
| Bald eagle | *Haliaeetus leucocephalus* | 0 | 3 | 8 |
| Northern goshawk | *Accipiter gentilis* | 0 | 0 | 0 |
| Red-tailed hawk | *Buteo jamaicensis* | 0 | 2 | 0 |
| Rough-legged hawk | *Buteo lagopus* | 0 | 1 | 0 |
| Golden eagle | *Aquila chrysaetos* | 0 | 0 | 0 |
| Unidentified eagle | | 1 | 0 | 0 |
| # Observers | | 2 | 4 | 2 |
| Observer Hours | | 8 | 12 | 10.5 |
| TOTAL # INDIVIDUALS | | 1 | 6 | 8 |
| **TOTAL # SPECIES** | | **1** | **3** | **1** |

Ripley's capture as a four-year-old in 2015 meant that she could potentially breed in 2016. In contrast to Ripley's 2015 summer locations which covered a much broader area, her 2016 locations were concentrated in one area which indicated that she was occupying her first nesting territory. In 2017, she occupied the same small area, which showed that she was nesting in this area for a second time. About 35 – 40% of this female golden eagle's annual life cycle is spent in migration, therefore conservation of migratory habitat is equally as important as conserving summer and winter habitats.

Unfortunately, after recording three full migrations from Camp Ripley to Nunavut Territory and back, Ripley's transmitter failed in January 2018. However, a second golden eagle (Victor) was captured on February 8 on Camp Ripley. The adult male golden eagle was also fit with an Argos/GPS solar powered backpack transmitter (Microwave Telemetry). Because he was captured in early February, his late winter movements were recorded showing that he spent most of the winter on Camp Ripley (Figure 22).

On his spring migration Victor left his winter area on March 6 and traveled from Minnesota to Nunavut Territory, Canada, arriving at his summer habitat on April 15, 40 days later (Figure 23). Locations from the transmitter indicate that Victor was tending a nesting territory on an island in a back bay of the Beaufort Sea (Figure 24). Unfortunately, Victor's transmitter stopped moving in late

July, indicating that either the transmitter had fallen off the eagle or the eagle had died. Bait sites will be monitored in the winter of 2018 – 2019 to determine if either Ripley or Victor return to Camp Ripley. In addition, two additional golden eagles will be captured and transmittered in 2019.

Figure 21. Satellite transmittered golden eagle (Ripley and Victor) migration routes, 2015 – 2018.

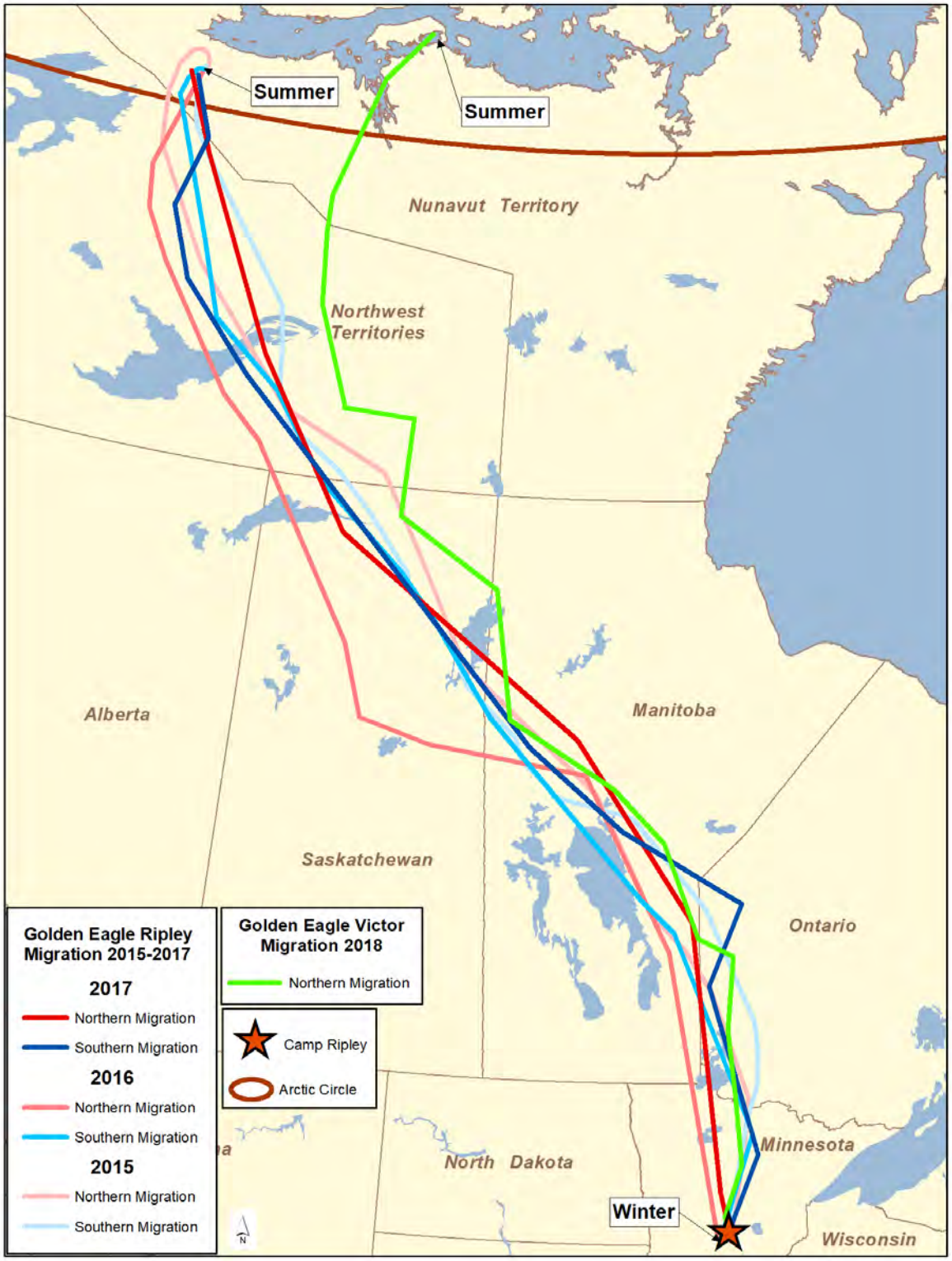


Figure 22. Satellite transmittered golden eagle winter areas, Camp Ripley Training Center, Minnesota, 2015 – 2018.

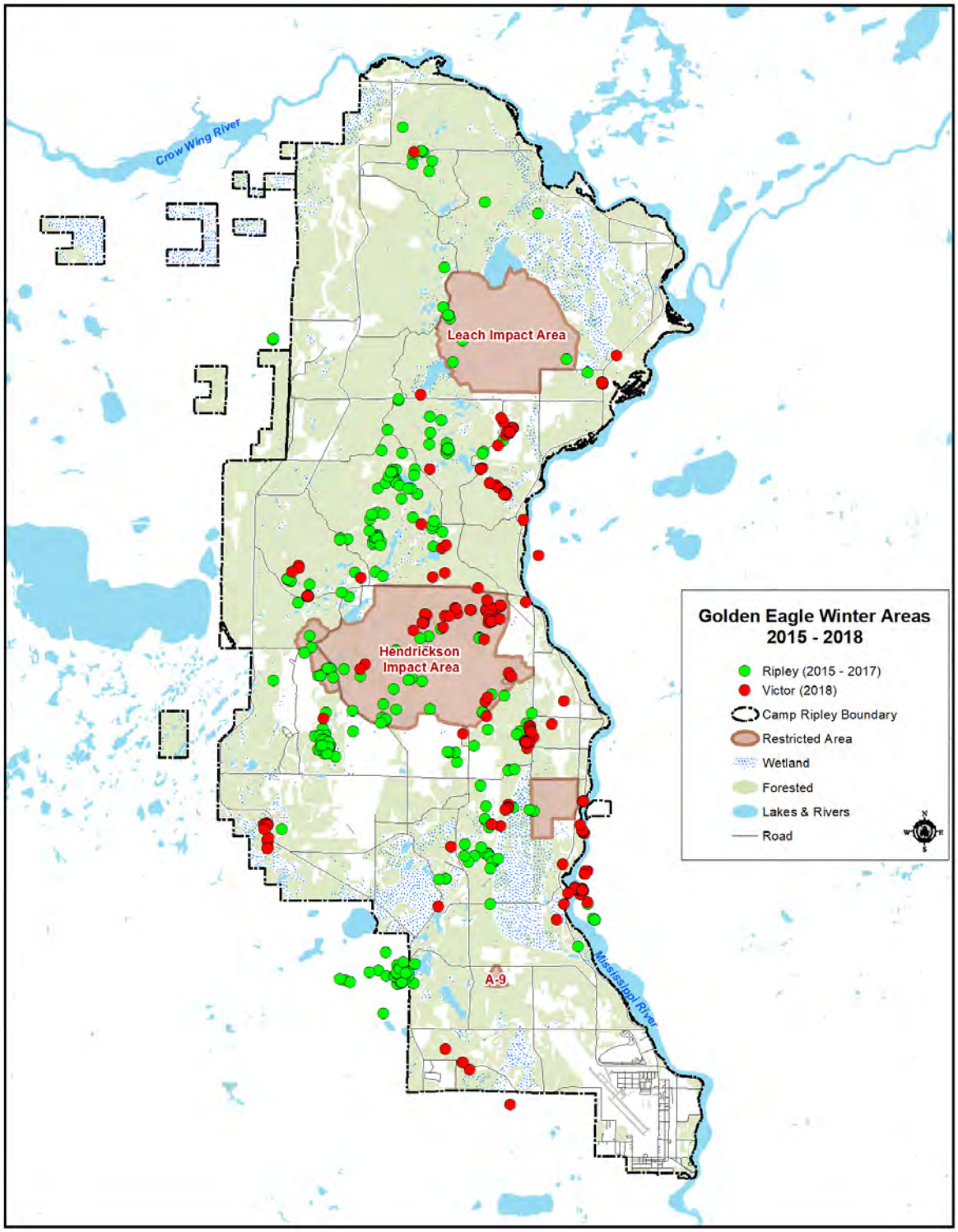
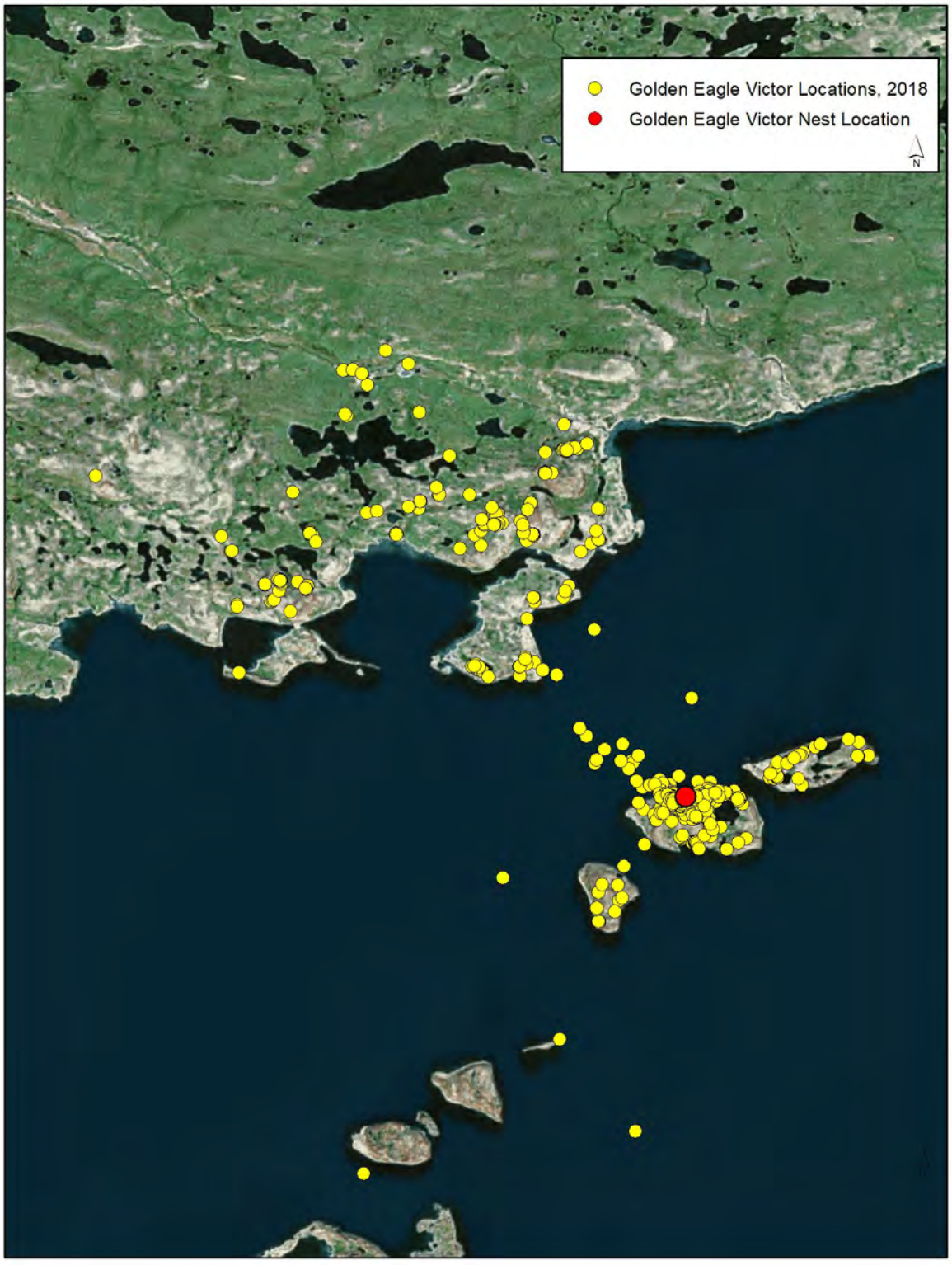


Figure 23. Satellite transmitted golden eagle (Victor) locations, 2018.

Figure 24. Satellite transmittered golden eagle (Victor) nesting territory, Beaufort Sea, Nunavut Territory, Canada, summer 2018.



## Eastern Bluebird (*Sialia sialis*)

Eastern bluebird populations declined significantly from the 1930s to 1960s due to loss of habitat and competition from other cavity nesting birds particularly non-native European starlings (*Sturnus vulgaris)* and house sparrows (*Passer domesticus*) (MNDNR 2017a). Nationwide bluebird recovery efforts began with the North American Bluebird Society in 1977 because of this population decline (North American Bluebird Society 2017a). In 1979 statewide recovery efforts were initiated by the Audubon Chapter of Minneapolis Bluebird Recovery Program of Minnesota (Bluebird Recovery Program of Minnesota 2017a) in cooperation with the Nongame Wildlife Program of the DNR. These recovery efforts provided artificial nest boxes for eastern bluebirds. Camp Ripley established artificial nest boxes in 1994 at the Minnesota State Veterans Cemetery and along the Camp Ripley cantonment fence in 2007 to aid in the eastern bluebird recovery. In addition, the nest boxes at the Minnesota State Veterans Cemetery provide visitors viewing enjoyment.

Table 14. Bluebird and tree swallow fledging production, Camp Ripley Training Center, Minnesota, since 2009.

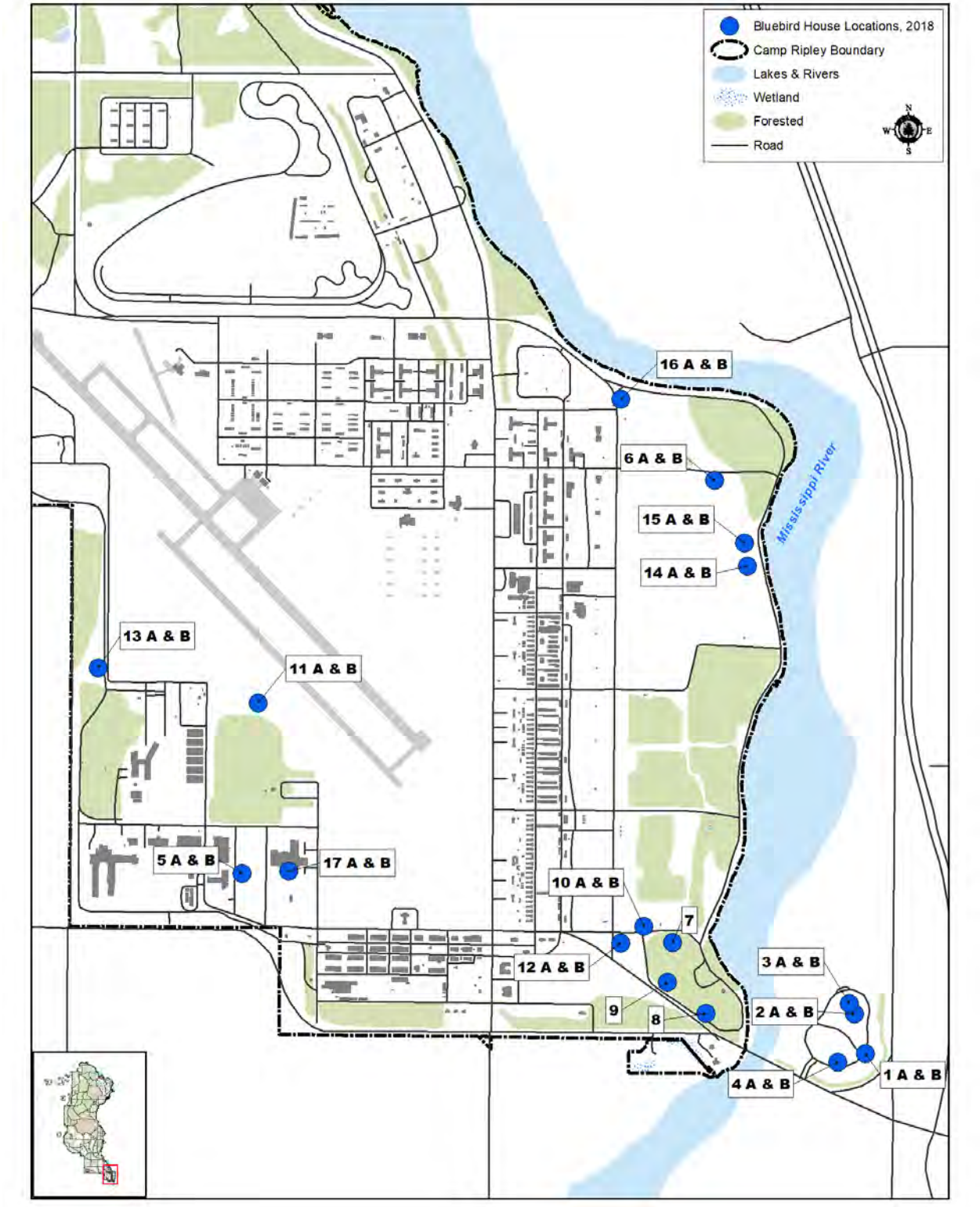
| Year | Veterans Cemetery | | | Cantonment | | |
|---|---|---|---|---|---|---|
| | # Nest Boxes | # Bluebirds Fledged | # Tree Swallows Fledged | # Nest boxes | # Bluebirds Fledged | # Tree Swallows Fledged |
| 2009 | 8 | 17 (5 boxes) | 10 (3 boxes) | 21 | 79 (12 boxes) | 6 (1 box) |
| 2010 | 8 | 17 (5 boxes) | 11 (2 boxes) | 23 | 79 (16 boxes) | 13 (4 boxes) |
| 2011 | 8 | 13 (3 boxes) | 19 (4 boxes) | 23 | 53 (11 boxes) | 10 (4 boxes) |
| 2012 | 8 | 7 (3 boxes) | 18 (5 boxes) | 23 | 82 (13 boxes) | 1 (2 boxes) |
| 2013 | 8 | 16 (4 boxes) | 10 (2 boxes) | 23 | 53 (14 boxes) | 10 (3 boxes) |
| 2014 | 8 | 16 (3 boxes) | 9 (2 boxes) | 21 | 79 (13 boxes) | 6 (1 box) |
| 2015 | 8 | 5 (1 box) | 10 (3 boxes) | 20 | 66 (10 boxes) | 6 (2 boxes) |
| 2016 | 8 | 5 (2 boxes) | 17 (3 boxes) | 23 | 43 (12 boxes) | 26 (6 boxes) |
| 2017 | 8 | 2 (1 box) | 14 (3 boxes) | 23 | 54 (11 boxes) | 15 (3 boxes) |
| **2018** | **8** | **4 (2 boxes)** | **27 (6 boxes)** | **23** | **57 (13 boxes)** | **31 (6 boxes)** |

In 2008, nest boxes were replaced with Gilbertson PVC artificial nest boxes (North American Bluebird Society 2017b). Bluebird nest box pairs were located in open areas close to scattered trees, at least 300 feet from brush, and more than 500 feet apart. Placing boxes away from brush areas minimizes nest box use by house wrens (*Troglodytes aedon*). These locations have been effective and eliminated use by house wrens from 2009 to 2018.

Thirty-one Gilbertson PVC bluebird nest boxes (Figure 25) were monitored regularly during the breeding season (April to August) by Mike Ratzloff, Minnesota Department of Natural Resources volunteer. Seventeen boxes were occupied by bluebirds, 11 by tree swallows (*Tachycineta bicolor*), one by black-capped chickadees (*Poecile atricapillus*) (Table 14) and none by house wrens. No successful nesting attempts were made by invasive house sparrows. Only four bluebirds fledged from the nest boxes at the Minnesota State Veterans Cemetery and 57 fledged from nest boxes within the

cantonment area. Additionally, 31 tree swallows and three black-capped chickadees successfully fledged. Camp Ripley's bluebird production has been lower in the past three years; however, the long-term mean (2009 – 2018) of 2.47 bluebirds fledged per nest box is higher than the statewide long-term (2005 – 2015) mean of 2.12 (Bluebird Recovery Program of Minnesota 2017b). Regular bluebird house maintenance and monitoring greatly improves the success of bluebird houses.

Figure 25. Location of eastern bluebird houses, Minnesota State Veterans Cemetery and Camp Ripley Training Center cantonment area, Minnesota, 2018.



## Mammals

### Gray Wolf (*Canis lupus*)

### Federal Court Decision

Through federal action and by encouraging the establishment of state programs, the 1973 Endangered Species Act (ESA) provided for the conservation of ecosystems upon which threatened and endangered species of fish, wildlife and plants depend (USFWS 2019b). The first federal ESA Preservation Act was passed in 1966, and in 1967 gray wolves were classified as endangered and provided limited protection. In 1974, gray wolves were afforded full protection under the federal ESA of 1973 (MNDNR 2016a). During the mid- to late-1970s the DNR estimated the wolf population at about 1,000 to 1,200; based on 2003 – 2004 and 2007 – 2008 surveys, the population had grown and stabilized at approximately 3,000 animals. The 2016 – 2017 survey estimated that the current population is stable at 2,856 wolves (Erb et al. 2018).

In a proposed rule issued on May 5, 2011, the U.S. Fish and Wildlife Service proposed to remove gray wolves in the Western Great Lakes Distinct Population Segment — which includes Minnesota, Michigan, Wisconsin and portions of adjoining states — from the Federal List of Endangered and Threatened Wildlife because wolves had recovered in this area and no longer required the protection of the ESA (USFWS 2019c). The Final Rule to remove ESA protection for gray wolves in this area took effect January 27, 2012 (USFWS 2018d). However, due to a federal court decision, wolves in the Great Lakes region were relisted under the ESA, effective December 19, 2014 (USFWS 2015). Wolves reverted to the federal protection status they had prior to being removed from the endangered species list in the Great Lakes region. This means wolves are currently federally classified as threatened in Minnesota and endangered elsewhere in the Great Lakes region (MNDNR 2015b).

### Wolf Monitoring Background

Besides serving as a National Guard training center, Camp Ripley is also a statutory game refuge. Wolves were first documented on Camp Ripley in 1993. Camp Ripley provides good quality habitat for wolves on the southern edge of the Minnesota gray wolf range. In the past 22 years, 51 wolves have been radio-collared and/or ear tagged on Camp Ripley to determine pack size, movements, causes of mortality and possible effects of military training (Table 15).

Comparing survival rates of wolves on and off Camp Ripley may provide additional insight into the effects of delisting and now relisting wolves. Research has demonstrated that military training activities on Camp Ripley do not negatively affect wolves and the presence of wolves on Camp Ripley has not resulted in any loss of training capabilities. In fact, evidence obtained from this study confirmed that wolves that move off Camp Ripley are moving into a more hostile environment where they are exposed to illegal and accidental caused mortality.

## Wolf Status and Movements

Since 2001, Camp Ripley has supported two or three wolf packs. In 2018, three wolf packs used Camp Ripley as most or part of their home range. The amount of time each pack spends on Camp varies. The North Pack, which occupies the north half of Camp, usually stays in this area, while only a small part of the South Pack's territory is on Camp. In addition, pack sizes vary each year and by time of year. Winter 2017 – 2018 pack estimates from remote cameras and track counts indicate that only three to four wolves were in the South Pack while the North and Miller Lake packs each contained a minimum of five wolves. This estimate is similar, although slightly lower than the number of wolves in Camp Ripley packs in recent years.

Plans to capture and radio collar additional wolves in January – March were thwarted because of insufficient snow depth. The only radio-collared wolf (#50) on Camp Ripley was in the North Pack. Wolf #50 has been the breeding male in the North Pack since before he was first radio-collared in February 2015. At one time the breeding female of the North Pack, wolf #40 was originally captured by helicopter and radio-collared in February 2010. She was caught again as an incidental catch during a wolf trapping/collaring project in May 2011. Because of wolf #40's age and condition she was not recaptured in 2015; however, she has continued to be located by remote camera and tracking her failing radio-collar. Even though her radio-collar eventually failed in 2017, she was observed at a remote camera bait site on March 16 and 17 in Training Area 68. An additional ear-tagged wolf (presumed to be #51), originally captured in 2015 but no longer collared, was also observed at the same bait site.

Table 15. Gray wolves captured, Camp Ripley Training Center, Minnesota, since 1996. (Bold = wolves monitored in 2018).

| Wolf# | Sex | # of Captures | Age at 1st Capture | Date of 1st Capture | Date of Last Capture | Weight (lbs.) at Last Capture | Ear Tag Color & Number (Left/ Right) | Fate | Comments |
|---|---|---|---|---|---|---|---|---|---|
| 1 | F | 1 | Yearling | 9/10/1996 | 9/10/1996 | 57 | | Dead | Illegally trapped/shot in Cass County (8/1997) |
| 2 | F | 2 | Pup | 9/19/1996 | 8/29/1997 | 42 | | Dead | Illegally shot-poacher |
| 3 | F | 1 | Yearling | 9/20/1996 | 9/20/1996 | 80 | | Dead | Poisoned |
| 4 | M | 2 | Yearling | 9/23/1996 | 1/31/1998 | 79 | | Dead | Hit by car |
| 5 | F | 1 | Yearling | 2/21/1997 | 2/21/1997 | 55 | | Unknown | Dropped collar for data retrieval |
| 6 | F | 3 | 4 – 5 years | 2/21/1997 | 7/24/1998 | 90 | | Dead | Hit by car |
| 7 | M | 3 | 10 month | 2/21/1997 | 2/1/1998 | 55 | | Dead | Illegally shot-poacher |
| 8 | F | 1 | 10 month | 2/21/1997 | 2/21/1997 | 50 | | Unknown | Dropped collar for data retrieval |
| 9 | M | 2 | 3 – 4 years | 2/21/1997 | 2/3/1998 | 90 | | Unknown | Pillsbury State Forest |
| 10 | M | 1 | Pup | 8/29/1997 | 8/29/1997 | 20 | | Dead | Starved? (9/23/2007) |
| 11 | F | 4 | Pup | 10/31/1997 | 2/4/1999 | 59 | | Dead | Illegally shot in Hillman area? Collar found in swamp |
| 12 | M | 2 | Yearling | 11/4/1997 | 2/3/1998 | 60 | | Dead | Killed by ADC in Pine County (7/26/1999) |
| 13 | M | 1 | Yearling | 2/3/1998 | 2/3/1998 | 88 | | Unknown | Dropped collar for data retrieval |
| 14 | F | 3 | Yearling | 9/14/1998 | 1/30/2002 | 76 | | Unknown | Collar failed –2003 |
| 15 | M | 3 | >3 years | 2/2/1999 | 1/17/2001 | 107 | | Dead | Found dead on Camp (7/2001) |
| 16 | F | 1 | 1 – 2 years | 1/18/2001 | 1/18/2001 | 65 | | Dead | Found dead in Michigan– Illegally shot (9/2002) (Sue) |
| 17 | M | 2 | 1 – 2 years | 9/26/2001 | 2/4/2004 | 88 | | Unknown | Missing |
| 18 | M | 3 | 3 – 4 years | 11/15/2001 | 2/25/2003 | 95 | | Dead | Struck by car on Hwy 371 (Lucky) |
| 19 | F | 2 | 1 – 2 years | 1/30/2002 | 12/13/2002 | 76 | | Dead | Illegally shot south of Camp |
| 20 | F | 2 | >3 years | 1/30/2002 | 1/30/2006 | 79 | | Dead | Found dead west of Camp unknown |
| 21 | F | 1 | 1 – 2 years | 2/25/2003 | 2/25/2003 | 68 | | Dead | Found dead in cornfield (shot?) |
| 22 | M | 1 | 2 – 3 years | 2/4/2004 | 2/4/2004 | 100 | | Dead | Killed by ADC 4/24/2004 in Cass County |
| 23 | M | 2 | 1 – 2 years | 2/4/2004 | 1/30/2006 | 72 | | Dead | Illegally shot during firearms deer season (11/2007) (Smokey) |
| 24 | M | 1 | 1 – 2 years | 2/4/2004 | 2/4/2004 | 78 | | Unknown | Collar failed |

Table 15. Gray wolves captured, Camp Ripley Training Center, Minnesota, since 1996. (Bold = wolves monitored in 2018)

| Wolf# | Sex | # of Captures | Age at 1st Capture | Date of 1st Capture | Date of Last Capture | Weight (lbs.) at Last Capture | Ear Tag Color & Number (Left/ Right) | Fate | Comments |
|---|---|---|---|---|---|---|---|---|---|
| 25 | M | 1 | 1 – 2 years | 2/4/2004 | 2/4/2004 | 83 | | Unknown | Collar chewed off |
| 26 | M | 1 | 3 – 4 years | 1/30/2006 | 1/30/2006 | 85 | | Dead | Illegally shot during firearms deer season (11/2008) (Sly) |
| 27 | M | 1 | 2 years | 1/30/2006 | 1/30/2006 | 85 | | Dead | Struck by car on Hwy 371 |
| 28 | M | 1 | 4 – 5 years | 1/30/2006 | 1/30/2006 | 103 | | Dead | Illegally shot – was North Pack breeding male (Big Foot) |
| 29 | F | 1 | 2 years | 1/30/2006 | 1/30/2006 | 67 | Orange 1/Blue 11 | Unknown | Collar chewed off –11/2009 North Pack |
| 30 | F | 1 | 3 years | 1/31/2006 | 1/31/2006 | 85 | | Dead | Found during helicopter capture (2/08) killed by wolves (Shep) |
| 31 | M | 1 | 4 – 5 years | 3/22/2008 | 3/22/2008 | 75 | | Dead | Illegally shot (11/2011) South Pack |
| 32 | F | 2 | 2 – 3 years | 3/22/2008 | 9/13/2011 | 76 | | Dead | Illegally killed (arrow) south of Camp Ripley (October 9, 2012) |
| 33 | F | 1 | 2 years | 3/22/2008 | 3/22/2008 | 76 | | Dead | Killed by depredation trapper in Manitoba, Canada (7/2008) |
| 34 | M | 1 | 4 – 5 years | 3/22/2008 | 3/22/2008 | 92 | | Dead | Illegally shot near Staples, MN on 11/12/2009 (Techno) |
| 35 | M | 1 | Pup | 10/6/2009 | 10/6/2009 | 55 | Metal 2117/2466 | Unknown | North Pack; VHF collar (Trickster); Collar chewed off Jan. 2010 |
| 36 | M | 1 | 3 years | 2/2/2010 | 2/2/2010 | 63 | | Dead | Lake Alexander Pack – illegally shot in February 2014 near Cushing, MN |
| 37 | M | 1 | 4 – 5 years | 2/3/2010 | 2/3/2010 | 77 | | Dead | Killed by wolves in adjacent pack in February 2012 |
| 38 | F | 1 | Pup | 2/3/2010 | 2/3/2010 | 56 | Blue 21/Orange 15 | Unknown | South Pack – satellite collared, failed May 2010 |
| 39 | M | 1 | 8 – 10 | 2/3/2010 | 2/3/2010 | 97 | | Dead | Died of natural causes February 2012 |
| 40 | F | 1 | 4 – 6 years | 2/3/2010 | 5/20/2011 | 69 | Orange 24/Yellow 29 | Unknown | North Pack – past breeding female – collar failed 2017 |

Table 15. Gray wolves captured, Camp Ripley Training Center, Minnesota, since 1996. (Bold = wolves monitored in 2018)

| Wolf# | Sex | # of Captures | Age at 1st Capture | Date of 1st Capture | Date of Last Capture | Weight (lbs.) at Last Capture | Ear Tag Color & Number (Left/ Right) | Fate | Comments |
|---|---|---|---|---|---|---|---|---|---|
| 41 | M | 1 | Pup | 9/25/2011 | 9/25/2011 | 50 | Blue 16/Blue 25 | Unknown | Moved to Fergus Fall, MN area from Miller Lake Pack |
| 42 | M | 1 | Pup | 9/26/2011 | 9/26/2011 | 40 | Yellow 50/Blue 17 | Unknown | North Pack – not radio–collared |
| 43 | F | 1 | Pup | 9/26/2011 | 9/26/2011 | 39 | Orange 23/Blue 23 | Unknown | North Pack – not radio–collared |
| 44 | M | 1 | 3 years | 2/14/2013 | 2/14/2013 | 87 | | Dead | Unknown Pack – illegally shot in early November 2013 near Little Elk WMA |
| 45 | F | 1 | 3 – 4 years | 2/14/2013 | 2/14/2013 | 77 | | Dead | Unknown Pack – legally harvested during wolf season NE of Rice, MN |
| 46 | M | 1 | 1 year | 2/27/2015 | 2/27/2015 | 65 | | Dead | South Pack – illegally shot December 2015 Rice Lake WMA south of Staples, MN |
| 47 | M | 1 | 2 – 3 years | 2/27/2015 | 2/27/2015 | 70 | Green 7/Green 8 | Unknown | South Pack – USGS GPS/Satellite collar programmed to drop off in late February 2016 |
| 48 | M | 1 | 2 – 3 years | 2/27/2015 | 2/27/2015 | 70 | White 4/Green 1 | Unknown | Miller Lake Pack – Missing since June 2015 |
| 49 | M | 1 | 2 – 3 years | 2/27/2015 | 2/27/2015 | 74 | Green 2/White 3 | Unknown | Miller Lake Pack – USGS GPS/Satellite collar programmed to drop off in April |
| **50** | **M** | **1** | **5 – 6 years** | **2/27/2015** | **2/27/2015** | **70** | **Orange 3/Orange 5** | **ALIVE** | **North Pack – breeding male** |
| **51** | **M** | **1** | **7 years** | **2/27/2015** | **2/27/2015** | **85** | **White 1/White 2** | **ALIVE** | **Collar chewed off 10/2015 – North Pack** |

## Black Bear (*Ursus americanus*)

### Research

A telemetry-based study of black bears was initiated at Camp Ripley in 1991. The current study is part of a statewide research project conducted by the DNR designed to monitor the body condition, movements and reproductive success of bears in the northern, central and southern parts of Minnesota's bear range. Camp Ripley lies along the southern edge of bear range in Minnesota. The principal objectives of this study include: 1) continued monitoring of reproduction and cub survival, 2) additional (improved) measurements of body condition, heart function and wound healing, 3) examination of habitat use and movements with GPS telemetry, 4) investigation of female dispersal near the southern fringe of the expanding bear range (Garshelis et al. 2004), and 5) monitoring the incidence of nuisance bears and in particular any conflicts with soldiers and military training.

Researchers from the University of Minnesota's Visible Heart Laboratory and Medtronic Inc. collaborate with DNR bear researchers to gather additional information during den visits at Camp Ripley and throughout the state. The goal of this additional research is to develop an understanding of the behaviors and physiological function of bears and develop applications that can be used in human medical treatments. Detailed information about this research, including publications, is available at the University of Minnesota's Black Bear Research website: http://www.vhlab.umn.edu/bears/.

### Movement and Reproduction

Ground and aerial tracking were used to monitor reproductive success, movements and survival of nine radio-collared black bears (Table 16). Researchers are now focusing more on reproductive success and survival than movements and habitat use; therefore most bears on Camp Ripley were located less frequently in 2012 – 2018 than in the past. However, bears 2182 and 2185 wore GPS/Iridium satellite collars (Telonics) that were programmed to take a location every two hours and collected thousands of locations during the year.

All nine of the radio-collared bears spent most of the year on Camp Ripley. Bear 2081 (19 years old) had two cubs in 2017; both were in the den with her during December (2017) and March (2018) den visits. Bear 2124 (nine years old) has taken up residence within her mother's (bear 2063) former home range in the northeast portion of Camp. She had three cubs in January 2017 and all three cubs denned with her in Training Area 64 that fall. Two of the cubs (2177 and 2179) were collared as yearlings in March; however, bear 2179's collar came off in early August. Bear 2130 (14 years old) was first collared during den visits in February 2012. She had three cubs in 2017, and all of them denned with her that fall in Training Area 48. One of the cubs (2174) was collared as a yearling in March. Bear 2154 (eight years old) was first discovered in her den in the winter of 2013 – 2014 and was collared in February 2014. She had two cubs in 2017, which denned with her in Training Area 25 that winter.

Two incidental bear dens were located during fall field work. Both females, bear 2182 (13 years old) was located in a brush pile in Training Area 23. Bear 2185 (18 years old) was located in an above ground den south of West Range (Training Area 40). In January, bear 2182 had two cubs and bear 2185 had three cubs. In March, both bears were collared with GPS/Iridium satellite collars.

Table 16. Black bears monitored, Camp Ripley Training Center, 2018.

| Bear ID | Sex | Age as of Jan. 2018 | Year of First Capture | Age at First Capture | Weight at Last Capture (lbs.) | Double Sided Ear Tag Color & Number (Left / Right) | Status |
|---|---|---|---|---|---|---|---|
| 2081 | F | 19 | 2004 | 5 yrs. | 208 (3/2018) | Red 265-Red 266 / Blue-Blue 369 | **ALIVE** |
| 2124 | F | 9 | 2009 | Cub | 170 (2/2018) | Red-Red 273 / White-White 327 | **ALIVE (2063's cub)** |
| 2177 | F | 1 | 2017 | Cub | 65 (2/2018) | White 5-button / White 3-button | **ALIVE (2124's cub)** |
| 2179 | F | 1 | 2017 | Cub | 62 (2/2018) | White 4-button / Yellow 4-button Recovered collar 8/6/2018 | **ALIVE (2124's cub)** |
| 2130 | F | 14 | 2012 | 8 yrs. | 234 (3/2018) | White-White 333 / Blue –Blue 368 | **ALIVE** |
| 2174 | F | 1 | 2017 | Cub | 74 (3/2018) | Pink-Pink 486 / White-White 347 | **ALIVE (2130's cub)** |
| 2154 | F | 8 | 2014 | 4 yrs. | 210 (2/2018) | Lt. Blue-Lt. Blue 351 / Lt. Blue-Lt. Blue 298 | **ALIVE** |
| 2182 | F | 18 | 2018 | 18 | 236 (3/2018) | Blue-Blue 444 / Pink-Pink 496 | **ALIVE** |
| 2185 | F | 13 | 2018 | 13 | 175 (3/2018) | Pink- Pink 497 / Pink-Pink 490 | **ALIVE** |

## Beaver (*Castor canadensis*)

Beaver are an important part of the natural ecosystems at Camp Ripley. This species can have a large effect on the environment in which it lives. In a natural system, beavers create or enlarge wetland areas which trap nutrients and help to reduce flooding by holding and slowly releasing water. However, problems occur in localized areas of Camp Ripley when beavers plug road culverts, flooding and damaging roads. When this occurs, a cooperative effort between the CRE, the DNR and Camp Ripley Department of Public Works (DPW) is initiated to identify problem areas and implement solutions.

All problem areas are inspected by CRE, and possible solutions are provided to Camp Ripley's DPW. Some areas require the removal of beaver through trapping. Trapping permits are issued by a

local DNR conservation officer. Camp Ripley beaver removal is conducted by the DNR and nuisance beaver trappers at the direction of DNR researchers. During the spring, 38 beavers were removed from problem areas and six during the fall. Weather conditions in the fall did not provide good trapping conditions. Beaver removal occurred in the following areas: Marne and Cunningham road intersection (culvert #366 & 71; n=11), Cunningham (culvert #108 &109; n=2), Miller Lake (culvert #376 & #377; n=2), Chickamauga Road (multiple culverts; n=5), East Boundary near Rest Area #3 (multiple culverts; n=9), Cody Road (culvert #136; n=4), East Boundary (culvert #329; n=3), Chorwan Road (culvert #334; n=2). Beaver trapping will continue in 2019.

Many problem areas can be addressed through the use of damage control structures, such as Clemson levelers and beaver deceivers. These devices have been used successfully at Camp Ripley in the past, and additional sites are targeted for these devices each year. However, these devices do require maintenance and eventually fail and/or need to be replaced. No beaver levelers nor deceivers were installed in 2018.

Beaver ponds throughout Camp Ripley provide habitat for Blanding's turtles, a state threatened species, and numerous other reptiles and amphibians; as well as provide feeding areas for a variety of wildlife and habitat for waterfowl and other birds. Therefore, it is important that these wetlands not be permanently drawn down or drawn down in fall or winter in order to install these devices. Installation should occur after a temporary draw down in spring or summer, or during natural low-water levels. Research in East-Central Minnesota investigated the effects of a controlled draw down on Blanding's turtle populations. The incidence of mortality was high after the draw down due to predation, road mortality and winterkill (Dorff Hall and Cuthbert 2000).

### Bats

"Bats are a critical component of Minnesota's ecosystems. A single bat may eat 1,000 insects per hour, and the state's bats likely provide many millions of dollars in pest control each year" (Boyles et al. 2011)" (Swingen et al. 2016). Eight species of bats have been documented in Minnesota: little brown myotis (*Myotis lucifugus*), northern long-eared bat (*Myotis septentrionalis*), big brown bat (*Eptesicus fuscus*), tricolored bat (*Perimyotis subflavus*), silver-haired bat (*Lasionycteris noctivagans*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*) and evening bat (*Nycticeius humeralis*). Four of Minnesota's bat species hibernate in caves and mines (northern long-eared bat, tricolored bat, little brown myotis, and big brown bat) during the winter, and disperse widely across the state in spring, summer, and fall. Very little is known about the summer habitat use of these species."(Swingen et al. 2016, 2018).

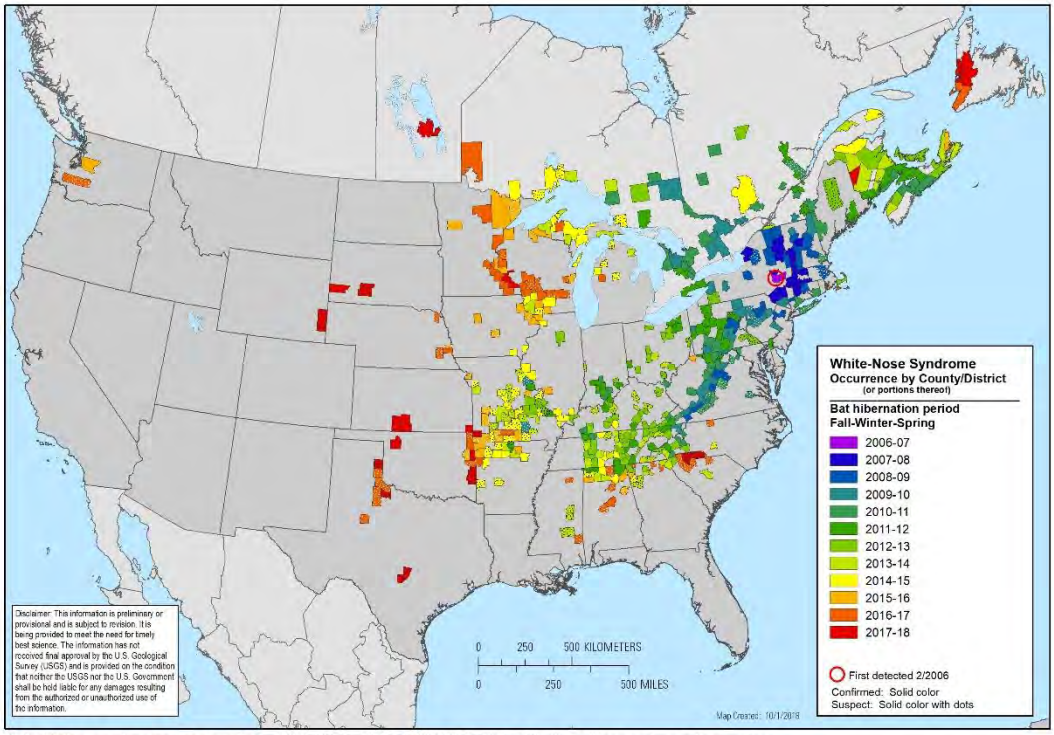
Camp Ripley is home to three bats that are designated state special concern species and SGCN: northern long-eared bat, little brown myotis and big brown bat. Three additional bats are SGCN only: silver-haired bat, eastern red bat and hoary bat. Past stationary acoustic bat surveys and captures have identified all of these bat species occurring on Camp Ripley (Dirks and Dietz 2010).

## Northern Long-eared Bat (*Myotis septentrionalis*) Federal Listing

In January 2010, the U.S. Fish and Wildlife Service (USFWS) received a petition from the Center for Biological Diversity requesting that the northern long-eared bat be listed as threatened or endangered under the Endangered Species Act (ESA) and to designate critical habitat. The USFWS announced on October 2, 2013 (U.S. National Archives Records Administration 2013), that listing the northern long-eared bat was warranted and proposed to list it as endangered throughout its range, which includes Minnesota. However, the USFWS listed the northern long-eared bat as "threatened" under the federal ESA in April 2015, largely due to the impact of white-nose syndrome on bat populations. A threatened species is an animal or plant that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range. On April 27, 2016, the USFWS determined that designating critical habitat for northern long-eared bat was not prudent (USFWS 2016a, 2018d).

White-nose syndrome is threatening bat populations in the eastern and central United States. "White-nose syndrome (WNS) is caused by the fungus *Pseudogymnoascus destructans* (Pd) that leads to increased winter activity and extremely high mortality rates of cave-hibernating bats" (Frick et al. 2010; Swingen et al. 2016). Since 2006, WNS has spread from a single central New York cave southward into Alabama; northwestward into Wisconsin, Iowa and Minnesota; and was recently discovered in Colorado, Kansas and South Dakota (Figure 26). WNS is a fungus that has killed more than 7 million hibernating bats since 2006 in North America with new range expansions of WNS occurring every year (Turner et al. 2011; MNDNR 2016b, 2016c; White-nose Syndrome 2018) (Figure 26). "*P. destructans* was detected in Minnesota in 2013, and bat mortalities from WNS were first recorded during January 2016 at Lake Vermilion – Soudan Underground Mine State Park, near Soudan, Minnesota" (MNDNR 2013c, 2016b; Swingen et al. 2016).

Figure 26. White-nose syndrome occurrence map – by year, 2018.



Citation: White-nose syndrome occurrence map - by year (2018). Data Last Updated: 10/1/2018. Available at: https://www.whitenosesyndrome.org/resources/map.

The northern long-eared bat is known to occur on Camp Ripley (Dirks and DeJong 2007) and has been designated as a state special concern species since 1984. While no winter habitat is known to occur on Camp Ripley, summer and migratory habitat is available (Figure 28). Northern long-eared bats are associated with forested habitats, especially around wetlands (MNDNR 2013b) and roost singly or in colonies underneath bark, in cavities or in crevices of both live and dead trees (MNDNR and MNARNG 2017, 2018; Dirks et. al. 2016). Northern long-eared bats begin feeding at dusk by flying through the understory along forested hillsides and ridges feeding on insects that they catch in flight using echolocation. The primary threat to northern long-eared bats is WNS. Other threats are loss and degradation of summer habitat, human disturbance of hibernacula, wind turbine operations, timber harvest and forest management (USFWS 2018c).

Due to WNS threats to Minnesota's bat populations, including SGCN, DNR researchers developed a mobile acoustic monitoring protocol in 2010 to examine possible bat population changes, conducted passive acoustic bat surveys and participated in the statewide study of *Endangered Bats, White-Nose Syndrome, and Forest Habitat* (Dirks et. al 2016; Swingen et. al. 2016, 2017). In 2015, the Minnesota legislature approved the statewide project with funding from the Environment and Natural Resources Trust Fund. The goal of the project was to collect data on the

distribution and habitat use of the northern long-eared bat in Minnesota. This project was conducted by the DNR, the University of Minnesota Duluth – Natural Resources Research Institute and the U.S. Department of Agriculture – Forest Service.

## Mobile Acoustic Bat Transect Survey

A mobile acoustic bat transect survey protocol was established in 2010 (Figure 27). The purpose of the mobile survey is to obtain quantitative data about bat populations and to monitor multiple species simultaneously in advance of WNS outbreaks in Minnesota and neighboring states. However, the mobile acoustic transect methodology has several limitations; one of which is it does not work well for all species of bats, including northern long-eared bats, as the route does not travel within forest understory habitats. Therefore, in 2014 and 2015, survey work also included use of stationary acoustic surveys in habitats suited for northern long-eared bats to better identify locations where they occur (MNDNR and MNARNG 2015, 2016). The project's goal is to assess the impacts of WNS on summer distribution of bats by examining changes in bat distribution and activity over successive years.

Camp Ripley's DNR researchers established a 30-mile mobile transect on Camp Ripley (Figure 27) that passes through common habitat types and could be easily sampled in successive years. Survey protocol (Britzke and Herzog 2009) requires that the acoustic survey be conducted while bats are on maternity range, generally between June 1 and July 15. To record bat echolocations monitoring is conducted on nights with low wind, no rain or fog, and suitable temperatures for bat activity. The Camp Ripley survey was conducted using an ANABAT II (zero crossing) (2010, 2012 – 2013) bat detector mounted on the top of the vehicle, with the microphone pointing straight up. In 2014 – 2017, an ANABAT SD2 (zero crossing) with mobile microphone was used. Surveys were conducted on July 8, 2010, June 26, 2012, July 11, 2013, July 9, 2014, July 8, 2015, June 29, 2016, July 2, 2017 and July 9, 2018, and the echolocations recorded were analyzed by Christi Spak, Minnesota Biological Survey (2010 − 2015) and Nancy J. Dietz, DNR Animal Survey Specialist (2016 − 2017). Analysis of 2018 mobile acoustic data is pending.

The highest number of bat echolocations recorded since the mobile survey began occurred in 2015 (n=132) which was similar to 2010 (n=130) with slightly fewer in 2016 (n=120) and more than 55% greater than what was recorded in 2014 (n=58), and 2017 (n=56) (Figure 28). Of the total bat calls recorded in 2017, the proportion of big brown /silver-haired bat echolocations was similar to 2010 and 2016 but greater than in 2012 – 2015. And, the proportion of red bat echolocations increased from 2010 but decreased from 2013 to 2016 (Figure 28). Examining the five years of survey data, the variable number of total survey echolocation calls, the proportion of big brown/silver-haired bat calls, and the increase in red bat calls do not indicate extensive population declines of these species, at this time. Camp Ripley's DNR researchers plan to continue to sample the mobile transect one to three times annually and additionally set up stationary locations to monitor bat population trends and to measure any impacts of WNS.

Figure 27. Mobile acoustic bat transect survey route, Camp Ripley Training Center, Minnesota, 2010, 2012 – 2018.

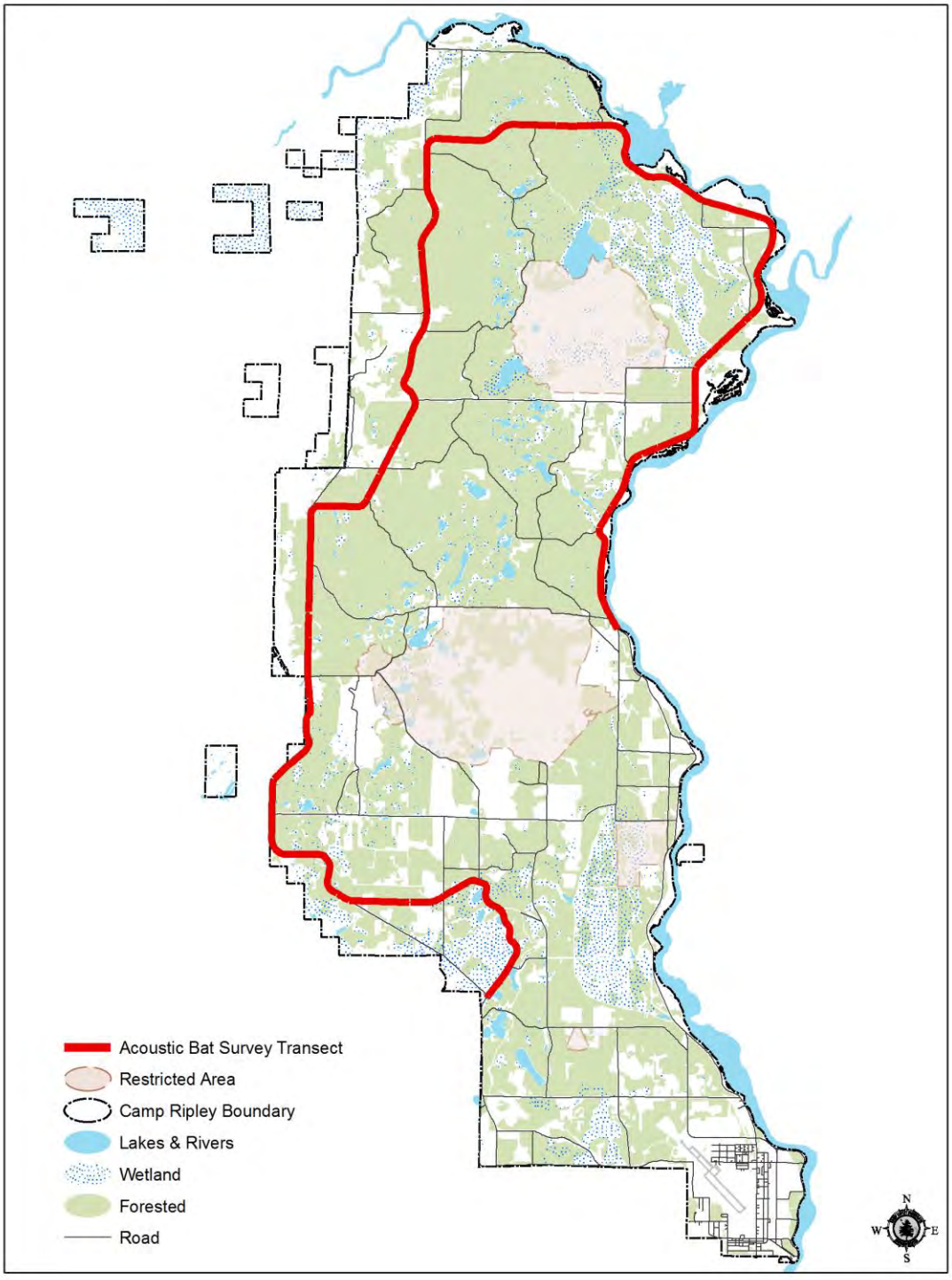
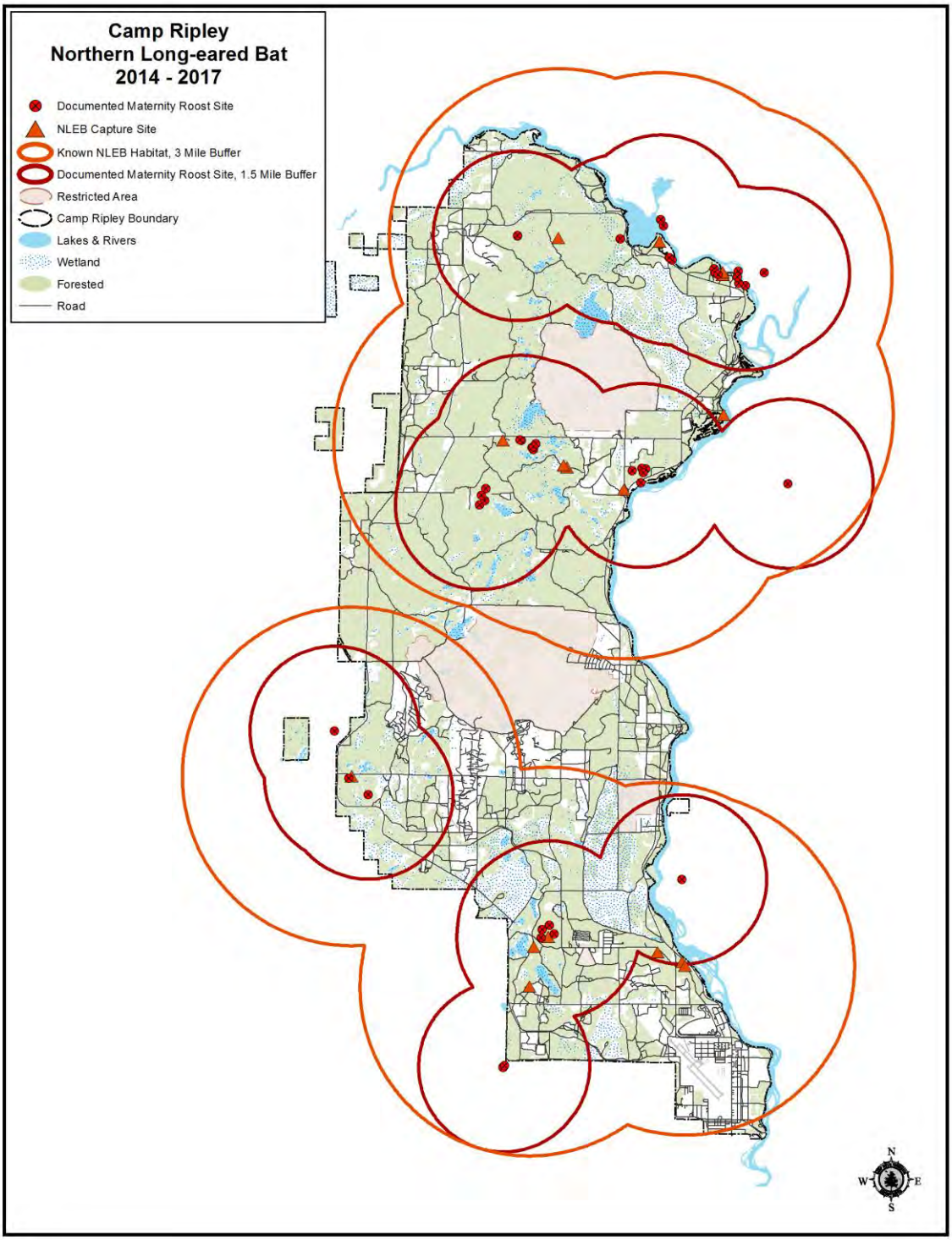


Figure 28. Locations of female northern long-eared bat captures and maternity roosts, Camp Ripley Training Center, Minnesota, 2014 – 2017.



### Porcupine (*Erethizon dorsatum*)

Porcupines are the second largest member of the rodent family. While most rodents have a high rate of reproduction along with a high rate of mortality, porcupines have neither. Female porcupines have one litter per year, with usually only one pup. Their winter diet consists of the inner bark of trees and their summer diet consists of a variety of woody and herbaceous vegetation, primarily at ground level (Hazard 1982). Fishers are effective predators of porcupines.

Porcupines can be a nuisance when they gnaw on wooden objects, tires and plastic tubing. Camp Ripley has maintained a porcupine nuisance permit from the DNR since 2008. Porcupines are taken only on problem areas identified by Range Control. Thirteen nuisance porcupines were taken under the DNR permit.

## Reptiles and Amphibians

### Blanding's Turtle (*Emys blandingii*)

By Arika Nyhus, St. Cloud State University, and Nancy J. Dietz, Minnesota Department of Natural Resources

The Blanding's turtle is a semi-aquatic freshwater turtle commonly known for its bright yellow chin (Congdon and Keinath 2006). This species is found in most parts of the upper Midwest and southeastern Canada, with isolated populations existing in Eastern states and provinces (Congdon et al. 2008). The species is considered threatened or endangered across most of its range and has been listed as state threatened in Minnesota since 1984. A species is considered state threatened if it is likely to become endangered within the foreseeable future throughout all or a significant portion of its range within Minnesota. In 2012, the U.S. Fish and Wildlife Service (USFWS) was petitioned to include Blanding's turtles as threatened or endangered under the federal Endangered Species Act (ESA). The USFWS determined, in July 2015, that the petition presented substantial information that federal listing of Blanding's turtles may be warranted. Therefore, a status review has been initiated and a determination will be made whether to propose Blanding's turtle listing under the ESA (USFWS 2018).

Due to the status of the Blanding's turtle, the DNR has implemented management strategies for the conservation of the species and Camp Ripley has three priority areas for conservation management. This species depends upon a variety of wetland types and sizes, and uses sandy upland areas and roadways for nesting. Minnesota's Wildlife Action Plan promotes the implementation of best management practices. Major threats impacting the Blanding's turtle include road mortality, habitat degradation and collection for trade (Congdon and Keinath 2006; Compton 2007; Beaudry and Hunter 2009). Additionally, the Blanding's turtle is a slow-maturing species (ages 14 – 20) that experiences low reproductive success and high nest predation (Congdon and Keinath 2006). In Michigan, Congdon et al. (1983) reported that nest predation accounted for 82% of nest mortality, with 42% of predation occurring within the first 24 hours. In addition, habitat loss and degradation exacerbate the threats (MNDNR 2015a). Since the early 1990s, several management practices have

been executed in attempts to conserve the species at Camp Ripley. These management practices include: 1) soldier education and outreach regarding the conservation of the Blanding's turtle, 2) Blanding's turtle crossing signs in high concentration areas, 3) mark recapture of females during nesting season via road surveys, and 4) nest protection with the use of metal cages. After nest emergence, hatchling turtles are direct released into the nearest wetland known to support adult turtles. However, it is uncertain what happens to the hatchlings after they are released. The goal was to continue mark recapture of adult females during nesting season and protect known nests via road surveys; as well as determine the survival and spatial ecology of hatchlings released in adult habitat.

A St. Cloud State University graduate student, Arika Nyhus, was recruited to further examine the effectiveness of Camp Ripley's conservation efforts and to determine movements of direct release hatchlings.

Roadside surveys were conducted from May 30 to June 27. Nesting seasons generally range from early-May to mid-July (Congdon et al. 1983). At Camp Ripley, nesting females are typically observed from June 2 through July 2. Surveys began just prior to the start of nesting season and terminated after one week of no turtle sightings. Roads were surveyed by conducting searches by vehicle through areas of known nesting activity as well as in areas for potential nesting activity. One to two trucks ran circular routes on the south and north end of Camp Ripley. Any observed tracks were investigated in efforts to locate the turtle and areas away from roads were occasionally checked for nesting females. Twenty-two Blanding's turtle observations were recorded, with the first sighting occurring on May 30 (BCX) (Table 17). Fourteen of these females were marked while four turtles were unmarked. Unmarked turtles were given a unique identification code to aid in future observations. It was unknown whether the remaining observed turtles had been previously marked. Standard protocol is to watch the turtle and determine if it is nesting. If the female is nesting, surveyors wait until nest completion and identify the turtle. If the female is not nesting, the surveyor may continue road surveys and return to check the status of the female. Unfortunately, none of the unknown turtles were seen again. In the northern region, three nests were protected in 121 hours of effort (BCI, BCO, BDP) (Figure 29) and four nests were protected in the southern region in 118 hours of effort (ACW, ACQ, ADU, AJV) (Figure 30). Additionally, road surveys on tertiary routes were conducted; one unmarked turtle was observed and one nest was protected in 33 hours of effort (ACY) (Figures 29 and 30). After data collection, a 1 x 1 meter metal cage was placed over the nest and the cage was dug into the ground about three to four inches to prevent predation. Two yellow posts with reflective tape were then positioned to face oncoming traffic to eliminate vehicle disturbance.

Figure 29. Blanding's turtle locations, nest locations and DNR priority areas in the northern region of Camp Ripley Training Center, Minnesota, 2018.

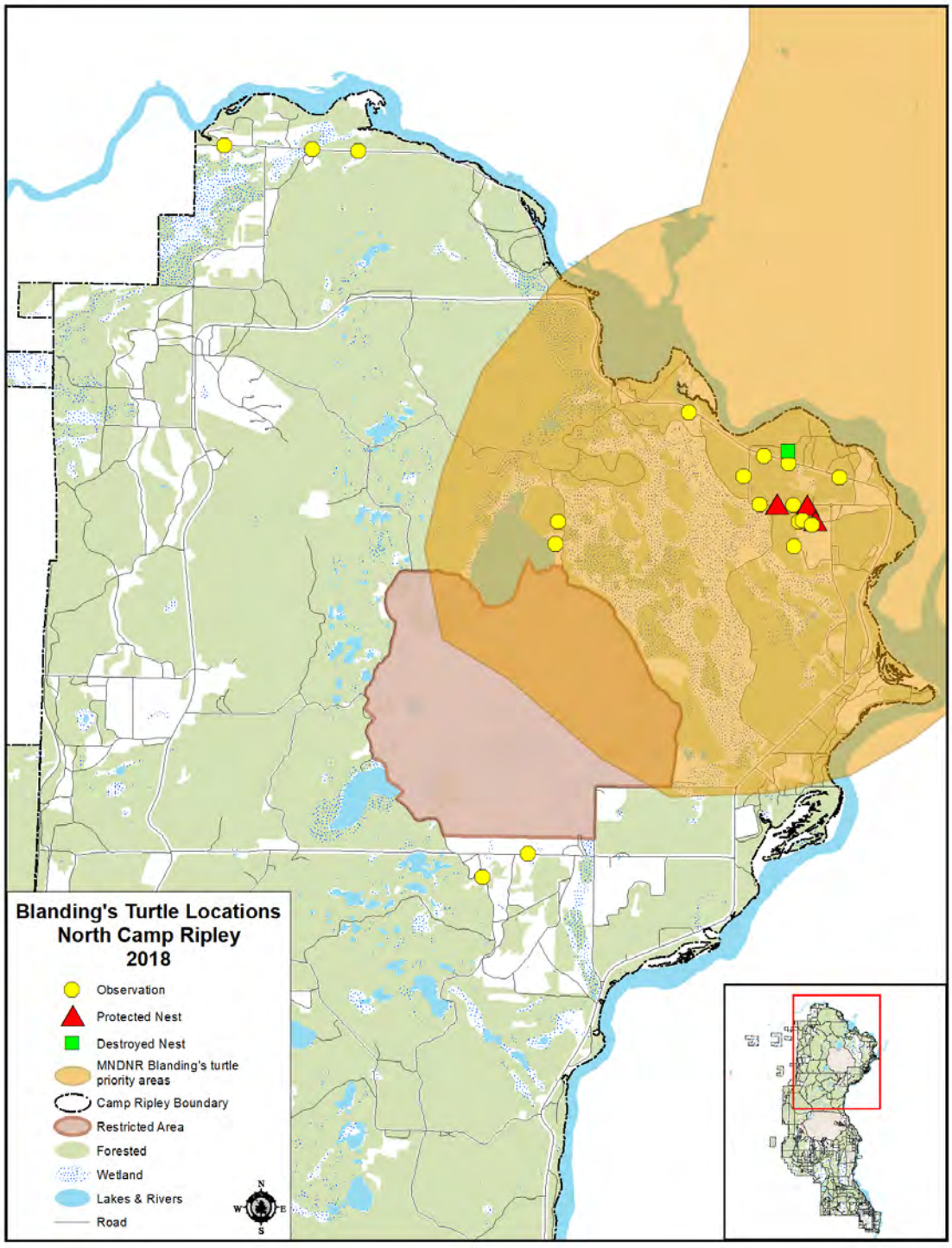
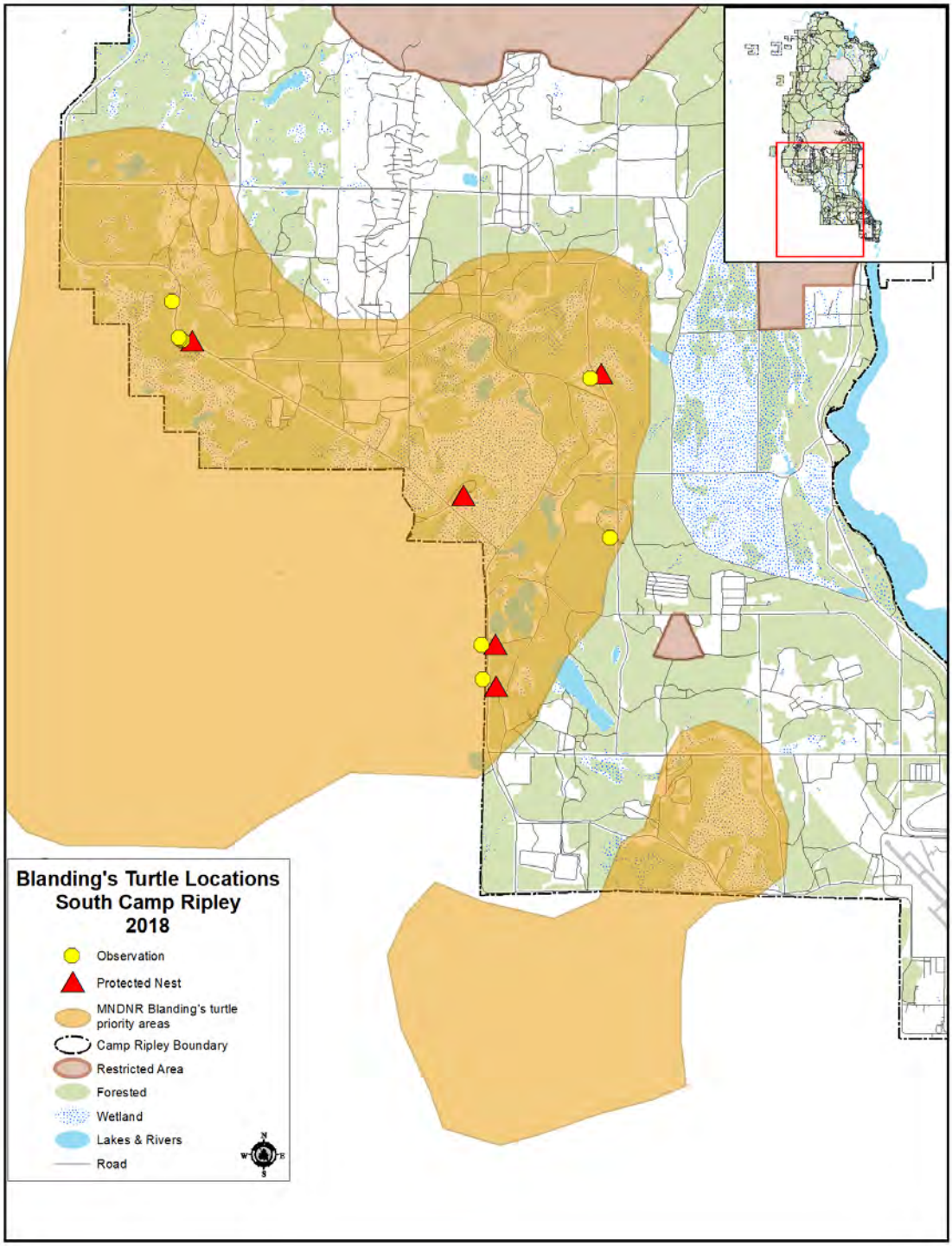


Figure 30. Blanding's turtle locations, nest locations and DNR priority areas in the southern region of Camp Ripley Training Center, Minnesota, 2018.



Nests were protected and monitored through mid-October and were excavated when no evidence of hatchling emergence existed by 127 days or more after nest completion. Typically, hatchlings emerge 75 – 110 days after the date of nest completion (Congdon et al. 1983). Nest incubation ranged from 81 – 102 days from the date laid to the date of first hatchlings. All but three nests exhibited asynchronous hatching. Seven of the eight protected Blanding's turtle nests hatched, with a total of 81 hatchlings for the year. Thirty-eight hatchlings were produced on the north end of Camp Ripley (4 BCI, 15 BCO, 19 BDP) and 43 eggs hatched successfully on the south end of camp (20 ACQ, 13 ACW, 8 ACY, 2 ADU, 0 AJV). Though many of the nests were successful, not all hatched completely. Three eggs did not hatch in nest BCO, with one egg containing no internal contents. Six unhatched eggs were discovered in nest ACW, with four approximately 90% developed and two about 100% developed. Ten eggs were found left unhatched in nest ADU, with seven of those eggs likely infertile. All eggs in nest AJV developed and hatched, however, none of the hatchlings made it out of the nesting cavity and died. It is unknown how successful nest ACY was as the nest was disturbed, likely by a bear, shortly after hatchling emergence.

Figure 31. Blanding's turtle midline length and width carapace and plastron measurements with digital caliper, Camp Ripley Training Center, Minnesota, 2018.

Following nest emergence of hatchlings arriving after September 8, individuals from each clutch were stored in a 10-liter bucket for data collection. Turtles were measured for midline length and width on the carapace and plastron to the nearest millimeter using a digital caliper (Figure 31). Mass of the hatchlings was determined using a 20-gram weight limit Pesola scale. Hatchlings were then assigned a number that was attached to the carapace using temporary construction tape. After data was collected from the clutch, hatchlings were separated by weight categories. The weight categories included hatchlings from 6.5-7.0 grams, 7.5-8.0 grams, 8.5-9.0 grams, and 9.5-10 grams. Seventeen hatchlings were then chosen to be affixed with transmitters randomly (Damon and Harvey 1987). Each hatchling affixed with a transmitter was given a unique turtle identification. The identification assigned to each hatchling was related to the identification that was provided to the adult maternal female followed by a consecutive number. The H in front of each identification represents "hatchling" to differentiate between the mothers and the offspring. The unique identifications assigned include H_ACW01, H_ACW02, H_ACW03, H_ACW04, H_ACW05, H_ACW_06, H_ACW07, H_ACW08, H_ACW09, H_ACW10, H_ACW11, H_ACW12, H_ACW13, H_ACY01, H_ACY02, H_ADU01, and H_ADU02.

Transmitters used on the selected hatchlings were models BD-2X (0.38 grams) from Holohil Systems Ltd., Ontario Canada, and R1615 (0.5 grams) and A2426 (0.65 grams) from Advanced Telemetry Systems, Isanti, Minnesota, USA. Each transmitter weighed no more than 7% of the hatchlings' body mass; transmitters had a battery capacity between 21 – 30 days (30 pulse position modulation). Transmitters were affixed using a fast drying (five minutes) epoxy compound (Figure 32). Prior to fitting the transmitter, the carapace of the hatchling was cleaned using water, and time was allowed for the carapace to dry to assure the transmitter set properly. The epoxy was applied to the carapace approximately midway down the turtle between the dorsal line and the marginal scutes. The turtles were then set in buckets individually to allow the epoxy to set. Though the recommended wait time to allow the epoxy to set was five minutes, turtles were held for approximately one hour prior to release. Hatchlings were subsequently escorted to two wetland complexes that support adult conspecifics and where previous cohorts were released: Range Marsh and Goose Lake. From the hatchlings chosen to be tracked, nine hatchlings were randomly (Damon and Harvey 1987) selected to be distributed in Goose Lake (H_ACW01, H_ACW04, H_ACW05, H_ACW06, H_ACW08, H_ACW09, H_ACW13, H_ACY01, H_ADU01) and eight hatchlings were spread throughout Range Marsh (H_ACW02, H_ACW03, H_ACW07, H_ACW10, H_ACW11, H_ACW12, H_ACY02). Following the release of hatchlings in Goose Lake and Range Marsh, individuals were located every one to three days using a three-element Yagi antenna and a R4100 Scanning Receiver (Advanced Telemetry Systems). After an individual was located, microhabitat data were collected using a 1 X 1 meter polyvinyl chloride quadrat frame (derivation of Daubenmire 1959). Data collected within this frame included open water percentage, emergent vegetation cover, floating vegetation cover, woody vegetation cover, dominant plant species, water depth, substrate depth, water temperature, air temperature, Universal Transverse Mercator (UTM) system coordinates of the hatchling, and whether the location was terrestrial or aquatic. Open water percentage was calculated by estimating the percent of the quadrat frame that had water as opposed to vegetation cover. Emergent, floating and woody vegetation cover was calculated by dividing the amount of the particular vegetation cover by total vegetation. The dominant plant species was assessed by dividing the cover of species by the total plant cover. Water depth was documented using a meter stick or ruler. Substrate depth was calculated by pushing a ruler or meter stick down into the water until the bottom was found. Water depth was then subtracted from this number to get the substrate depth.

Figure 32. Blanding's turtle hatchling with radio-transmitter, Camp Ripley Training Center, Minnesota, 2017 – 2018.

Water and air temperature were found using two different thermometers and UTM coordinates were identified using a GPS unit. Microhabitat data from a random point was also collected to determine if hatchlings possess microhabitat preference. The average daily movement distance of the hatchlings from 2017 was 8.75 meters. Therefore, after collecting data from the hatchling point, field technicians would randomly choose a cardinal direction and document the microhabitat data 8.75 meters away.

In 2017 and 2018, 43.5% of hatchlings left the wetland complexes and moved to various habitats. Of the hatchlings that left Range Marsh and Goose Lake, 40% resided in red maple (*Acer rubrum*) swamp forests, 30% moved to sugar maple (*Acer saccharum*) forests, 10% traveled to a tamarack (*Larix laricina*) swamp shrubland, 10% resided in a bluejoint (*Calamagrostis Canadensis*) Midwest wet meadow, and 10% could not be determined due to a lost transmitter. Between the two wetland complexes, 50% of hatchlings left Goose Lake while only 36% of hatchlings left Range Marsh. Of the hatchlings that did leave the wetland complexes, survivorship was 50% with 20% not accounted for due to a transmitter falling off or a lost signal. Mortality of hatchlings that left the wetland complexes was 30%; all due to predation. Mortality in hatchlings that stayed in the wetland complexes was 38.5% with drowning accounting for 23.1% and predation 15.4%. In 2018, the longest distance traveled was 142.3 meters by hatchling H_ACY02 while the longest distance traveled in 2017 was 450.7 meters. Differences seen in distance could be due to the contrast in hatchling sizes between the two years. The average weight of hatchlings in 2018 was 7.8 grams while the average weight in 2017 was 9.2 grams. Due to field work extending through mid-November, statistical analyses are still being conducted on movement patterns and the significance of macro-micro habitat on hatchlings.

The goal in 2019 is to release hatchlings at the nest site to compare survivorship, micro-macro habitat selection, and movement patterns to the direct release hatchlings. By releasing hatchlings at the nest site, current conservation efforts of direct release can be evaluated and modified to incorporate the best management practices to assure a long-term stable population.

Table 17. Summary of Blanding's turtle nest search surveys, Camp Ripley Training Center, Minnesota, 2000 – 2017.

| Year | Survey Period | First Female Blanding's Observed | First Blanding's Nest Found | Last Blanding's Observed | Number of Survey Hours | Number of Turtles Observed | Average Temp. (°F) during Survey Period* | Average Temp. (°F) during March to May* |
|---|---|---|---|---|---|---|---|---|
| 2000 | May 31 – June 23 | June 5 | No nests found | June 14 | 91.5 | 11 | 60 | 56 |
| 2001 | June 6 – ? | June 15 | No nests found | June 27 | 79 | 9 | 66 | 41 |
| 2002 | June 7 – June 25 | June 11 | June 11 | June 22 | 75 | 19 | 67 | 36 |
| 2003 | June 6 – June 22 | June 9 | June 11 | June 17 | 129.5 | 10 | 65 | 41 |
| 2004 | June 2 – July 2 | June 14 | June 14 | July 2 | 225 | 12 | 61 | 42 |
| 2005 | June 6 – June 23 | June 10 | June 12 | June 17 | 225 | 18 | 68 | 44 |
| 2006 | June 2 – June 30 | June 2 | June 8 | June 20 | 158 | 10 | 66 | 47 |
| 2007 | June 1 – June 21 | June 3 | June 7 | June 20 | 189 | 19 | 68 | 45 |
| 2008 | June 4 – July 1 | June 14 | June 18 | June 27 | 243 | 33 | 64 | 39 |
| 2009 | June 11 – June 28 | June 11 | June 13 | June 27 | 205 | 17 | 68 | 41 |
| 2010 | June 2 – June 24 | June 8 | June 16 | June 19 | 203 | 10 | 64 | 48 |
| 2011 | June 3 – June 29 | June 6 | June 13 | June 29 | 208 | 44 | 64 | 40 |
| 2012 | May 31 – June 18 | June 2 | June 3 | June 17 | 155 | 46 | 65 | 49 |
| 2013 | June17 – July 5 | June 19 | June 25 | July 5 | 198 | 37 | 71 | 37 |
| 2014 | June 9 – June 27 | June 11 | June 20 | June 22 | 113 | 12 | 69 | 41 |
| 2015 | June 10 – June 24 | June 10 | N/A | June 19 | 24 | 2 | 64 | 43 |
| 2016 | June 1 – June 23 | June 1 | June 2 | June 21 | 198 | 16 | 64 | 45 |
| 2017 | June 1 – June 24 | June 2 | June 2 | June 20 | 151 | 30 | 65 | 42 |
| **2018** | **June 1 – June 27** | **May 30** | **May 30** | **June 20** | **272.6** | **22** | **67** | **41** |

*Weather Underground online – Brainerd Airport (Weather Underground 2018a)

## Anuran Surveys

Frog and toad calling surveys are conducted as part of a larger statewide survey, and have been conducted at Camp Ripley since 1993. The statewide survey began due to growing concern over declining amphibian populations worldwide. Frog and toad abundance estimates are documented by the index level of their chorus, following Minnesota Herpetological Society guidelines (Moriarty, unpublished). If individual songs can be counted and there is no overlap of calls, the species is assigned an index value of one. If there is overlap in calls the index value is two, and a full chorus is designated a three. Anuran surveys are performed at 10 stops along two separate routes at Camp Ripley. The routes are surveyed three times from April through July (Figure 33).

Both routes were surveyed by Camp Ripley's DNR researchers. Only the south (#50195) route survey occurred during all three time periods on May 2, May 30 and July 10. The north (#50295) route survey occurred during the second and third run on June 7 and July 2. The first survey period (April 15 – 30) was delayed due to extensive snow cover, cold temperatures and frozen ponds into late April. Only six stops were surveyed on the south route during the first survey period, due to access issues. Wood frogs (*Rana sylvatica*) were at a 25-year high and spring peepers (*Pseudacris crucifer*) were near the high point that occurred in 1994. Several northern leopard frogs (*Rana pipiens*) were also heard (Figure 34 and Table 18). Boreal chorus frog (*Pseudacris maculata*) index values were above their all−time low in 2015. During the second survey period (May 15 – June 5), spring peepers, Cope's gray treefrogs (*Dryophytes chrysoscelis*) and gray treefrogs (*Hyla chrysoscelis*) index values were all lower than the previous year. American toads (*Anaxyrus americanus*) were also heard calling during the second survey period (Figure 35 and Table 18). The third survey period included calls from gray treefrog, mink and green frogs (Table 18). The spring was very late with ice on ponds until late April; however, May was unusually warm. Typical frog calling periods were unusual.

Statewide results, between 1998 and 2015, indicate a marginally-significant increase ($p = 0.06$) in the proportion of routes where Cope's gray treefrogs were heard; and, a significant increase ($p = 0.03$) in the proportion of routes where green frogs were heard. No statewide trends were detected in the other 12 species of frogs and toads in Minnesota, indicating overall populations of these species are stable (Larson 2017).

Figure 33. Anuran survey routes, Camp Ripley Training Center, Minnesota, 1993–2018.

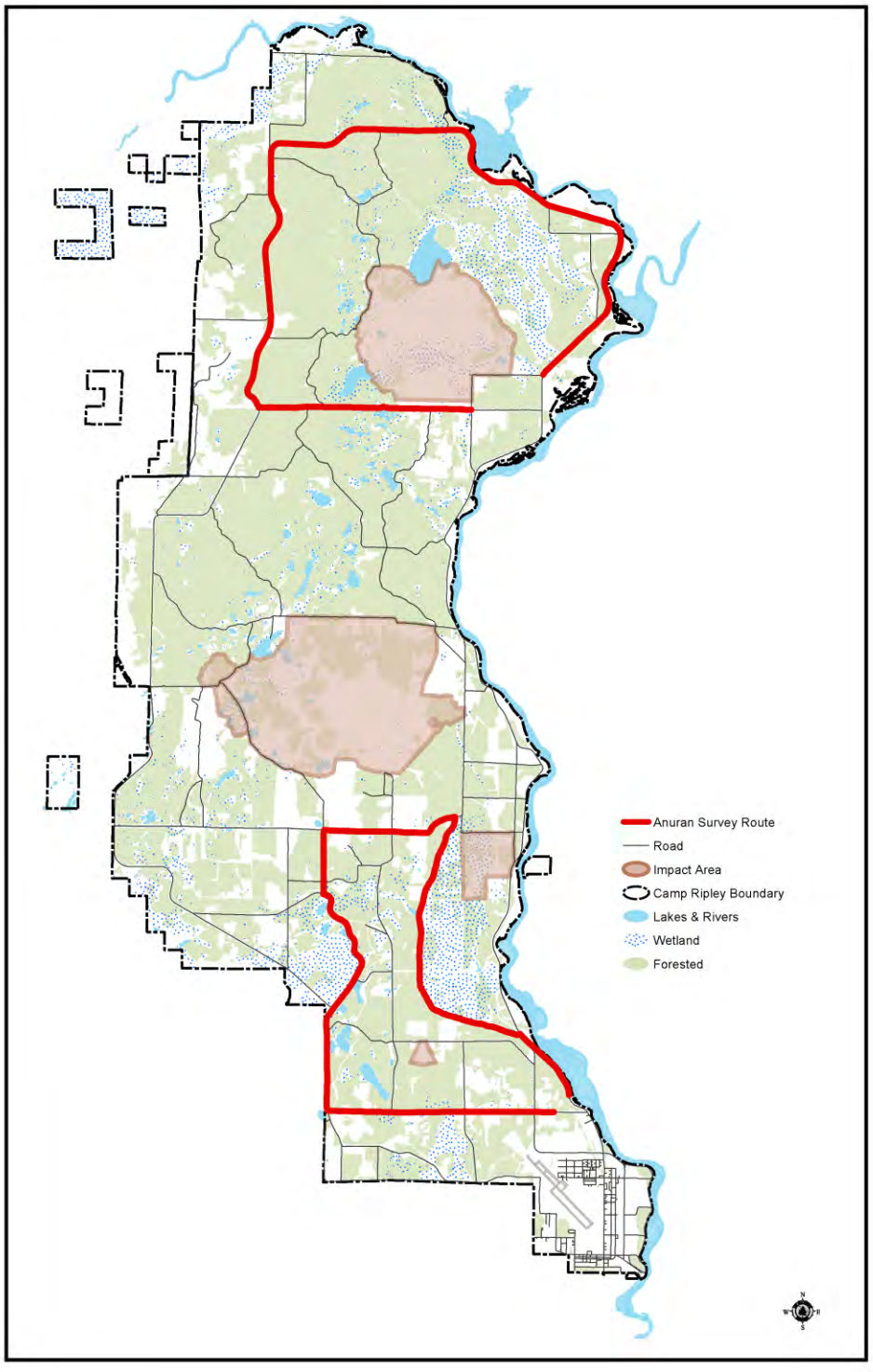


Figure 35. Average anuran index value during the first survey period, Camp Ripley Training Center, Minnesota, 1994 – 2018. Surveys were not conducted during 2008.

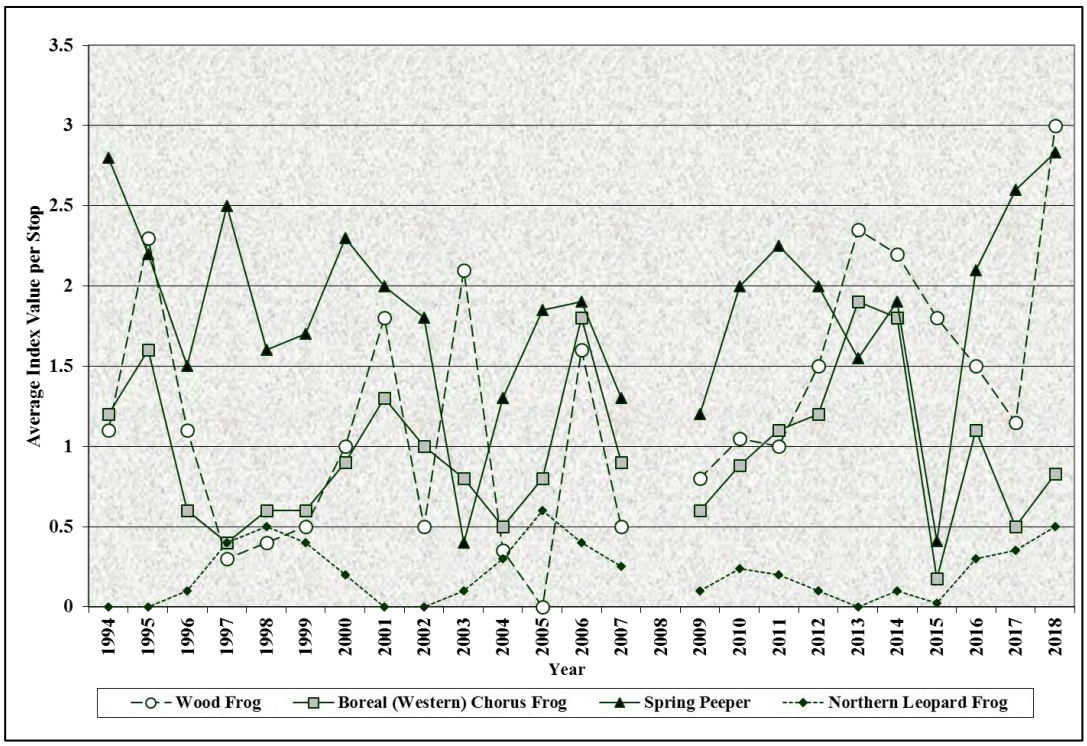



Figure 34. Average anuran index value during the second survey period, Camp Ripley Training Center, Minnesota, 1993 – 2018. Surveys were not conducted during the second survey period in 2005 and 2008.

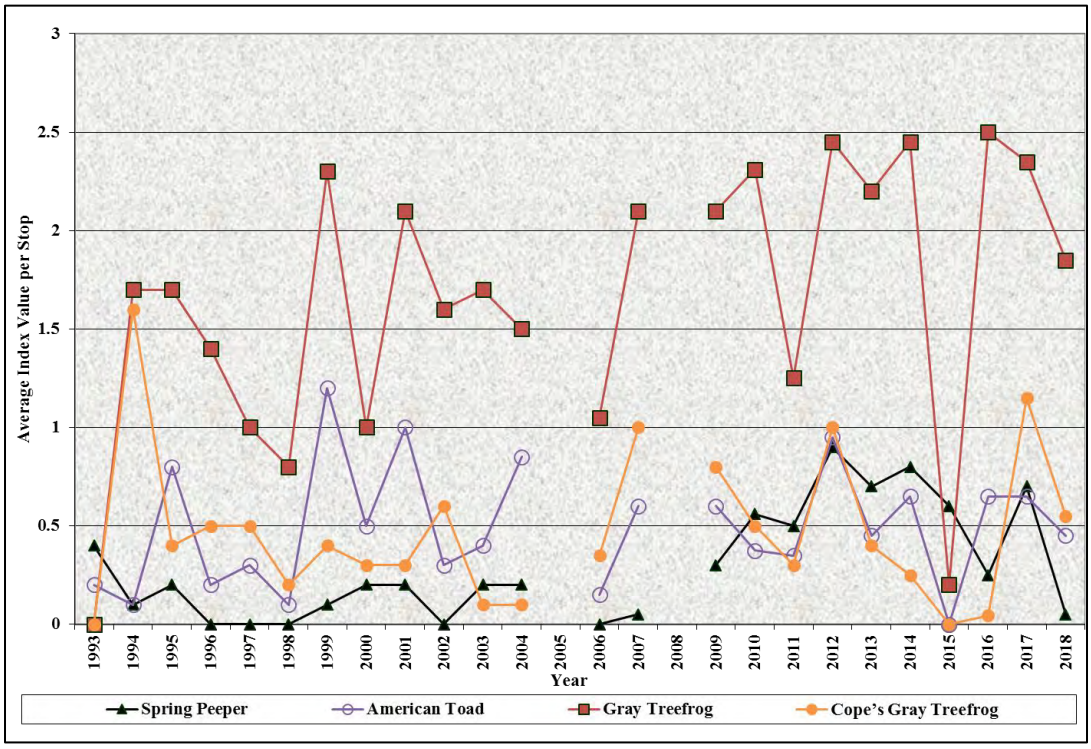


Table 18. Anuran survey index data, Camp Ripley Training Center, Minnesota, 1993 – 2018. *No survey conducted

| **Survey Period 1** | **1993** | **1994** | **1995** | **1996** | **1997** | **1998** | **1999** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wood frog | * | 1.1 | 2.3 | 1.1 | 0.3 | 0.4 | 0.5 | 1 | 1.8 | 0.5 | 2.1 | 0.35 | 0 | 1.6 | 0.5 | * | 0.8 | 1.05 | 1.0 | 1.5 | 2.35 | 2.2 | 1.8 | 1.5 | 1.15 | 3.0 |
| Boreal (Western ) chorus frog | * | 1.2 | 1.6 | 0.6 | 0.4 | 0.6 | 0.6 | 0.9 | 1.3 | 1 | 0.8 | 0.5 | 0.8 | 1.8 | 0.9 | * | 0.6 | 0.88 | 1.1 | 1.2 | 1.9 | 1.8 | 0.18 | 1.1 | 0.5 | 0.83 |
| Spring peeper | * | 2.8 | 2.2 | 1.5 | 2.5 | 1.6 | 1.7 | 2.3 | 2 | 1.8 | 0.4 | 1.3 | 1.85 | 1.9 | 1.3 | * | 1.2 | 2.0 | 2.25 | 2.0 | 1.55 | 1.9 | 0.41 | 2.1 | 2.6 | 2.83 |
| Northern leopard frog | * | 0 | 0 | 0.1 | 0.4 | 0.5 | 0.4 | 0.2 | 0 | 0 | 0.1 | 0.3 | 0.6 | 0.4 | 0.25 | * | 0.1 | 0.24 | 0.2 | 0.1 | 0 | 0.1 | 0.02 | 0.3 | 0.35 | 0.5 |
| American toad | * | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.8 | 0 | 0 | * | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray treefrog | * | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.35 | 0 | 0 | * | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cope's gray treefrog | * | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | * | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mink frog | * | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | * | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Green frog | * | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | * | 0 | 0 | 0 | 0 | 0 | 0.05 | 0 | 0 | 0 | |
| **Survey Period 2** | **1993** | **1994** | **1995** | **1996** | **1997** | **1998** | **1999** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** |
| Wood frog | 2.4 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | * | 0 | 0 | * | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.1 |
| Boreal (Western ) chorus frog | 0.4 | 0.1 | 0.2 | 0 | 0 | 0 | 0.1 | 0.2 | 0.2 | 0 | 0.2 | 0.2 | * | 0 | 0.05 | * | 0.3 | 0.56 | 0.5 | 0.9 | 0.7 | 0.8 | 0.6 | 0.25 | 0.7 | 0.05 |
| Spring peeper | 1.9 | 2.2 | 2.3 | 0.2 | 0 | 0.9 | 0.8 | 0.9 | 0.6 | 0.2 | 0.4 | 0.5 | * | 0.05 | 0.25 | * | 0.9 | 1.93 | 1.7 | 1.6 | 1.1 | 1.55 | 1.0 | 1.85 | 2.15 | 0.9 |
| Northern leopard frog | 0 | 0 | 0 | 0 | 0 | 0.1 | 0.1 | 0.3 | 0.1 | 0 | 0.1 | 0.1 | * | 0.1 | 0.05 | * | 0 | 0.06 | 0.1 | 0.05 | 0.15 | 0.05 | 0.15 | 0.05 | 0.15 | 0 |
| American toad | 0.2 | 0.1 | 0.8 | 0.2 | 0.3 | 0.1 | 1.2 | 0.5 | 1 | 0.3 | 0.4 | 0.85 | * | 0.15 | 0.6 | * | 0.6 | 0.375 | 0.35 | 0.95 | 0.45 | 0.65 | 0 | 0.65 | 0.65 | 0.45 |
| Gray treefrog | 0 | 1.7 | 1.7 | 1.4 | 1 | 0.8 | 2.3 | 1 | 2.1 | 1.6 | 1.7 | 1.5 | * | 1.05 | 2.1 | * | 2.1 | 2.31 | 1.25 | 2.45 | 2.2 | 2.45 | 0.2 | 2.5 | 2.35 | 1.85 |
| Cope's gray treefrog | 0 | 1.6 | 0.4 | 0.5 | 0.5 | 0.2 | 0.4 | 0.3 | 0.3 | 0.6 | 0.1 | 0.1 | * | 0.35 | 1 | * | 0.8 | 0.5 | 0.3 | 1.0 | 0.4 | 0.25 | 0 | 0.04 | 1.15 | 0.55 |
| Mink frog | 0 | 0 | 0 | 0.2 | 0.1 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | * | 0 | 0 | * | 0 | 0 | 0 | 0 | 0.1 | 0 | 0 | 0 | 0 | 0 |
| Green frog | 0 | 0 | 0 | 0.1 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | * | 0 | 0 | * | 0.1 | 0 | .05 | 0 | 0 | 0 | 0 | 0.05 | 0 | 0.15 |
| **Survey Period 3** | **1993** | **1994** | **1995** | **1996** | **1997** | **1998** | **1999** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** |
| Wood frog | * | * | 0 | 0 | * | * | * | * | 0 | 0 | * | * | 0 | * | 0 | * | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Boreal (Western ) chorus frog | * | * | 0.1 | 0 | * | * | * | * | 0 | 0 | * | * | 0 | * | 0 | * | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spring peeper | * | * | 0 | 0 | * | * | * | * | 0 | 0 | * | * | 0 | * | 0 | * | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Northern leopard frog | * | * | 0 | 0 | * | * | * | * | 0 | 0 | * | * | 0 | * | 0 | * | 0.3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.05 | 0 |
| American toad | * | * | 0 | 0 | * | * | * | * | 0 | 0 | * | * | 0 | * | 0 | * | 0 | 0 | 0.1 | 0 | 0 | 0 | 0.05 | 0 | 0.05 | 0 |
| Gray treefrog | * | * | 0.2 | 0 | * | * | * | * | 0.2 | 0.3 | * | * | 0.25 | * | 0.4 | * | 0.5 | 0.05 | 1.8 | 1.05 | 0.6 | 0.15 | 0.2 | 0.5 | 1.25 | 0.05 |
| Cope's gray treefrog | * | * | 0 | 0 | * | * | * | * | 0 | 0.3 | * | * | 0.1 | * | 0.12 | * | 0.3 | 0 | 0.45 | 0.2 | 0.2 | 0.05 | 0 | 0.25 | 0.15 | 0 |
| Mink frog | * | * | 0.3 | 0.4 | * | * | * | * | 0 | 0.1 | * | * | 0.05 | * | 0.06 | * | 0 | 0.1 | 0.15 | 0.05 | 0.2 | 0.2 | 0.05 | 0.1 | 0.15 | 0.05 |
| Green frog | * | * | 0 | 0.3 | * | * | * | * | 0.3 | 0.1 | * | * | 0.25 | * | 0.06 | * | 0.7 | 0.25 | 0.55 | 0.5 | 0.25 | 0.35 | 0.04 | 0.56 | 0.5 | 0.3 |

## Four-toed Salamander (*Hemidactylium scutatum*) Survey

By Luke Groff, Minnesota Department of Natural Resources Nongame Wildlife Program

The four-toed salamander was first documented in Minnesota in 1994 and was listed as a species of special concern in 1996. Despite the availability of apparently suitable habitat and the presence of populations in neighboring Mille Lacs County, the species has not yet been documented in Morrison County. The aim of this project was to conduct targeted surveys to refine, and potentially expand, the four-toed salamander's geographic distribution.

Four-toed salamander breeding surveys were conducted in selected wetlands located throughout Camp Ripley during May 7 – 10 between 09:20 and 17:50. Luke Groff conducted the surveys and was assisted by Nancy Dietz and Brian Dirks on May 7 and Nate Wesenberg on May 10. Surveyors identified potential nesting sites in each selected wetland and carefully searched for egg clusters and brooding adult females (Figure 36). Potential nesting sites included logs, hummocks, stumps, etc. that were elevated above open water, had steeply or vertically sloped sides, and supported relatively deep mosses (e.g., *Sphagnum spp.*).

Although several surveyed wetlands appeared suitable for breeding, the surveyors failed to detect four-toed salamanders. The following amphibian species were incidentally detected during the targeted surveys: wood frog (*Lithobates sylvaticus*), spring peeper (*Pseudacris crucifer*), and boreal chorus frog (*Pseudacris maculata*).

Four-toed salamanders range 2 – 4 inches in total length (Petranka 1998); have reddish-brown backs, grayish flanks, and white bellies with black spots; and are often speckled with black, silver, or blueish flecking. The species can be distinguished from other salamanders using one of two diagnostic characteristics. As its name suggests, the four-toed salamander has four toes on each foot (Petranka 1998), whereas all other terrestrial salamanders in Minnesota have five toes on their rear feet. The species also has a cylindrical tail that is distinctly constricted near the base, allowing individuals to quickly detach their tails and potentially confuse and evade predators.

Minnesota marks the northwestern most extent of the four-toed salamander's geographic distribution, which extends across most of the eastern United States and into southeastern Canada. The species' known distribution in Minnesota currently is restricted to Itasca, Saint Louis, Aitkin, Carlton, Mille Lacs, and Pine counties; however, our current suite of observation records likely underestimate the species' true distribution.

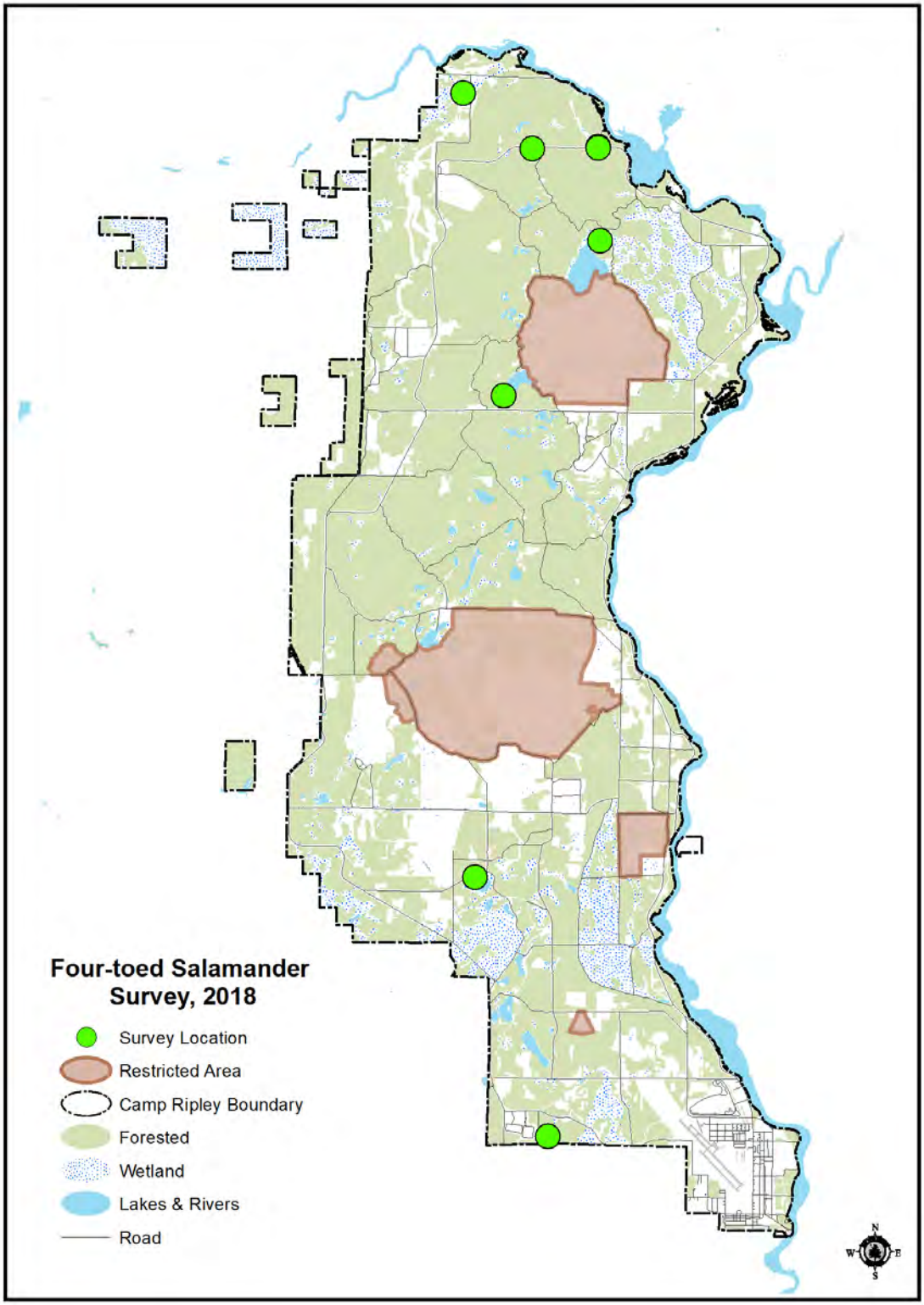
The species has specific and unique habitat requirements and a relatively limited dispersal capacity. Consequently, the four-toed salamander is patchily distributed throughout its geographic range, and populations tend to be relatively small, isolated, and vulnerable to catastrophic events (e.g., wildfire) and habitat changes. Currently, the greatest threat to the species is the loss and degradation of ephemeral or fish-free wetlands and adjacent upland forests.

Generally, four-toed salamanders occupy mature closed-canopy deciduous or mixed deciduous-coniferous forests interspersed with seepages and isolated wetlands in glacial moraine and, to some extent, drumlin plain landscapes (Petranka 1998). Sustained populations require fish-free wetlands with suitable nesting sites (e.g., Sphagnum mosses) and upland closed-canopy forests with moist soil, relatively deep leaf litter, abundant coarse woody debris, an adequate prey base (e.g., mollusks, beetles), and accessible underground refuge and overwintering sites (e.g., rodent burrows, decayed root channels) (Petranka 1998). Importantly, these wetland and upland habitats must be contiguous and without physical or perceived barriers (e.g., roads, open-canopy forests) or connected with closed-canopy corridors so that salamanders can move between them.

Typical breeding wetlands include vernal pools, coniferous swamps, and ephemeral or fish-free wetlands (Petranka 1998). Females oviposit 4 – 80 eggs in solitary or communal nests and brood the eggs for at least a few weeks. Nests are located above water usually in relatively deep Sphagnum mosses attached to structures (e.g., hummocks, logs) with steeply sloped or vertical sides (Petranka 1998); less commonly used nesting substrates include grasses, sedges, rotted wood, and other mosses (e.g., *Thuidium spp.*). Larvae hatch from eggs 1 – 2 months after oviposition, wriggle free from the substrate, and drop into the water below. Larvae continue to develop therein for another 3 – 6 weeks before exiting the wetland (Petranka 1998). Recently metamorphosed salamanders often remain near wetland edges for extended periods prior to moving to upland areas. Mating, overwintering, and most foraging occurs in upland closed-canopy forests.

In Minnesota, females migrate annually from upland overwintering sites to breeding wetlands during late April or early May. Numerous studies have reported movements in excess of 500 feet; however, migration and dispersal distances are likely site- and population-specific.

Figure 36. Four-toed salamandar survey locations, Camp Ripley Training Center, Minnesota, 2018.



## Snake Fungal Disease

Snake fungal disease (SFD) is an emerging skin infection in wild snakes. The disease is caused by the fungus *Ophidomyces ophiollcola* and was first discovered in 2006 in New Hampshire. As of August 2017, the fungus had been detected in 23 states, including Minnesota, and one Canadian Province (MNDNR 2018a; Thompson et al. 2018). The fungus resides in the soil. Once a snake has contracted the fungus, incubation is 30 – 37 days and clinical signs can occur in 12 days. One locally known affected species is garter snakes (*Thamnophis spp.*). Clinical signs include facial swelling, crusty scales, skin lesions and scattered subcutaneous nodules (lumps) or ulcerations (Cornell University 2018; MNDNR 2018a; Thompson et al. 2018). The fungus can be spread into the environment by infected animals particularly by animals that share den sites. Snakes survive an average of 90 days with SFD and have a 40% mortality rate. The number of snakes submitted to wildlife health labs with fungal dermatitis has been increasing substantially (MNDNR 2018a; Thompson et al. 2018).

Snakes play a vital role in food webs as both prey and predator. They are an important food item for many mammals and bird species and consume rodents that can cause damage to agricultural crops and carry diseases that affect humans and other animals. Snakes can reduce local incidence of tick borne diseases by consuming rodents and other small mammals infested with ticks that transmit diseases (Thompson et al. 2018).

Camp Ripley's DNR researchers partnered with the Department of Defense (DoD) Partners in Amphibian and Reptile Conservation (PARC) to sample for SFD among 50 military installations. DoD PARC provided snake sampling supplies and training. Thirteen common garter snakes (*Thamnophis sirtalis*) were captured and sampled on Camp Ripley. Samples were submitted for testing; results from the lab are pending and will be available in 2019.

## Insects

### Monarch Butterfly (*Danaus plexippus*)

By Nancy J. Dietz, Minnesota Department of Natural Resources, and Bethany Walters, Minnesota Department of Natural Resources Volunteer

Monarch butterflies are found throughout the United States. Eastern populations migrate vast distances of over 3,000 miles between the United States, Canada and central Mexico from breeding grounds to overwintering locations, across multiple generations each year. Adults in a summer generation live for two to six weeks while migratory generations live up to nine months. Monarchs from northern latitude breeding grounds that emerge after mid-August begin to migrate south towards overwintering grounds where they have never been before. When this migratory generation begins the northward journey into the southern United States, this generation lays eggs and nectars as they breed and migrate north. The generation that repopulates the northern latitude breeding grounds the next spring is the second and third generation of the previous falls' generation (Monarch Joint Venture 2015).

Populations of monarchs are declining in both the eastern and western portions of their North American range. Monarchs are now being considered for protection under the federal Endangered Species Act (ESA). The U.S. Fish and Wildlife Service (USFWS) is currently conducting a species status assessment to describe the viability of monarch populations which will support ESA decisions. The USFWS anticipates an ESA listing decision by June 2019. The major population threats are breeding, migration and overwintering habitat losses. Insecticides used to control insects are harmful to monarchs. And, herbicides used to control weeds can affect milkweed populations, the only plant that female monarchs use to lay eggs and the only plant its caterpillars eat (Monarch Joint Venture 2015).

Recent comprehensive surveys for monarch butterflies have not been completed on Camp Ripley. Butterfly surveys in 1994 encountered monarchs numerous times between May 21 and October 2 (Hansen 1994). In 2017, larvae were observed on common milkweed in Training Area 64. Adults, pupa, larvae and eggs were observed near the White Pine Walking Trail in 2018.

CRE, Central Lakes College interns and DNR volunteers participated in Monarch Conservation Science Partnership's Integrated Monarch Monitoring Program (IMMP) training conducted by Bethany Walters. The training addressed all aspects of IMMP field activities, including recording blooming plants, counting milkweed (*Asclepias spp*.) stems, and surveying for monarch eggs, larvae or adults. With guidance from DNR researchers, Bethany Walters recommended multiple monitoring plots on Camp Ripley, and two were selected (plot #s 052595-111111 and 019827-111111) (Figure 37) to annually monitor monarchs and their habitats.

On August 16, baseline monarch and habitat information was collected along two established IMMP plots (Figure 37 and Table 19). This field activity recorded the number of monarch eggs, larvae and adults found per number of milkweed plants along the plot transect and within the plot.

Table 19. Integrated Monarch Monitoring Program baseline data, Camp Ripley Training Center, Minnesota, 2018.

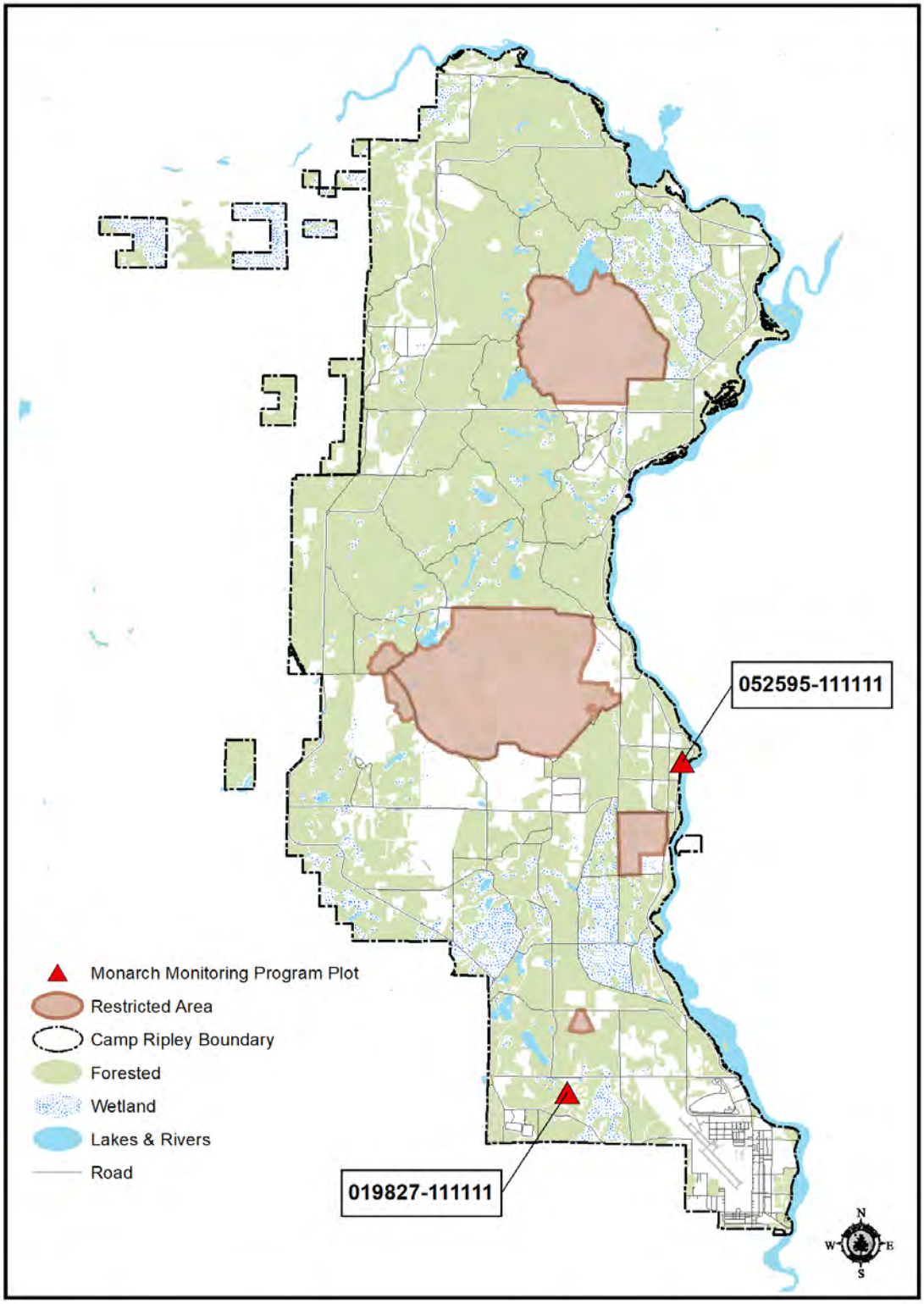
| IMMP Plot | Year | Survey Type | Plot Surveys | Milkweed Plants with No Monarchs | Milkweed Plants with One Monarch | Milkweed Plants with Two Monarchs | Misc. Monarch Observations |
|---|---|---|---|---|---|---|---|
| 019827-111111 | 2018 | Transect/Plot | 8/16/2018 | 90/110 | 2 (pupa & 4th instar larvae) / 0 | 1 (eggs) / 0 | 1 flying adult<br>1 nectaring adult (Goldenrod nectar plant) |
| 052595-111111 | 2018 | Transect/Plot | 8/16/2018 | Few/200 | 0 / 1 (2nd instar larvae) | 0 / 0 | 0 |

Peak monarch fall migration abundance occurs at Camp Ripley from August 27 to September 8 (Monarch Watch 2018). Tags from Monarch Watch's tagging program were obtained to track monarch migration patterns through mark and recapture. Each tag is uniquely coded with a 3-letter, 3-number identification for each season. Eight monarchs were tagged at Camp Ripley at two locations in cantonment: White Pine Walking Trail and along Engineer Road. Citizen scientists capture monarchs throughout the migration season, and submit the tag code, date and monarch gender to Monarch Watch (Monarch Watch 2018). Information about the season's monarch tag recoveries is not yet available on Monarch Watch's website.

Best management practices for monarch populations on Camp Ripley should include avoiding mowing ditches when monarch larvae are present, late April to mid-August, particularly locations where common milkweed (*Asclepias syriaca*) is present. In addition, limiting insecticide and herbicide use would be beneficial.


*Pictured: Tagged monarch butterfly.*
*Source: Monarch Watch.*

Figure 37. Integrated Monarch Monitoring Program plot locations, Camp Ripley Training Center, Minnesota, 2018.



## Bumble Bees

Historically about 400 native bee species occurred in Minnesota. However, little is known about bees because the most recent state species list was published in 1919. Bumble bees are a group of insect pollinators. Pollinators are critical to the agricultural economy and natural habitats and ecosystems as 90% of the world's flowering plants rely on animal pollinators. "Pollination happens when wind, water and wildlife carry pollen from the anther (male part) to the stigma (female part) of plants" (Hatfield et al. 2012; MNDNR 2017c). Threats to bumble bee populations include habitat fragmentation, grazing, pesticide use, genetic diversity, pests and diseases, competition with honey bees and climate change (Hatfield et al. 2012). The economic value of pollination services provided by native insects (mostly bees) is estimated at $3 billion dollars annually in the United States (USFWS 2019e).

Five bumble bees are listed as SGCN in Minnesota, including rusty patched bumble bee (*Bombus affinis*), Ashton cuckoo bumble bee (*Bombus bohemicus*), yellowbanded bumble bee (*Bombus terricola*), American bumble bee (*Bombus pensylvanicus*) and golden northern bumble bee or yellow bumble bee (*Bombus fervidus*). Rusty patched bumble bee abundance and distribution has declined by 90% since the late 1990s. In 2017, the rusty patched bumble bee was listed as federally endangered under the Endangered Species Act. None of the single threats noted above is causing the rusty patched population decline, but the threats working in concert are likely causing the decline (USFWS 2019e). Rusty patched bumble bee range includes Camp Ripley. Recent observations of rusty patched and yellowbanded bumble bees have occurred in southeast Crow Wing County (MNDNR 2016d); therefore, it is likely that they are present on Camp Ripley.

## Native Bee Transect Surveys

By Nancy J. Dietz, Minnesota Department of Natural Resources, and Nicole Gerjets, Bee Survey Specialist, Minnesota Department of Natural Resources

Native pollinators face multiple challenges including habitat loss, pesticides, pathogens and climate change. Despite the importance of pollinators, little is known about their distribution in Minnesota. To begin filling gaps in knowledge, Crystal Boyd with the DNR Minnesota Biological Survey (MBS) coordinated native bee surveys at two sites in Camp Ripley during the summer of 2017. Camp Ripley DNR staff continued bee surveys in 2018. This survey is the first native bee survey conducted on Camp Ripley.

Camp Ripley survey efforts were designed to match the MBS methods in other parts of the state. Transects of 24 elevated pan traps was set at each site (Figure 38). The pan traps were filled with water and Dawn dish soap, and bees trapped in the soapy water were collected 24 hours later. In 2017, pan traps were set on two transects during three events: August 7 – 8, August 22 – 23, and September 21 – 22. In 2018, pan traps were set on two transects during the following three events: June 21 – 22, July 12 – 13 and July 30 – 31.

Specimens of 137 and 177 wild bees were collected during 2017 – 2018 surveys at Camp Ripley, respectively. Native bee identification was conducted by Nicole Gerjets, Bee Survey Specialist with the MBS. Species identifications from the 2017 – 2018 surveys on Camp Ripley are in Table 20. For specimens of the genus *Melissodes* (long-horned bees), this genus is the lowest level of indentification possible due to the lack of availability of an extensive scientific identification key. *Dialictus* (metallic sweat bees) subgenus is also a difficult group to identify as only two people in North America can accurately identify this group. Ninety percent of the specimens were identified to the lowest taxomic level possible. Data was archived in the DNR Observation Database and specimens are vouchered with the University of Minnesota Insect Collection.

Camp Ripley is home to 10 bumble bee species, three confirmed SGCN bumble bees including the yellowbanded bumble bee, a USFWS species of concern (USFWS 2019) (Table 21). Yellowbanded bumble bees were observed at the transects in the northeast and southwest (Figure 38). In 2015, the Defenders of Wildlife petitioned the U.S. Fish and Wildlife Service to provide federal protection for the yellowbanded bumble bee. The USFWS has determined that federal protection may be warranted and is assessing possible federal protection for the yellowbanded bumble bee as threatened or endangered. Threats to yellowbanded bumble bee include commercial bumble bee rearing and the diseases carried by commercial bumble bees to wild populations. Habitat alterations that destroy, alter, fragment, degrade or reduce their food supply (flowers that produce nectar and pollen), nest sites and hibernation sites for over-wintering queens cause impacts to bumble bees. Insecticide pose a direct threat to foraging bumble bees and broad-spectrum herbicides can indirectly cause harm by decreasing flower production. Invasive species that invade native grasslands and compete with native flowering forbs also threaten this species (Xerces Society 2019).

Figure 38. Bee survey transect locations, Camp Ripley Training Center, Minnesota, 2018.

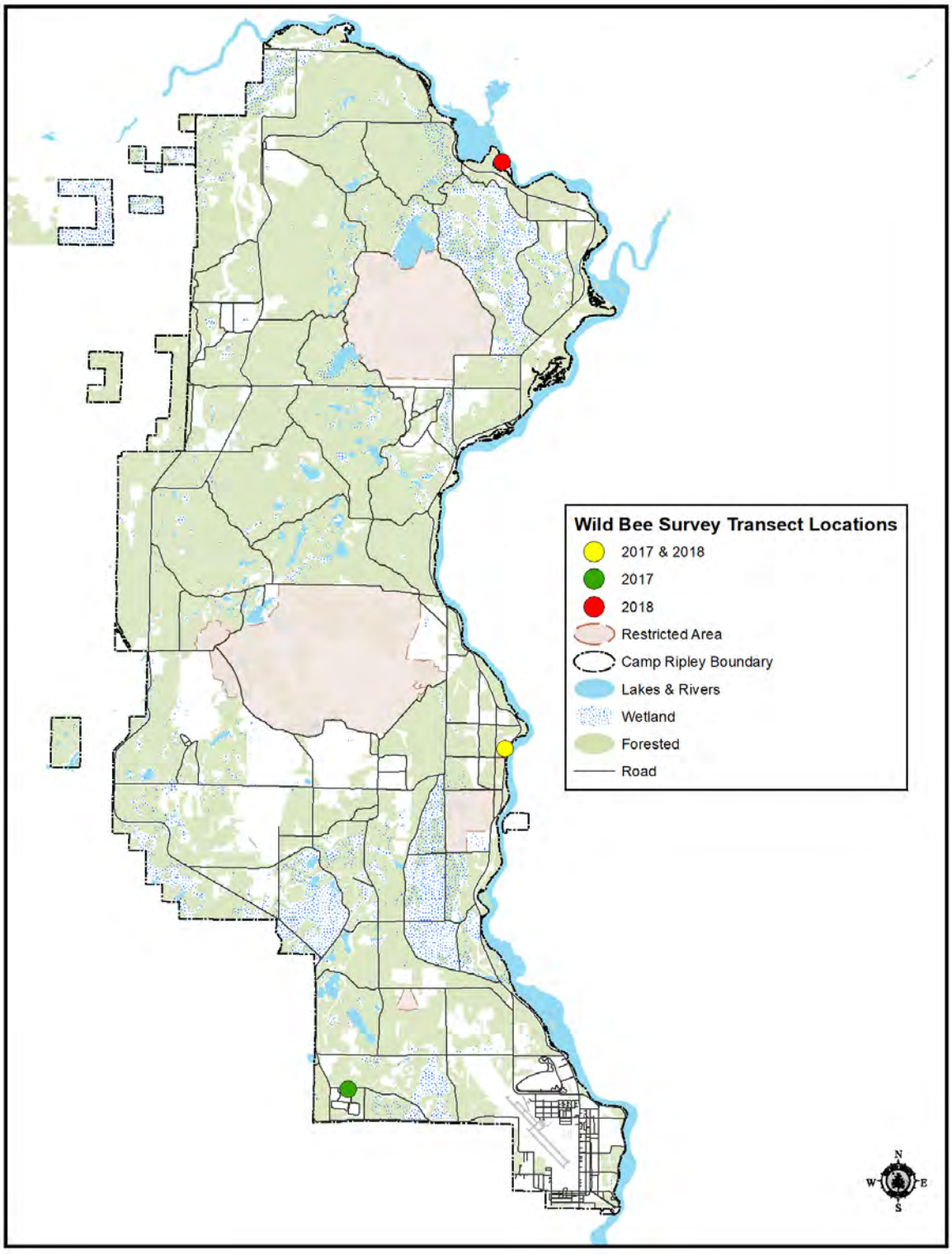


Table 20. Native bee transect survey, Camp Ripley Training Center, Minnesota 2017 – 2018. (Bolded species SGCN).

| Common Name | Scientific Name | # Identified | |
|---|---|---|---|
| | | 2017 | 2018 |
| **Plasterer, Yellow-faced Bees – Family Colletidae** | | | |
| A species of masked bees | *Hylaeus affinis/odestus* group | 12 | -- |
| Masked bees | *Hylaeus spp.* | -- | 1 |
| **Mining Bees – Family Andrenidae** | | | |
| Species of mining Bees | *Andrena spp.* | 1 | -- |
| Swenk's miner bee | *Perdita swenki* | 1 | -- |
| **Sweat Bees – Family Halictidae** | | | |
| Texas sweat bee | *Agapostemon texanus* | 2 | 1 |
| Bicolored striped sweat bee | *Agapostemon virescens* | 5 | 7 |
| A species of sweat bee | *Agapostemon spp.* | 3 | -- |
| Golden sweat bee | *Augochlorella aurata* | 4 | 21 |
| Ligated gregarious sweat bee | *Halictus ligatus* | 2 | 1 |
| Leathery sweat bee | *Lasioglossum coriaceum* | 11 | 12 |
| Green gold bee | *Lasioglossum pictum* | 1 | -- |
| Metallic-sweat bees | *Lasioglossum (Dialictus) spp.* | 1 | 43 |
| Small sweat bees | *Lasioglossum (Evylaeus) spp.* | 3 | -- |
| | *Lasioglossum (Lasioglossum) spp.* | -- | 16 |
| | *Lasioglossum spp.* | 1 | 11 |
| **Leafcutter, Mason Bees – Family Megachilidae** | | | |
| A leafcutter bee | *Coelioxyx rufitarsis* | 2 | -- |
| A leafcutter bee | *Hoplitis pilosifrons* | | 1 |
| Small-handed leafcutter bee | *Megachile gemula* | 1 | -- |
| Unarmed leafcutter bee | *Megachile inermis* | -- | 1 |
| Furry leafcutter bee | *Megachile perihirta* | 1 | -- |
| **Cuckoo, Digger, Bumble, Honey Bees – Family Apidae** | | | |
| Red-tipped digger bee | *Anthohora terminalis* | 1 | -- |
| Western honey bee | *Apis mellifera* | 2 | 2 |
| Common eastern bumble bee | *Bombus impatiens* | 14 | 3 |
| Brown-belted bumble bee | *Bombus griseocollis* | 5 | 4 |
| Red-belted bumble bee | *Bombus rufocinctus* | -- | 3 |
| Half-black bumble bee | *Bombus vagans* | 12 | 28 |
| Northern amber bumble bee | *Bombus borealis* | 2 | 1 |
| Tricolored bumble bee | *Bombus ternarius* | 8 | 1 |
| Two-spotted bumble bee | *Bombus bimaculatus* | 1 | 2 |
| **Golden northern bumble bee** | ***Bombus fervidus*** | **3** | **--** |
| **American bumble bee** | ***Bombus pensylvanicus*** | **2** | **--** |
| **Yellowbanded bumble bee** | ***Bombus terricola*** | **1** | **1** |
| Long-horned bees | *Melissodes spp.* | 36 | 15 |
| Squash bee | *Peponapis pruinosa* | -- | 1 |
| **Total Observations** | | **137** | **177** |

## Minnesota Bee Atlas Survey

The Minnesota Bee Atlas (MBA) is a citizen science program hosted by the University of Minnesota Extension that uses volunteer participants to provide information about the distribution and diversity of native bee species in Minnesota. One way to participate in MBA is to submit anecdotal observations by submitting photographs of bees from different angles (University of Minnesota 2018). Don Leaon, MBA volunteer, photographed bees at the two 2017 wild bee survey transect locations (Figure 38) and along Fort Ripley Road during 2017 and 2018. Mr. Leaon visted these sites on three occasions: June 19, August 7 and September 22. Photographs are submitted to iNaturalist https://inaturalist.org where other volunteers identify bee species from the images.

Table 21. Wild bee observations, Donald Leaon photographer, Minnesota Bee Atlas, Camp Ripley Training Center, Minnesota 2018.

| Common Name | Scientific Name | # Observations |
|---|---|---|
| **Bees** | | |
| Common eastern bumble bee | *Bombus impatiens* | 4 |
| Brown-belted bumble bee | *Bombus griseocollis* | 2 |
| Red-belted bumble bee | *Bombus rufocinctus* | 1 |
| Half-black bumble bee | *Bombus vagans* | 1 |
| Northern amber bumble bee | *Bombus borealis* | 1 |
| Tricolored bumble bee | *Bombus ternarius* | 1 |
| Bumble bee | *Bombus spp.* | 3 |
| Bumble bee Subgenus Pyrobombus | *Bombus (Pryrobombus) spp.* | 1 |
| Bicolored striped sweat bee | *Agapostemon virescens* | 2 |
| Western honey bee | *Apis mellifera* | 1 |
| Broad-handed leafcutter bee | *Megachile latimanus* | 1 |
| Leafcutter bees | *Megachile spp.* | 1 |
| Small sweat bees | *Lasioglossum spp.* | 3 |
| Long-horned bees | *Melissodes spp.* | 3 |
| Masked bees | *Hylaeus spp.* | 1 |
| Mining bees | *Andrena spp.* | 3 |
| A member of sweat bees | *Tribe Augochlorini* | 1 |
| Species of bees | *Epifamily Anthophila* | 3 |
| **Wasps** | | |
| Crabronid Wasps | *Philanthus Lepidus* | 1 |
| Thynnid Wasps | *Myzinum spp.* | 1 |
| Spider Wasps | *Family Pompilidae* | 1 |
| Potter Wasps | *Subfamily Eumeninae* | 1 |

## Fisheries

By Jake Kitzmann, Minnesota Department of Military Affairs

Electrofishing and vegetative surveys were conducted on August 29 of near shore (< 1 meter from shore) points on Lake Alott. Lake Alott is a 40-acre lake located in Training Area 36 (Figure 6). It has a fishing access with boat ramp and dock maintained on the north side. The substrate consists mostly of sand and gravel. There is no development along its shores other than a small landing on the north side. There were 14 plant species identified (Table 22).

Table 22. Vegetative surveys of floating and emergent taxa, Lake Alott, Camp Ripley Training Center, Minnesota, 2018.

| **Emergent Plants** | | |
|---|---|---|
| **Common Name** | **Scientific Name** | **2018 Near Shore Survey** |
| Three-way sedge | *Dulichium arundinaceum* | X |
| Arrowhead | *Sagittaria spp.* | X |
| **Emergent Plant Species TOTAL** | | **2** |
| **Floating Leaved Plants** | | |
| **Common Name** | **Scientific Name** | **2018 Near Shore Survey** |
| Floating-leaf burreed | *Sparganium fluctuans* | X |
| Water smartweed | *Persicaria amphibia* | X |
| Watershield | *Brasenia schreberi* | X |
| Floating-leaved pondweed | *Potamogeton natans* | X |
| **Floating-leaved Plant Species TOTAL** | | **2** |
| **Submerged Plants** | | |
| **Common Name** | **Scientific Name** | **2018 Near Shore Survey** |
| Needle Spikerush | *Eleocharis acicularis* | X |
| Small Waterwort | *Elatine minima* | X |
| Canada waterweed | *Elodea canadensis* | X |
| Narrowleaf pondweed | *Potamogeton strictifolius* | X |
| Slender waternymph | *Najas gracillima* | X |
| | *Characea spp.* | X |
| Water celery | *Vallisneria americana* | X |
| Coontail | *Ceratophyllum demersum* | X |
| **Submerged Plant Species TOTAL** | | **8** |

In June, a fisheries lake survey was conducted on Ferrell Lake in cooperation with the DNR Fish and Wildlife Division. June is not the ideal time for electrofishing as the presence of mature lake vegetation interferes with electrical pulses. This interference may have skewed the results of this activity. Electrofishing was conducted along the shoreline of the entire lake and one pass was made around the lake. Largemouth bass (*Micropterus salmoides*), blue gill (*Lepomis macroshirus*), pumpkin

seed (*Lepomis gibbosus*) and black crappie (*Poximus nigromaculatus*) were sampled and the length of each fish was measured (Table 23). Fisheries lake survey data may be used to monitor fisheries population trends over time and to establish future management goals and actions.

Table 23. Fisheries lake survey data, Ferrell Lake, Camp Ripley Training Center, Minnesota, 2018.

| Species length (mm) | | | |
|---|---|---|---|
| **Largemouth bass** | **Bluegill** | **Black crappie** | **Pumpkin seed** |
| 210 | 48 | 145 | 181 |
| 251 | 50 | 145 | 244 |
| 254 | 50 | 280 | |
| 255 | 55 | | |
| 256 | 56 | | |
| 256 | 65 | | |
| 265 | 75 | | |
| 294 | 75 | | |
| 315 | 76 | | |
| 316 | 81 | | |
| 328 | 85 | | |
| 329 | 85 | | |
| 341 | 87 | | |
| 341 | 89 | | |
| 341 | 90 | | |
| 351 | 90 | | |
| 355 | 90 | | |
| 370 | 91 | | |
| 377 | 100 | | |
| 382 | 100 | | |
| 400 | 100 | | |
| 483 | 140 | | |
| | 145 | | |
| | 145 | | |
| | 160 | | |
| | 165 | | |
| | 165 | | |
| | 165 | | |
| | 166 | | |
| | 169 | | |
| | 176 | | |
| | 181 | | |
| | 183 | | |
| | 190 | | |
| | 205 | | |
| | 210 | | |
| | 211 | | |
| | 216 | | |
| | 230 | | |
| | 247 | | |

## Pest Management

By Molly Peterson, Epidemiologist, Minnesota Department of Health

### Vectorborne Diseases

Vectorborne diseases (i.e., illnesses spread by ticks and mosquitoes) are a complex, dynamic, and significant health risk to persons who live, work, and travel within Minnesota. Dozens of species of ticks and mosquitoes thrive throughout the state but not all of them bite people and not all of them spread disease. For instance, two ticks of primary public health concern include *Ixodes scapularis* (deer tick) and *Dermacentor variabilis* (wood or dog tick). *Ixodes scapularis* may transmit the pathogens that cause several diseases in humans including but not limited to Lyme disease, human anaplasmosis, and babesiosis. In addition, while human disease transmission from *D. variabilis* is rare within the state of Minnesota, diseases such as Rocky Mountain spotted fever and tularemia can have serious and life-threatening consequences. In regards to mosquito-borne diseases, one particular mosquito of primary public health concern here in Minnesota is *Culex tarsalis,* our main vector of West Nile virus disease. Other mosquito species may spread diseases and exotic species (e.g*., Aedes japonicus* and *Aedes albopictus*) may be introduced throughout the state as well. For these reasons, the Minnesota Department of Health (MDH) conducts annual surveillance for ticks and mosquitoes in order to better understand and communicate the risks of vectorborne disease in Minnesota.

Camp Ripley was visited three times (May 11, June 7 and June 20) in an effort to collect at least 200 *I. scapularis* (100 adult and 100 nymph life stage ticks). Three sites (Training Areas 1, 20/22, and 29) within Camp Ripley were selected for study based on accessibility and optimal blacklegged tick habitat (i.e. wooded and brushy mesic areas with at least 50% canopy coverage). All transects were sampled at least once throughout the three visits, with transects in Trainings Areas 1 and 29 visited twice. MDH field personnel collected ticks by dragging white canvas cloths over the ground along four 100-meter transects established at each site. Personnel also collected any ticks found crawling on themselves while walking along each transect. Ticks were stored in vials containing 70% ethanol. The MDH Public Health Laboratory (MDH PHL) performed polymerase chain reaction (PCR) testing on *I. scapularis* collected at these sites to detect the genetic material of *Borrelia burgdorferi* (Lyme disease), *Anaplasma phagocytophilum* (anaplasmosis), *Ehrlichia muris eauclairensis* (ehrlichiosis), *Babesia microti* (babesiosis)*, Borrelia miyamotoi* (hard tick relapsing fever), and *Borrelia mayonii* (a recently identified form of Lyme disease).

While collecting *I. scapularis* at these sites, MDH personnel also incidentally collected *D. variabilis* adult ticks on all of these visits as well. These ticks were sorted by sex and life stage, submitted to the MDH PHL for PCR testing to detect the genetic material *of F. tularensis* (tularemia), and tested in pools with a maximum of 10 ticks per pool. The minimum infection rate (MIR) of ticks was calculated by dividing the minimum number of positive ticks per positive pool (i.e. one tick per positive pool) by the total number of ticks tested.

Over the duration of the three site visits, a total of 584 *I. scapularis* (218 adults, 90 nymphs, and 276 larvae) ticks were collected at Camp Ripley. *Ixodes scapularis* ticks were found at all sites that were sampled although most nymphs and larvae (59% and 74%, respectively) were collected within Training Area 20/22 while most adults (42%) were collected within Training Area 29 (Table 24). Of the 584 *I. scapularis* ticks collected, 189 ticks (100 adults, 89 nymphs, and 0 larvae) were randomly selected and submitted for testing by PCR for the previously listed pathogens.

Table 24. Summary of *I. scapularis* ticks collected, by collection site and life stage, Camp Ripley Training Center, Minnesota, 2018.

| **Training Area** | **Number of *Ixodes scapularis* Collected** | | | |
|---|---|---|---|---|
| | **Adults** | **Nymphs** | **Larvae** | **Total** |
| 1 | 80 | 6 | 24 | 110 |
| 20/22 | 34 | 53 | 203 | 290 |
| 29 | 92 | 30 | 49 | 171 |
| Other* | 12 | 1 | 0 | 13 |
| All Sites | 218 | 90 | 276 | 584 |

* "Other" ticks include ticks found off-transect with unknown location of collection (e.g., found in the vehicle between sites)

Of the 100 adults and 89 nymphs tested, approximately 65% of adult ticks and 17% of nymphs were infected with *B. burgdorferi*. There was a much lower infection prevalence found with the other pathogens (Table 25). Of the total *I. scapularis* tested, 70% of adult ticks and 32% of nymphs were infected with at least one disease agent while 24% of adult ticks and 5% of nymphs were coinfected with at least two disease agents. In addition, 84 adult (36 males and 48 females) *D. variabilis* ticks collected from Training Area 20/22 were tested for *F. tularensis* in 16 pools. Two of 16 (12.5%) pools were positive for *F. tularensis* giving a MIR of 2.4%.

Table 25. *Ixodes scapularis* infection prevalence by disease agent, Camp Ripley Training Center, Minnesota, 2018.

| **Disease Agent** | **Adults**<br>**# Positive/# Tested** | **Nymphs**<br>**# Positive/# Tested (%)** |
|---|---|---|
| *Borrelia burgdorferi* | 62/100 (65%) | 15/89 (16.9%) |
| *Anaplasma phagocytophilum** | 8/100 (8%) | 10/89 (11.2%) |
| *Ehrlichia muris eauclairensis* | 7/100 (7%) | 4/89 (4.5%) |
| *Babesia microti* | 17/100 (17%) | 3/89 (3.4%) |
| *Borrelia miyamotoi* | 4/100 (4%) | 1/89 (1.1%) |
| *Borrelia mayonii* | 0/100 (0%) | 0/89 (0%) |

* Human variant only (excludes other variants)

As in past years, MDH found evidence of established *I. scapularis* and *D. variabilis* populations at each of the sites visited within Camp Ripley during the tick collection effort. Within those populations, evidence of several different tick-borne disease agents have been documented in the past (see Appendix B). In this year's cohort of ticks, MDH found similar infection prevalence rates as in previous year's tick testing results, which was expected. Note that for *B. mayonii*, rates were 0% for nymphs and adults, which is similar to last year. However, low infection rates in this year's cohort of ticks may not necessarily be evidence of the pathogen's absence in the environment, but may much more likely be

due to normally low infection prevalence and small sample size. While infection prevalence may vary by year and site, the five year average of *B. burgdorferi* was 54.6% *I. scapularis* adult ticks and 24.8% *I. scapularis* nymphs to be infected *with B. burgdorferi* from 2014 to 2018 (Table 26). Other tick-borne disease agents have regularly been found in *I. scapularis* ticks collected from Camp Ripley but at lower infection prevalence. For instance, anaplasmosis is the second most commonly reported tick-borne disease in Minnesota and, on average, MDH has found that 14.4% of adult *I. scapularis* and 8.5% of *I. scapularis* nymphs to be infected with *A. phagocytophilum* in the same time period. This year, adult infection prevalence rates for *B. burgdorferi* (65%) and *B. microti* (17%) were noticeably higher than last year's rate and *A. phagocytophilum* was notably lower (8%); however, these rates did not differ greatly from the past five-year average (Table 26).

Table 26. *Ixodes scapularis* average infection prevalence by disease agent, Camp Ripley Training Center, Minnesota, 2014 – 2018.

| **Disease Agent** | **Adults**<br>**# Positive/# Tested** | **Nymphs**<br>**# Positive/# Tested (%)** |
|---|---|---|
| *Borrelia burgdorferi* | 291/533 (65%) | 70/282 (16.9%) |
| *Anaplasma phagocytophilum* | 77/533 (8%) | 24/282 (11.2%) |
| *Ehrlichia muris eauclairensis* | 42/533 (7%) | 10/282 (4.5%) |
| *Babesia microti* | 63/533 (17%) | 27/282 (3.4%) |
| *Borrelia miyamotoi* | 18/533 (4%) | 5/282 (1.1%) |
| *Borrelia mayonii* | 6/533 (0%) | 2/282 (0%) |

This was the second year that MDH has tested *D. variabilis* ticks for *F. tularensis*. Camp Ripley was one of 11 sites in Minnesota from which ticks were collected and tested in order to get a better understanding of the tick borne disease risk for tularemia across the state. Among all sites tested, the MIR varied significantly with a range of 0 – 5.4%. At Camp Ripley, this year's MIR was lower than last year's MIR (2.4% vs 7.2%), but MDH is still working to optimize *F. tularensis* testing and better understand the variation in infection prevalence across time and space in Minnesota. Further ecologic studies are needed to fully understand the importance of tick species in the maintenance and transmission of *F. tularensis* in Minnesota.

Based on MDH tick and mosquito findings, it is strongly recommend that military personnel and visitors at Camp Ripley take precautions against tick and mosquito bites:

- Repellents containing DEET (20 – 30%) or permethrin are safe and effective against both tick and mosquito bites. Other EPA-approved products, such as picaridin and IR3535, are also available.
- Perform thorough and systematic tick checks at least once a day after being in or near wooded or grassy areas. Ticks must be attached for at least 12-hours to spread anaplasmosis or 24-hours to spread Lyme disease so remove ticks as soon as possible, before they have a chance to spread a disease agent.

- Tumble dry clothing in a dryer on high heat for at least 10 minutes (or at least 60 minutes if wet) to kill any blacklegged (deer) ticks remaining on clothing. Longer dry times may be needed to kill American dog (wood) ticks.
- Watch for signs of vectorborne disease (e.g., rash, fever, headache, muscle/joint aches), especially from May through October, and talk to a doctor about possible exposure to ticks and mosquitoes if becoming ill.

## Vascular Plants

By Welby Smith, Minnesota Biological Survey, and Nancy J. Dietz, Minnesota Department of Natural Resources

### Moonwort (*Botrychium spp.*) Survey

Moonworts are "small (some species maximum size is four centimeters) and inconspicuous ferns that are difficult to find and easily overlooked" (MNDNR 2018a). Minnesota has 14 moonwort species that are state listed as either endangered, threatened or special concern. Camp Ripley has prospective habitat for several moonwort state special concern species. A species of special concern is "extremely uncommon in Minnesota or has unique or highly specific habitat requirements and deserves careful monitoring of its status. Species on the periphery of their range that are not listed as threatened may be included in this category along with those species that were once threatened or endangered but now have increasing or protected, stable populations" (MNDNR 2018b).

On June 18, Welby Smith, Mike Lee and Malcolm MacFarlane with the Minnesota Biological Survey searched portions of the Miller Airfield for *Botrychium campestre*, a rare fern with the common name prairie moonwort, a state special concern species. It normally occurs in dry, short-grass prairies, but the conditions that exist around the airfield seemed to be potential habitat. No prairie moonworts were found, although two other uncommon moonworts were found, least


*Pictured: Botrychium simplex*
*Source: Minnesota Department of Natural Resources*

moonwort (*Botrychium simplex*), a state special concern species, and *Botrychium tenebrosum* (no common name). Least moonwort prefers pasture, meadow and gravelly slope habitats (Chadde 2013). It is thought that a search in May rather than June might have a better chance of finding prairie moonwort. A return visit will be arranged in May 2019.

On July 3, Welby Smith returned to Camp Ripley to scout additional moonwort habitat. In particular, the wet prairie/meadow at the south end of Hole-in-the-Day marsh. It was rather late in the moonwort season, and, not surprisingly, no moonworts were found. But the habitat was thought promising and a return visit earlier in the season in 2019 is desirable.

## Tubercled Rein Orchid (*Platanthera flava var. herbiola*) Survey

Tubercled rein orchid is an unusual orchid that is found in the northeastern United States, and is either rare or threatened throughout a majority of its range. In 1984, Minnesota designated the species as state endangered, as only eight locations were known in the state. Since then additional locations have been discovered leading to the species being down-listed to threatened in 2013. Even though more locations have been found, its population trend is declining due to destruction of its prairie and wetland habitat (MNDNR 2018c).

*Pictured: Platanthera flava var. herbiola*
*Source: Minnesota Wildflowers*


"Moist or wet meadows or sunny swales in savannas," alder thickets, sedge meadows and moist sand prairies are its habitat (Chadde 2013; MNDNR 2018c). Tubercled rein orchid disappear if its habitat becomes completely shaded. Dormant season fires in the spring can result in tubercled rein orchid to improve above ground stems and productivity, a response that is rare among orchids. Once plants are above ground they can be severely damaged by fire; therefore, timing of spring burns is critical. If a prescribed burn occurs when plants are one to two inches above ground, the fire can cause harm to the population. Threats also include

drought, changes in water management, invasive plant species and increases in woody cover (MNDNR 2018c).

A visual encounter survey was conducted on July 3 on the south end of Hole-in-the-Day marsh by Welby Smith and Brian Dirks. The surveyors estimated 10,000 tubercled rein orchids in this previously known location. The population had expanded its original boundary. In Minnesota, Carlos Avery Wildlife Management Area also has a population of turbercled rein orchids; however Camp Ripley's population is denser and has higher quality habitat. Camp Ripley's tubercled rein orchid population is the largest in Minnesota (W. Smith, personal communication, July 3, 2018 and January 11, 2019).

# Land Use Management

## Army Compatible Use Buffer Program

By Josh Pennington, Minnesota Department of Military Affairs

### Introduction

The Department of Defense Authorization Act passed December 2, 2002, created 10 U.S.Code § 2684a – *Agreements to limit encroachments and other constraints on military training, testing and operations*, which authorizes a military installation to enter into an agreement with state, local government or private conservation organizations to limit encroachment on lands neighboring the installation. Subsequently, the Headquarters Department of the Army, Director of Training, issued guidance pursuant to a memorandum dated May 19, 2003, subject: *Army Range and Training Land Acquisitions and Army Compatible Use Buffers*. The memorandum defines the requirements of an Army Compatible Use Buffer (ACUB) proposal in order for an installation to execute any land acquisition.

### Purpose

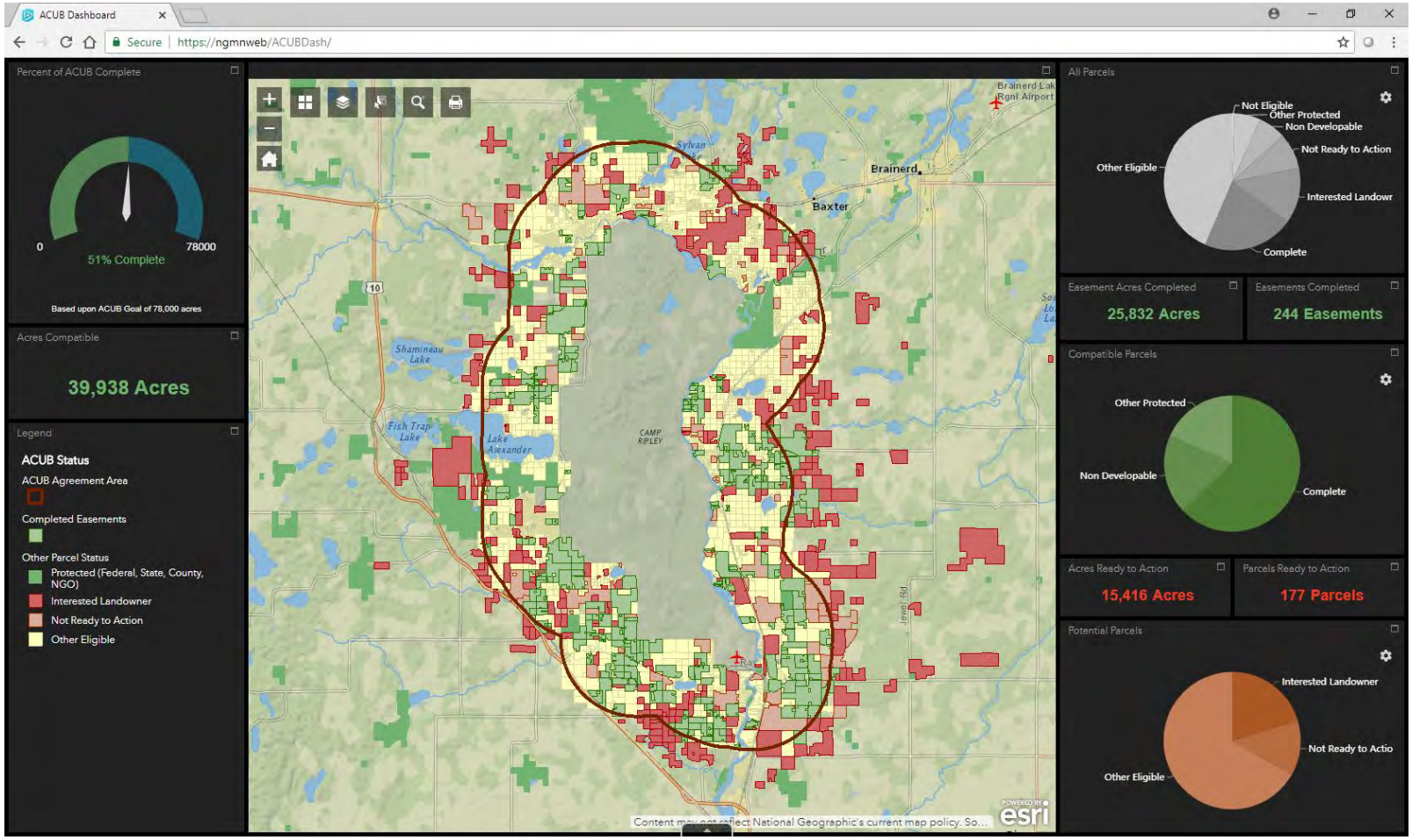
The purpose of the Camp Ripley Army Compatible Use Buffer (ACUB) program, known locally as Central Minnesota Prairie to Pines Partnership*,* is to create and enhance a natural undeveloped buffer around Camp Ripley by taking advantage of available opportunities to prevent encroachment and enhance conservation and land management. By securing a buffer, Camp Ripley can continue to offer and provide critically important, high quality military training and operations to ensure combat readiness, as well as mitigate community development encroachment around the installation. Through implementation of Camp Ripley's proposal, Camp Ripley will also be contributing to preserving the local heritage and enhancing a regional conservation corridor.

### Management

The ACUB dashboard, a new web-based geographic information system (GIS) management tool was developed to allow ACUB administrators simplified access to site specific parcel information within the ACUB agreement area surrounding Camp Ripley (Figure 39). The map interface allows for manual

inspection of parcels which are symbolized based upon an ACUB status. Information such as owner name, acres, ranking value, etc. can be referenced for each individual parcel. Specific parcels can also be located using the search tool and a standardized map can be exported based upon the current map extent. In addition to mapping capabilities, summarized program metrics are automatically tallied to show current status of key program measures. The capability to monitor near real-time updates has allowed ACUB administrators to expedite investigations of individual target areas as well as maintain a more comprehensive understanding of the landscape.

Figure 39. Army Compatible Use Buffer program GIS dashboard.



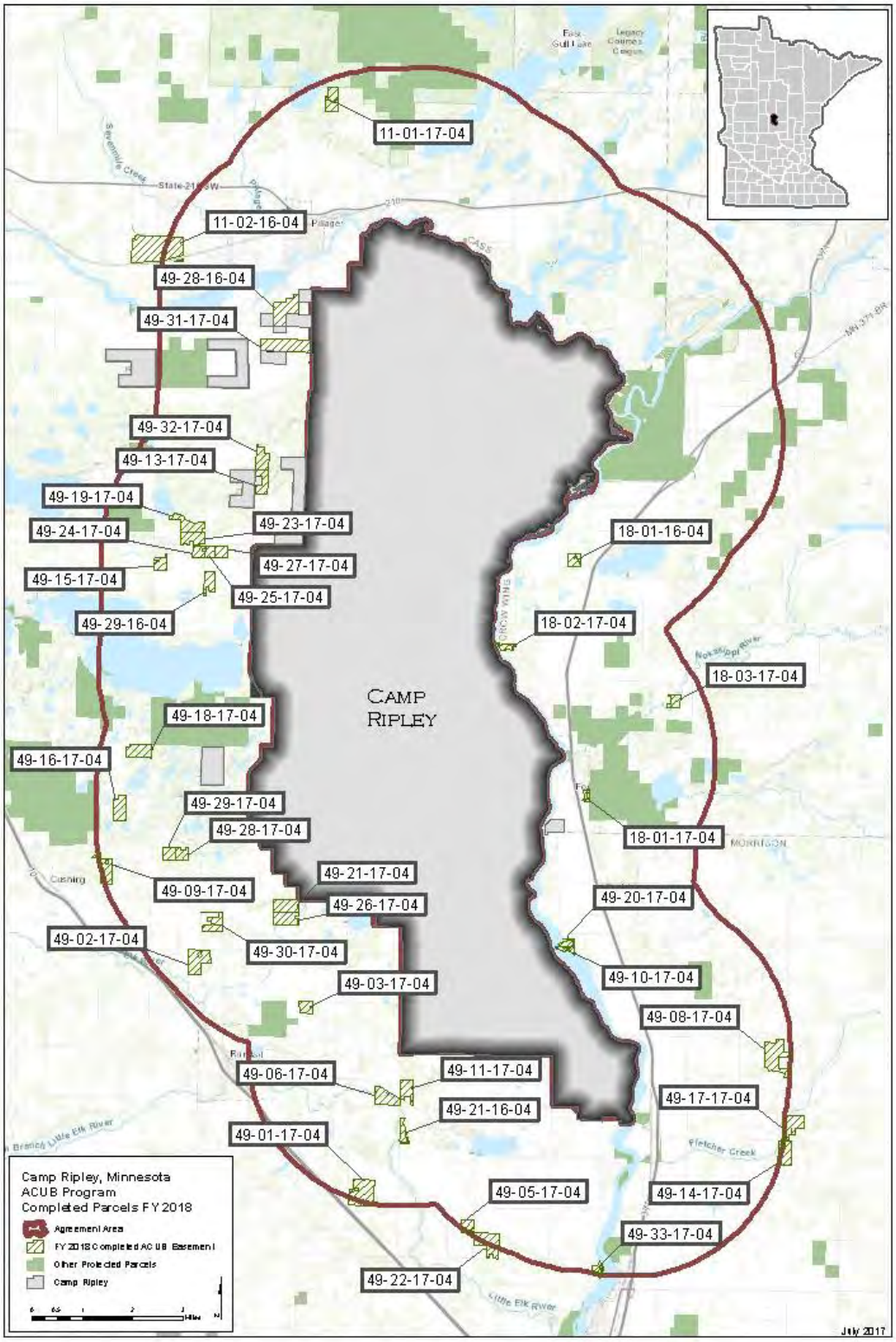
## Update

To date, Camp Ripley's ACUB program has attained 55% completion; 42,760 acres within the ACUB boundary have been identified as compatible with the program's overarching goal to protect 78,000 acres. Compatible acres include:

- Non-developable parcels (lakes, wetlands, roads)
- Federal, state, or county lands dedicated to ACUB
- Completed ACUB easements

Presently, 248 easements have been completed for eligible parcels within the ACUB boundary accounting for 26,304 acres. The Minnesota Board of Water and Soil Resources (BWSR) completed 39 conservation easements as a partner to the Camp Ripley ACUB, executing $1,858,673.78 in federal funds, leveraging $4,934,096.35 in matching partner funds that protected 2,331 acres (Figure 40). Another 177 interested landowners are enrolled in the program, accounting for 12,803 acres that have been identified as ready to action and awaiting funding. Camp Ripley's ACUB biennial review was conducted in October. Camp Ripley submitted an ACUB plan update to in August to the Army National Guard proposing to realign the ACUB boundary and cooperative agreement area to mitigate conflict from noise propagation associated with military training activities.

Figure 40. Completed ACUB conservation easements, Camp Ripley Training Center, Minnesota, fiscal year 2018.

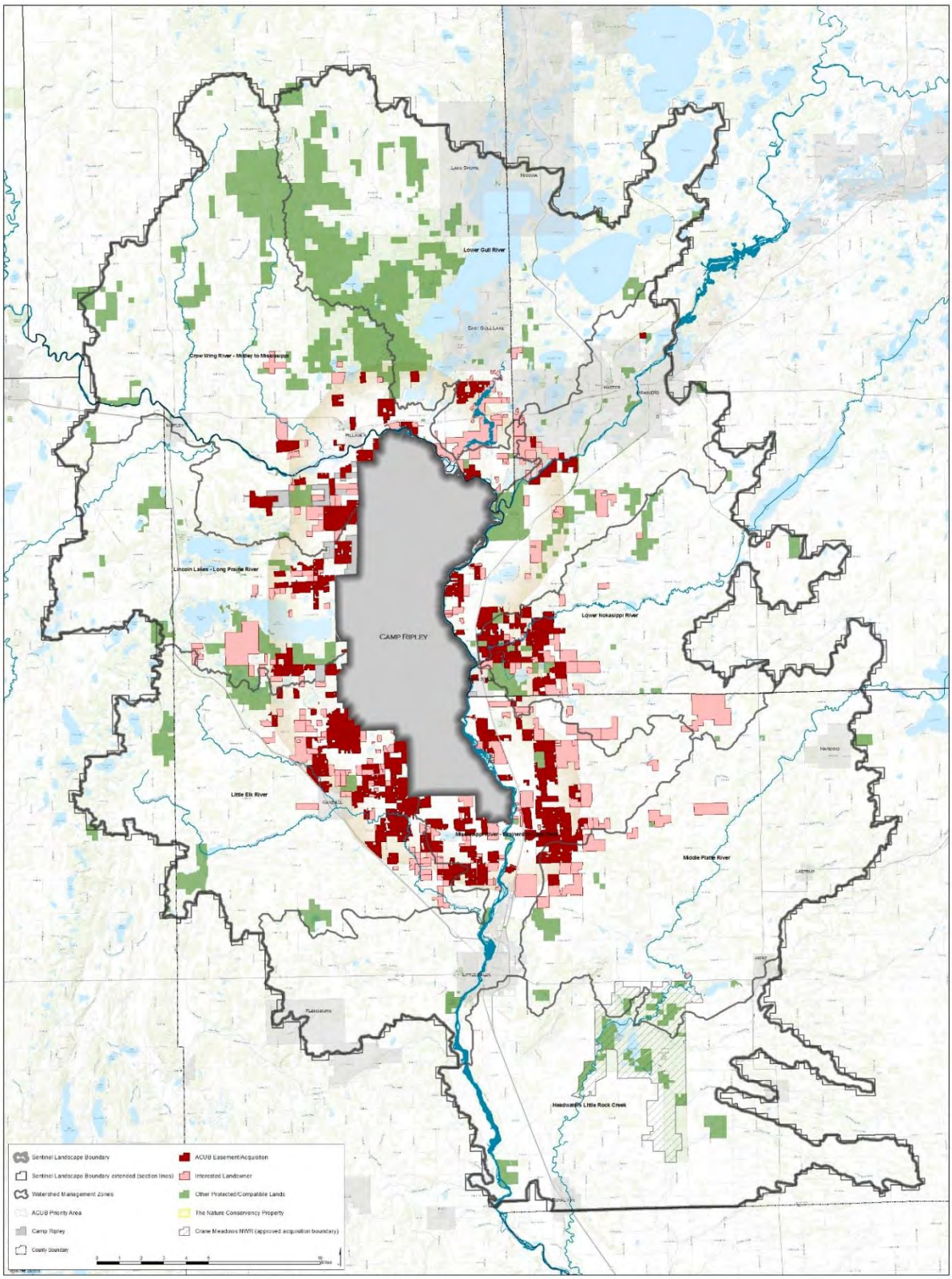


## Camp Ripley Sentinel Landscape

The Camp Ripley Sentinel Landscape includes 34 minor watersheds grouped into seven sub-watersheds, 40 miles of the Mississippi River, and the Crane Meadows National Wildlife Refuge. Thousands of acres of public and private conservation lands converge on the Camp Ripley Sentinel Landscape, which is also one of the state's most important source water protection areas for drinking water. While coordination across county and city boundaries has long been necessary to protect the quality of cross-border watersheds, the Camp Ripley Sentinel Landscape Partnership is leveraging broader support to protect and improve the quality of the region's soil and water resources. The Minnesota Forest Resource Council is working with landowners to implement forest stewardship plans within the Sentinel Landscape, while the Partners for Fish and Wildlife program administered by the U.S. Fish and Wildlife Service will work with private landowners to restore and enhance fish and wildlife habitat, wetlands, and pollinator habitat. These efforts are also resulting in additional opportunities for the community, including expanded trail, water, and natural area access for hunting, fishing, and recreation.

The Sentinel Landscape partnership at Camp Ripley will continue to coordinate and leverage the resources of the Department of Defense Readiness and Environmental Protection Integration Program, U.S. Department of Agriculture's Natural Resources Conservation Service, U.S. Fish and Wildlife Service, and U.S. Forest Service with state and local partners to advance the goals of the Camp Ripley Sentinel Landscape. Together, these actions will sustain area agriculture, protect the Mississippi River headwaters, and preserve a unique landscape that will allow Camp Ripley to continue to effectively train National Guard members for decades to come. Figure 41 illustrates the boundary of the Camp Ripley Sentinel Landscape.

Figure 41. Camp Ripley Sentinel Landscape boundary, Camp Ripley Training Center, Minnesota, 2018.



## Integrated Training Area Management

By Jason Linkert, Timothy Notch, Brian Sanoski, and Adam Thompson, Minnesota Department of Military Affairs

### Program Overview

The increased technology of military weapons and equipment along with the increased operational tempo in support of the global war on terrorism has placed more pressure on training lands. Past and continued degradation of natural resources can have a negative effect on the realism of future training exercises. To meet all environmental laws and regulations, the U.S. Army Construction Engineering Research Laboratory has developed the Integrated Training Area Management (ITAM) program. A report or overview of the ITAM program is documented annually to include all assessments, accomplishments and products purchased or produced from the preceding year. This plan is reviewed annually and revised as mission, accomplishments or environmental changes warrant. Major revisions are formally reviewed every five years to include changes to the introduction, ITAM program, goals and objectives, funding equipment, back log requirements and projected budget.

The ITAM program is a comprehensive tool that consists of five components necessary to maintain and improve the condition of natural resources. Funding requirements to implement the five components identified in the ITAM work plan are submitted to National Guard Bureau annually for validation. The five components are:

1. Range and Training Land Assessment
2. Land Rehabilitation and Maintenance
3. Training Requirements Integration
4. Sustainable Range Awareness
5. Geographic Information System

### Range and Training Land Assessment

The Range and Training Land Assessment (RTLA) is the component of the ITAM program that provides for the collecting, inventorying, monitoring, managing and analyzing of tabular and spatial data concerning land conditions on an installation. The RTLA provides data needed to evaluate the capability of training lands to meet multiple use demands on a sustainable basis. It incorporates a relational database and GIS to support land use planning decision processes. This data is intended to provide information to effectively manage land use, and natural and cultural resources.

The mission requirements of the military units training on Camp Ripley determine the focus of the RTLA program. It analyzes the training requirements and conducts assessments that evaluate the training lands ability to support those requirements. The results of RTLA provide treatment prescriptions

that are forwarded to the LRAM component for execution. The training requirements of Camp Ripley customers are determined using a multi-step process.

1. Review of the Range Facility Management Scheduling System and the Army Range Requirements Model to determine types of units utilizing Camp Ripley
2. Review of current tactics, techniques and procedures being used in theater for which areas soldiers utilize during training
3. Coordinate with units, range control and operations to refine and prioritize assessments

The process identified six major types of training conducted on Camp Ripley. While each type of training has its own unique requirements, they do share common characteristics that help form the mission-scape for each training type. The six training types are:

1. Field Artillery
2. Mechanized Maneuver
3. Engineer
4. Patrolling/Convoy Operations
5. Assembly Area/Bivouac
6. Light/Dismounted Infantry

Since the start of the global war on terrorism, added emphasis has been placed on patrol and convoy training by all units that utilize Camp Ripley; while bivouac and assembly area operations have decreased due to the increased reliance on forward operating bases in the theaters of operation and tactical training bases on the installation. As operations overseas are reduced, a return to the "traditional" training seen before the global war on terrorism will increase the importance of assembly area and bivouac operations.

To support the mission-scape requirements, RTLA currently being conducted includes:

1. Annually assess Camp Ripley's maneuver trails to ensure safe travel by all vehicles (also known as LRAM assessment)
2. Assess the quality and sustainability of artillery firing points
3. Assess woody vegetation and safety hazards in open maneuver areas
4. Assess forest structure and condition for maneuver corridors in Maneuver Area K1
5. Assess site condition and usage of eight observation points
6. Monitor the maneuverability of Camp Ripley's land navigation courses
7. Assess maneuver training areas for historic and potential training or safety hazards
8. Measure visibility through the underbrush of mature forests
9. Maintain 14 Landing Zone/Pick-Up Zone for woody encroachment and maneuver damage

RTLA Results

**Maneuver Trails**. The north half of Camp Ripley was assessed for maneuver training damage. A total of 89 sites have been identified for repair.

**Artillery Points**. A total of 24 (Set A) field artillery firing points were assessed. Sites were assessed on 10 pre-selected attributes such as encroachment, maximum slope and surface-danger zone training conflicts. Each site was given a red, amber or green rating with green being the most suitable land condition for field artillery. Ten firing points scored red and required immediate treatment to remain serviceable as firing points. To avoid future loss of available lands for artillery training it is recommended that a more frequent prescribed fire regime be implemented and fire treatments be allowed to burn into the forest edge to discourage future encroachment.

**Open Maneuver**. All open maneuver areas (350 acres) are assessed annually for woody encroachment, ingress/egress and maneuver damage. Assessments revealed once a year mowing regime for is ample to maintain these open areas. To reduce training hazards rock piles and boulders need to be removed from open maneuver areas. Maneuver damage from tracked vehicles was disked and areas of disturbance were reseeded to promote native vegetation.

**Maneuver Corridor**. Maneuver corridors were assessed by CRE. A spring prescribed burn was completed for the grassland portion of the maneuver lanes to invigorate the native vegetation. Maneuver trails were constructed on the forested edge by ITAM personnel due to the steep topography of the corridor and concerns over protecting the integrity of the forested islands from prescribed fire effects. Hazard trees were also removed from the interior maneuver trails. Woody encroachment on the grassland portion of the corridor was also treated using a carbide head and a follow up treatment of the broadleaf herbicide triclopyr.

**Observation Points.** All observation points were assessed. Completed work included repairing maneuver damage on the ingress and egress roads and trails. Observation Point 1.5 required tree removal to open up the canopy for better communications and a bivouac area was established. Assessments indicated no immediate vegetative repair work or improvements were required to maintain existing observation points.

**Land Navigation**. B-5 Land Navigation Course was assessed for snag density and ease of traverse. Areas of dense snags and brush are noted along transects randomly distributed throughout the course. Movement throughout B-5 was graded easy-moderate (some brush density), and there were 4 – 6 snags identified requiring further mitigation.

**Hazards and Artifacts**. Maneuver Area B (~3,950 acres) was assessed for historical training and farm artifacts. Random transects were traversed in designated training areas to locate any hazard to troop training. No sites were identified which posed an immediate hazard.

**Forest Understory**. Training Areas 16, 24, 25, 26, 27 and 35 were assessed using 109 random points. A Visual Signal-17 panel was placed at the assessment points and a photograph taken 50 meters away. Each photograph was rated on a 1 – 5 scale with 1 indicating the panel was completely obscured and 5 denoting that the panel was fully visible. Thirty of the 109 plots were denoted as "1" or completely obscured. Future mitigation of these areas may include chemical or mechanical control of vegetation.

**Helipads**. Fourteen helipads were reviewed to meet end user requirements for training. Helipads require 1,000 feet by 1,500 feet of open space free of woody vegetation and maneuver damage. Mowing four times a year meets training objectives to support end user requirements. Maneuver damage repair was required on five helipads that posed an immediate hazard to training.

## Land Rehabilitation and Maintenance

Land Rehabilitation and Maintenance (LRAM) is an ongoing program whereby erosion control measures and good vegetation management practices are employed to maintain and stabilize the soil. LRAM is the component of the ITAM program that provides a preventive and corrective land rehabilitation and maintenance procedure to reduce the long-term impacts of training on Camp Ripley. LRAM uses technologies such as re-vegetation and erosion control techniques to maintain soils and vegetation required to support Camp Ripley's mission. These specifically designed efforts help to maintain Camp Ripley as a quality military training site and subsequently minimize long-term costs associated with land rehabilitation. LRAM includes programming, planning, designing and executing land rehabilitation, maintenance and reconfiguration projects based on requirements and priorities identified in the Training Requirements Integration and RTLA components of the ITAM program. A key component of the LRAM program is an annual assessment that is conducted to document LRAM needs attributable to past years activities.

## LRAM Results

The LRAM program accomplished the following work:

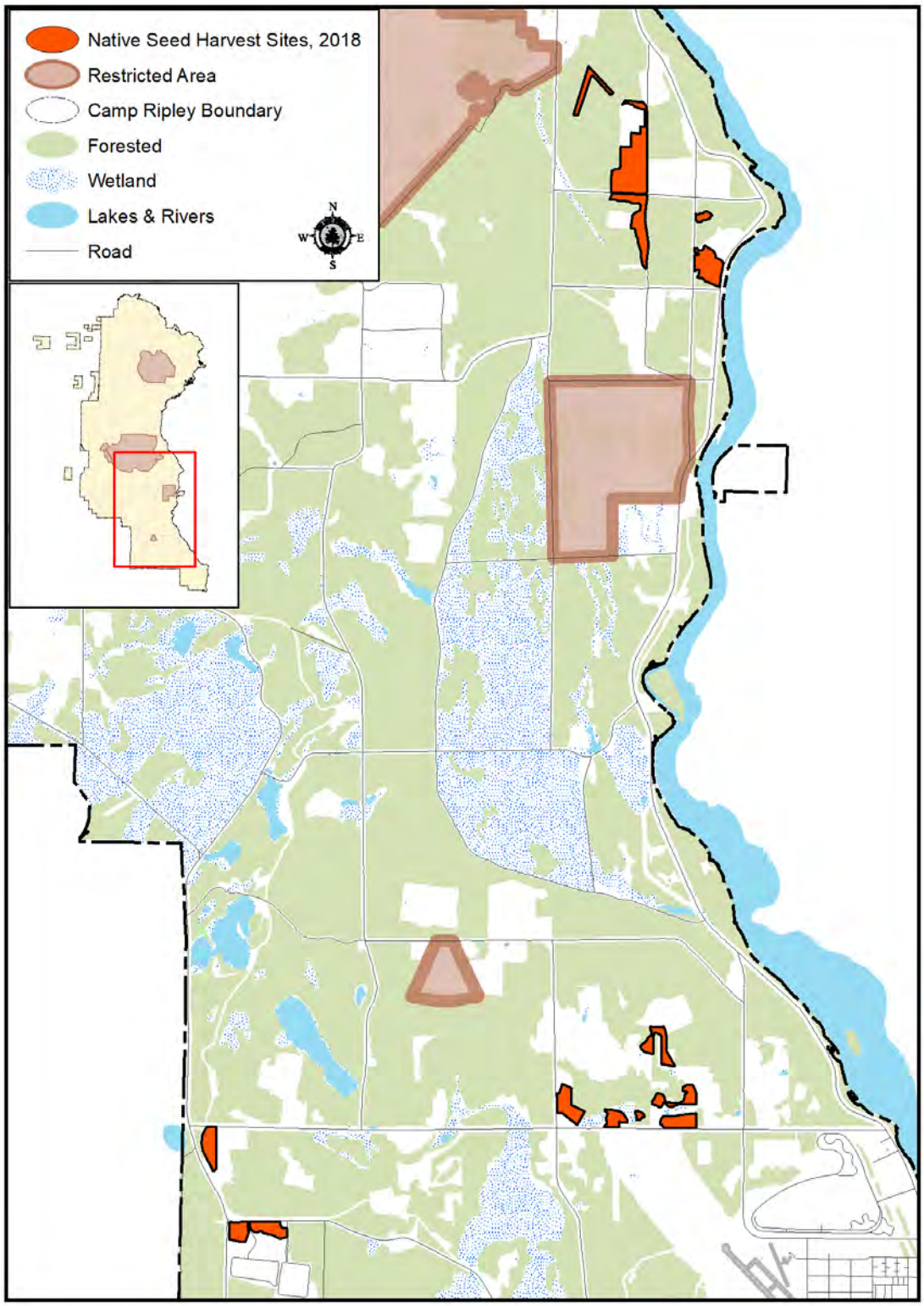
1. Repaired all 115 sites identified in the 2017 maneuver trail assessment.
2. Continued management on prior year firing points in Training Areas 21, 22, 26, 29, 4, 18, 20, 50, 2, 33, 30 and 32. The 433.2 acres of treatments included woody encroachment removal, stumping and grubbing, native grass seeding, erosion control, maneuver damage repair, and herbicide treatment. Maintenance is conducted to improve firing point sight to crest.
3. A total of 305.5 acres of open maneuver lands were mowed using a batwing mower and tractor. Eighty-four acres of maneuver damage repair was restored back to native vegetation.

4. Fourteen helipads were mowed four times during the summer growing season totaling 21.6 acres. Five helipads received treatment for maneuver damage.
5. Thirty-two acres of the maneuver corridors received chemical application to control woody encroachment. Snags were removed and maneuver trails were constructed on the grassland edges to preserve the integrity of the forested islands for training concealment.
6. Fifty acres were mowed using a batwing mower and tractor to support battalion level bivouac.
7. Historical hazard assessments discovered no further mitigation.
8. Hydro-seeded land navigation assembly areas, water basin, tower pad, maneuver trails for access to Center Range, Y-2 bivouac site, off-installation parking areas and Arno Bypass.
9. Repaired approximately 847 acres of maneuver damage during the summer annual training period in Training Areas 41, 42, 49, 52, 54, 55, 57, 58, 61, 63, 64, 68, 69, 70, 71, 72, 78, 79 and 80.
10. Harvested 2,750 pounds of native grass seed (big bluestem, little bluestem, Indian grass, gramma and switch grass) on 125.5 acres for future use on disturbed training areas (Figure 42).
11. Improvement of 0.36 miles maneuver trail network to provide access around Arno Drop Zone when alternate access is inaccessible.
12. Restored an additional 5.0 acres of brome grass into native pollinator habitat adjacent to 5.4 acres completed in 2017.

## Training Requirements Integration

Training Requirements Integration (TRI) is a program developed to integrate the training mission with natural resources requirements. TRI is the component of the ITAM program that provides a decision support procedure that integrates training requirements with land management, training management, and natural and cultural resources management. The integration of all requirements occurs through continuous consultation between operations, range control, natural and cultural resources managers and other environmental staff members, as appropriate. The Integrated Natural Resource Management Plan and ITAM work plan are documents that require TRI input. The ITAM work plan is a web-based program recorded in the Range Complex Master Plan (RCMP) annually.

Figure 42. Native seed harvest sites, Camp Ripley Training Center, Minnesota, 2018.



## Sustainable Range Awareness

Sustainable Range Awareness (SRA) is the component of the ITAM Program that provides a means to develop and distribute educational materials to land users. Materials relate procedures for sound environmental stewardship of natural and cultural resources and reduce the avoidable impacts. The SRA intent is to inform land users of restrictions and activities, and to avoid and prevent damage to natural and cultural resources. The SRA component applies to soldiers, installation staff and other land users.

The SRA component purchases 10,000 updated laminated Camp Ripley soldier field cards every other year. The field cards have proven to be very popular with the installations' customers and include information on the back side that supports sustainable land use. Additional field cards will be updated and purchased in 2019 to support map requests and educate end users on Camp Ripley. Annual ITAM accomplishments are published in the local newspaper circular. Additional brochures, pamphlets and maps are produced and distributed annually for further educational uses and per soldier request to support training missions.

## Geographic Information System

By Craig Erickson and Lee Anderson, Minnesota Department of Military Affairs

As a component of both the CRE and ITAM programs, a geographic information system (GIS) is used to support management of those programs and is subsequently used to implement related resource management plans. This decision support tool is maintained to adapt with end user needs whether used for data development, maintenance, analysis, display or cartographic production. Continuous coordination with program support staff, other directorates, departments and external entities is required to ensure the most accurate and complete geospatial data is available.

Program coordination both within MNARNG and Army National Guard is facilitated through working groups. In addition, there is routine interaction between GIS specialists and Range Control, Facilities Management Office Design, Department of Public Works and the Joint Operations Center. At the federal level the Environmental Advisory Committee (EAC) sponsors a GIS/Automation Committee. This group is made up of 10 state GIS representatives, to include a representative from Minnesota, the Army National Guard – Installations & Environment (ARNG – I&E) GIS Manager and an EAC representative who functions as the working group chair.

CRE, ITAM, Facilities Management, Information Technology (J6) and Operations (J3) are the core program areas supporting GIS within the MNARNG. The established coordination between these areas has led to an expanded use of GIS in support of other program areas as well. These areas include family assistance, recruiting and retention, Personnel (J1), logistics and public safety. Although not specific to this document it should be noted that CRE GIS specialists also support those efforts outside primary program areas.

The use of consistent datasets and products across common geographic areas (i.e., Camp Ripley and Arden Hills Army Training Site) as well as the required integration between range management and environmental sustainability initiatives has inherently lead to shared efforts regarding GIS support for CRE and ITAM programs. As a result, designating specific efforts between these two program areas is not always clear-cut. Therefore, for the sake of simplified reporting, GIS accomplishments and management efforts listed in this section include support beyond the ITAM program.

## Data Management

Several MNARNG GIS goals and objectives are defined by federal, Army and National Guard Bureau regulations that govern management of GIS. These regulations pertain to data standardization and conceptual design of the system. The goal is to coordinate data and GIS structure within the states as well as nationally. This coordination and standardization is necessary to keep state and federal efforts synchronized. In accordance with these regulations, environmental related data layers within the MNARNG GIS repository are compliant with the Spatial Data Structure for Facilities, Installations and Environment (SDSFIE) version 3.1 as well as federal Geographic Data Committee metadata standards.

To support visibility and analysis efforts, standardized geospatial data layers are submitted annually to the Department of the Army and Army National Guard. Specific to ARNG – I&E are the Common Installation Picture (CIP) layers. The Army Sustainable Range Program (SRP) also has requirements for annual data submissions. These requirements initiate a review of current data layers and coordination with subject matter experts to ensure spatial and attribute data is current, accurate, properly documented and compliant with CIP and SRP Quality Assurance Plans (QAP). In addition to those submissions, there is continued development and maintenance of geospatial data layers based upon MNARNG business needs.

## End User Support

The GIS program accomplished the following work:

- Development of ACUB dashboard (see pg. 118 for more information)
- Army Compatible Use Buffer support
- Sentinel Landscape initiative support
- Range Complex Master Plan update
- Range data collection in support of QAP revisions
- Range reconciliation between Planning Resource Infrastructure Development and Evaluation (PRIDE), Range Facility Management Scheduling System (RFMSS) and GIS
- Fire unit review and map updates
- Camp Ripley and AHATS events (hunts, fishing, races and other outreach)
- Plans and reports

Custom maps (hard copy and digital) continue to be the primary GIS product.

- Total maps: 1,055 (does not include report graphics)

All production data has been maintained to SDSFIE and QAP (CIP and SRP) standards.

## Information Technology Coordination

The J6 (Information Technology) directorate is responsible for essential components of GIS which includes hardware, software and network support for the MNARNG. With the Department of Defense's continued pursuit to strengthen its cybersecurity posture, general users are no longer able to manage these components. In order to obtain necessary permissions and priority to maintain core components of the GIS, CRE GIS specialists function as a liaison with the J6 Directorate.

Through this relationship GIS has become more integrated with core J6 capabilities and infrastructure. This has also streamlined the approval process for GIS software updates and has provided a J6 point of contact for resolving GIS related software issues. As cybersecurity requirements increase, the position is also critical to mitigate potential GIS-related issues which may result from changes to the information technology environment.

CRE GIS staff with privileged level permissions are also required to support web-based applications. The ability to disseminate a web-based interface to interact with data from multiple program areas and sources is a powerful capability of this technology and it will continue to expand within the MNARNG. Understanding data sources and limitations are essential for reliable analysis and information sharing through web applications; as are application development capabilities for improvement of tools and interfaces to present data for specific user needs. This will require continued integration and support between J6 and CRE GIS staff.

Four production GIS databases (gER, gINST, gIMG and gMN) reside on J6 production servers. In addition, network storage space has been designated as GIS workspace to better organize GIS project files across multiple functional areas and allow for simplified sharing of projects and project specific data. The integration of GIS data and applications onto J6 systems also allows CRE to take advantage of in-place continuity of operations and fail over procedures. In addition, it reduces the overhead of hardware costs and maintenance for CRE and ITAM as well as the other program areas using the system.

# Outreach and Recreation

By Jake Kitzmann, Minnesota Department of Military Affairs

One of Camp Ripley's missions is to add value to the community. The conservation team does this by being active in many special events. Camp Ripley is a valuable asset to the local community and the state of Minnesota. It is important that Camp Ripley, in particular the conservation team, be interactive with the citizens of our community and the state of Minnesota. Over the past year, the conservation team has helped implement activities such as the Morrison County Water Festival, Earth Day and National Public Lands Day.

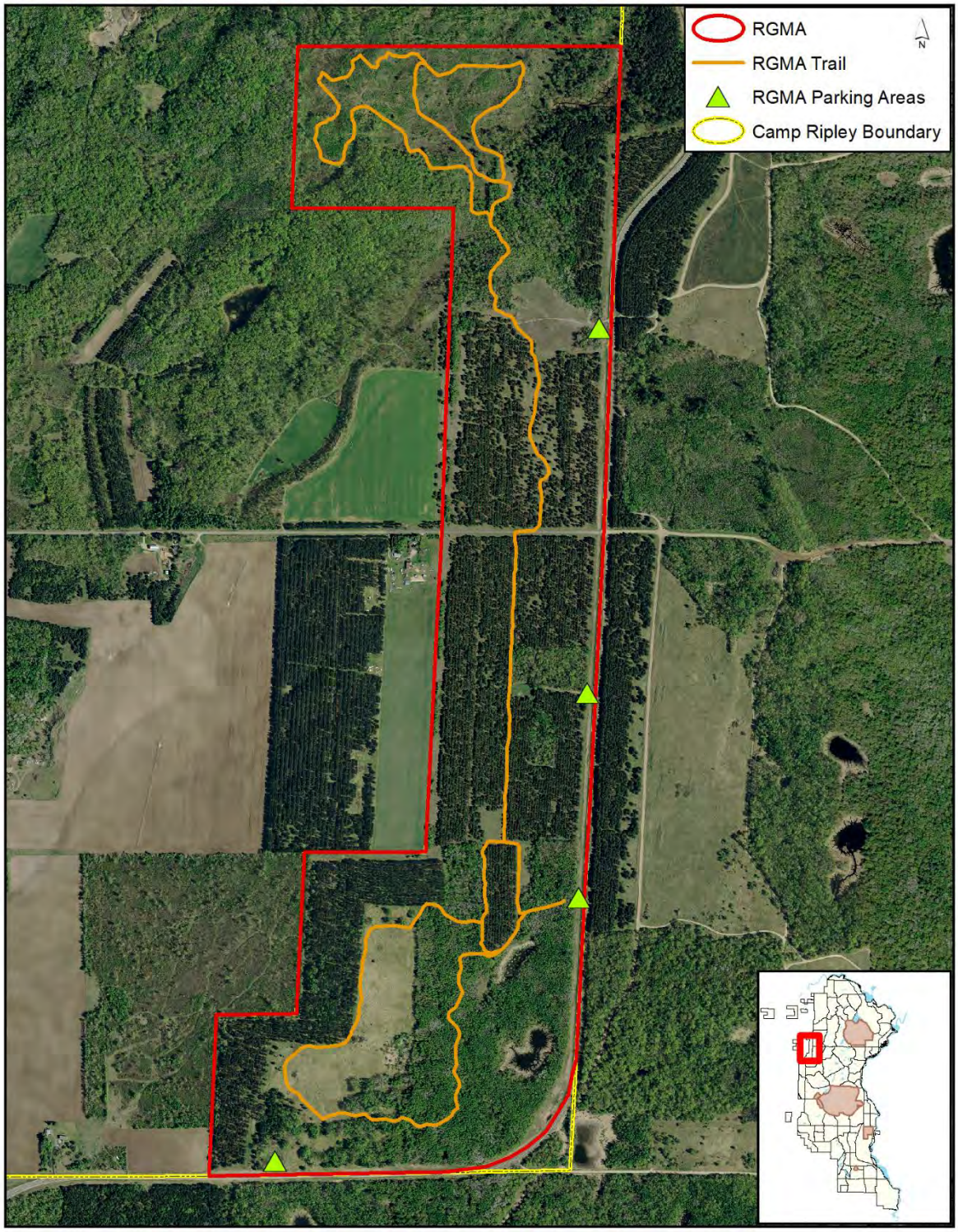
Camp Ripley Environmental manages approximately 1,700 acres of land that are noncontiguous to the main body of the installation. These parcels are not used for training and are open to the public for hunting and outdoor recreation. In July, a memorandum of understanding was developed between the Minnesota Department of Military Affairs and the Ruffed Grouse Society to share resources and management of a 382 acre parcel. On August 29, the parcel was formally designated as a state Ruffed Grouse Management Area to be managed in cooperation with the DNR, Ruffed Grouse Society, Minnesota Deer Hunters Association and Pillager High School. The goal of the management on this parcel will be to improve ruffed grouse and woodcock habitat through the creation of young forest. CRE also created 4.5 miles of hunter walking trails and one new parking area on the parcel to encourage public access to the site (Figure 43). Planned future projects include emplacement of interpretative signage, timber harvests and planting of wildlife friendly tree and shrub species.

Earth Day activities were held on May 16, and consisted of activities for Camp Ripley employees to actively engage with their environment. Activities included litter pick-up, tree planting, and clearing of trails. Approximately 500 white pine trees were planted in cooperation with Minnesota Power. An ALLETE company, and the Rajala Woods Foundation.

On October 4, Camp Ripley in cooperation with Jack Pine Brewery and the Rajala Woods Foundation, hosted the first annual Drink a Pint Plant a Pine event at the Viking Club on Camp. Jack Pine Brewery and Starry Eyed Brewing donated beer to the event and proceeds totaling $960.00 from the sale of these craft brews was donated to the Raja Woods Foundation to be used for planting long lived tree species within the Camp Ripley Sentinel Landscape.

The Morrison County Water Festival was held on September 18 – 19 and is a partnership between Morrison County, the Morrison Soil and Water Conservation District, the city of Little Falls, the DNR, the U.S. Fish and Wildlife Service and Camp Ripley. This event brings hundreds of fifth-graders from Morrison County to Camp Ripley for a series of educational events hosted by natural resource professionals.

Figure 43. Ruffed Grouse Management Area, Camp Ripley Training Center, Minnesota, 2018.



Camp Ripley was awarded $8,000 from the National Environmental Education Foundation for National Public Lands Day. On September 22, volunteers from the Minnesota Master Naturalist program assisted in removing non-native species from a 17.5-acre native prairie restoration site. A native seed mix (Table 27) and 576 locally sourced forbs were also purchased with this grant to expand upon restoration efforts from 2017.

*Pictured: National Public Lands Day volunteers at Camp Ripley Training Site, Minnesota, 2018.*

CRE hosted and participated in several canoeing events on the Mississippi River. The environmental office partnered with the Mississippi River Headwaters Board for a public event and hosted a private event for Camp Ripley employees.

CRE has been a long-term partner with various educational institutions within the state. The CRE team has been involved in local high school job shadow programs. Partnering with local colleges has not only been beneficial to the students but the conservation program as well. Along with internships and job shadow opportunities, CRE partnered with the Pillager High School to create and install quick response (QR) code enabled signs on the newly designated Camp Ripley Ruffed Grouse Management Area. These signs will guide hunters to informational websites about young forest management and its benefit to wildlife species.

Camp Ripley is also available for environmental presentations and tours. Using the Martin J. Skoglund Environmental Classroom has been a great way to introduce students to conservation and hands-on science. The CRE team gave 70 presentations, tours and briefs to 5,448 people entailing more than 256 staff hours.

Table 27. Prairie restoration site native grass and forb species, Camp Ripley Training Center, Minnesota, 2018.

| Common name | Scientific name |
|---|---|
| **Forbs** | |
| Alum root | *Heuchera richardsonii* |
| Azure aster | *Symphyotrichum oolentangiense* |
| Black-eyed Susan | *Rudbeckia hirta* |
| Butterfly milkweed | *Asclepias tuberosa* |
| Canada milk vetch | *Astragalus canadensis* |
| Canada tick trefoil | *Desmodium canadense* |
| Columbine | *Aquilegia canadensis* |
| Common milkweed | *Asclepias syriaca* |
| Common ox-eye | *Heliopsis heianthoides* |
| Cylindric blazing star | *Liatris cylindracea* |
| Fragrant giant hyssop | *Agastache foeniculum* |
| Golden alexanders | *Zizia aurea* |
| Gray goldenrod | *Solidago nemoralis* |
| Harebell | *Campanula rotundifolia* |
| Hoary vervain | *Verbena stricta* |
| Leadplant | *Amorpha canascens* |
| Long-headed coneflower | *Ratibida columnifera* |
| Meadow blazing star | *Liatris ligulistylis* |
| Mountain mint | *Pycnanthemum virginianum* |
| Narrow-leaved coneflower | *Echinacea angustifolia* |
| Northern bedstraw | *Galium boreale* |
| Partridge pea | *Chamaecrista fasciculata* |
| Pasque flower | *Anemone patens* |
| Prairie blazing star | *Liatris pycnostachya* |
| Prairie dropseed | *Sporobolus heterolepis* |
| Prairie onion | *Allium stellatum* |
| Prairie phlox | *Phlox pilosa* |
| Prairie smoke | *Geum triflorum* |
| Prairie spiderwort | *Tradescantia bracteata* |
| Prairie violet | *Viola pedatifida* |
| Purple prairie clover | *Dalea purpurea* |
| Pussytoes | *Antennaria neglecta* |
| Rough blazing star | *Liatris aspera* |
| Round-headed bushclover | *Lespedeza capitata* |
| Showy goldenrod | *Solidago speciosa* |
| Showy milkweed | *Asclepias speciosa* |
| Showy penstemon | *Penstemon grandiflorus* |

| Table 27. Prairie restoration site native grass and forb species, Camp Ripley Training Center, 2018. | |
|---|---|
| **Common name** | **Scientific name** |
| Slender beardtongue | *Penstemon gracilis* |
| Slender wheat grass | *Elyms trachycaulus* |
| Smooth blue aster | *Symphyotrichum laevis* |
| Spotted bee balm | *Monarda punctata* |
| Stiff goldenrod | *Solidago rigida* |
| Stiff sunflower | *Helianthus pauciflorus* |
| Stiff tickseed | *Coreopsis palmata* |
| Thimbleweed | *Anemone cylindrica* |
| White prairie clover | *Dalea candida* |
| Wild bergamot | *Monard fistulosa* |
| Wild lupine | *Lupinus perennis* |
| Yarrow | *Achillea millefolium* |
| **Grasses** | |
| Bicknell's sedge | *Carex bicknellii* |
| Blue grama | *Bouteloua gracilis* |
| June grass | *Koeleria macrantha* |
| Little bluestem | *Schizachyrium scoparium* |
| Poverty oat grass | *Danthonia spicata* |
| Side oats grama | *Bouteloua curtipendula* |

## Hunting Programs

### Disabled American Veteran Firearms Wild Turkey Hunt

Camp Ripley hosted the 14th annual Disabled Veteran turkey hunt May 2 – 3. Beautiful mid-spring conditions welcomed the hunters this year. The hunt was again organized and conducted by the Veterans Administration with support from CRE and the DNR. Thirty hunters participated in this year's turkey hunt, harvesting 14 birds (Table 28).

Table 28. Disabled American Veteran spring wild turkey hunt, Camp Ripley Training Center, Minnesota, 2005 – 2018.

| Year | Turkeys Harvested | Hunter Success | Permits Issued | Number of Hunters | Dates | Largest Turkey (lbs.) |
|---|---|---|---|---|---|---|
| 2005 | 11 | 58% | 22 | 19 | May 3 – 4 | 24 |
| 2006 | 12 | 48% | 27 | 25 | April 25 – 26 | 22.5 |
| 2007 | 15 | 52% | 31 | 29 | April 25 – 26 | 23.5 |
| 2008 | 27 | 75% | 39 | 36 | April 23 – 24 | 23.8 |
| 2009 | 23 | 66% | 40 | 35 | April 22 – 23 | 23.6 |
| 2010 | 15 | 40% | 40 | 37 | April 21 – 22 | 24.6 |
| 2011 | 16 | 46% | 40 | 35 | April 20 – 21 | Unknown |
| 2012 | 19 | 50% | 40 | 38 | April 25 – 26 | Unknown |
| 2013 | 12 | 38% | 40 | 32 | April 24 – 26 | Unknown |
| 2014 | 5 | 14% | 40 | 36 | May 4 – 6 | 23.5 |
| 2015 | 10 | 31% | 35 | 31 | May 4 – 6 | 22.2 |
| 2016 | 14 | 42% | 37 | 33 | May 3 – 5 | Unknown |
| 2017 | 12 | 40% | 38 | 30 | May 3 – 5 | 22 |
| **2018** | **14** | **46%** | **40** | **30** | **May 2 – 3** | **Unknown** |
| | | | | | | |
| **Total** | **205** | | **509** | **446** | | |
| **Average** | **15** | **46%** | **37** | **32** | | |

## Soldier Firearms Wild Turkey Hunt

Camp Ripley hosted its 10th annual soldier turkey hunt on May 7 – 8 and May 14 – 15. The hunt was organized and conducted by the CRE office. This hunt was organized into two, two-day hunt periods (Table 29).

Table 29. Soldier firearms wild turkey hunt, Camp Ripley Training Center, Minnesota, 2009 – 2018.

| Year | Turkeys Harvested | Hunter Success | Permits Issued | Number of Hunters | Dates | Largest Turkey (lbs.) |
|---|---|---|---|---|---|---|
| 2009 | 18 | 64% | 45 | 28 | April 27 – 29 | 23.8 |
| 2010 | 25 | 53% | 60 | 47 | April 26 – 28 | 25.5 |
| 2011 | 27 | 46% | 86 | 58 | April 25 – 26<br>April 28 – 29 | 23.4 |
| 2012 | 27 | 53% | 86 | 53 | April 30 –<br>May 1 | 23.5 |
| 2013 | 30 | 57% | 92 | 52 | April 29 – 30<br>May 2 – 3 | 24.86 |
| 2014 | 29 | 47% | 70 | 62 | May 1 – 2 | 24.3 |
| 2015 | 22 | 41% | 100 | 53 | April 30 – May1<br>May 7 – 8 | 22.7 |
| 2016 | 26 | 51% | 98 | 51 | April 28 – 29<br>May 9 – 10 | 23 |
| 2017 | 24 | 44% | 104 | 54 | April 24 – 25 and<br>May 15 – 16 | 22.5 |
| **2018** | **21** | **62%** | **82** | **34** | **May 7 – 8 and<br>May 14 – 15** | **23.25** |
| | | | | | | |
| **Total** | **228** | | **823** | **492** | | |
| **Average** | **24.9** | **52%** | **82.3** | **49.2** | | |

## Disabled American Veterans Firearms White-tailed Deer Hunt

The 27th annual Disabled American Veteran firearms white-tailed deer hunt on Camp Ripley was held October 10 – 11. This year, 38 hunters participated and eight deer were harvested (Table 30).

Table 30. Disabled American Veteran firearms white-tailed deer hunt, Camp Ripley Training Center, Minnesota, 1992 – 2018.

| Year | Deer Harvested | Hunter Success | Bucks | Does | Fawns | Permits Issued | Number of Hunters | Dates | Largest Deer (lbs.) |
|---|---|---|---|---|---|---|---|---|---|
| 1992 | 7 | 37% | 4 | 2 | 1 | 19 | 19 | Oct. 14 – 15 | 152 |
| 1993 | 11 | 35% | 5 | 4 | 2 | 31 | 31 | Oct. 13 – 14 | 132 |
| 1994 | 14 | 35% | 3 | 3 | 8 | 42 | 40 | Oct. 12 – 13 | 185 |
| 1995 | 6 | 15% | 1 | 5 | 0 | 40 | 39 | Oct. 11 – 12 | 142 |
| 1996 | 9 | 23% | 3 | 4 | 2 | 40 | 39 | Oct. 9 – 10 | 132 |
| 1997 | 9 | 23% | 2 | 2 | 5 | 40 | 38 | Oct. 8 – 9 | 152 |
| 1998 | 11 | 30% | 2 | 5 | 4 | 39 | 37 | Oct. 7 – 8 | 129 |
| 1999 | 8 | 23% | 4 | 3 | 1 | 38 | 35 | Oct. 6 – 7 | 137 |
| 2000 | 14 | 37% | 5 | 5 | 4 | 40 | 38 | Oct. 4 – 5 | 181 |
| 2001 | 4 | 11% | 1 | 1 | 2 | 45 | 38 | Oct. 10 – 11 | 123 |
| 2002 | 12 | 26% | 3 | 8 | 1 | 46 | 46 | Oct. 9 – 10 | 144 |
| 2003 | 10 | 20% | 4 | 6 | 0 | 50 | 48 | Oct. 8 – 9 | 160 |
| 2004 | 15 | 33% | 6 | 7 | 2 | 48 | 45 | Oct. 6 – 7 | 184 |
| 2005 | 12 | 24.5% | 3 | 7 | 2 | 52 | 49 | Oct. 5 – 6 | 152 |
| 2006 | 9 | 19.5% | 2 | 6 | 1 | 50 | 46 | Oct. 4 – 5 | 146 |
| 2007 | 18 | 31% | 7 | 8 | 3 | 59 | 59 | Oct. 3 – 4 | 168 |
| 2008 | 9 | 16% | 2 | 6 | 1 | 58 | 53 | Oct. 8 – 9 | 180 |
| 2009 | 13 | 25% | 5 | 4 | 4 | 55 | 52 | Oct. 7 – 8 | 174 |
| 2010 | 8 | 12% | 2 | 5 | 0 | 60 | 55 | Oct. 6 – 7 | 123 |
| 2011 | 12 | 20% | 3 | 9 | 0 | 60 | 59 | Oct. 5 – 6 | 170 |
| 2012 | 9 | 14% | 4 | 3 | 1 | 60 | 56 | Oct. 3 – 4 | 10 pts, 200 |
| 2013 | 7 | 13% | 1 | 5 | 1 | 60 | 54 | Oct. 1 – 2 | 130 |
| 2014 | 7 | 15% | 2 | 5 | 0 | 55 | 47 | Oct. 7 – 8 | 4pts, 117 |
| 2015 | 7 | 12% | 2 | 3 | 2 | 60 | 59 | Oct. 7 – 8 | 132 |
| 2016 | 2 | 5% | 2 | 0 | 0 | 45 | 42 | Oct. 4 – 6 | 6 pts |
| 2017 | 7 | 14% | 4 | 1 | 2 | 54 | 49 | Oct 3 – 5 | 8 pts |
| **2018** | **8** | **21%** | **4** | **3** | **1** | **50** | **38** | **Oct 10 – 11** | **8 pts** |
| | | | | | | | | | |
| **Total** | **258** | | **86** | **120** | **50** | **1,296** | **1,211** | | |
| **Average** | **10** | **22%** | **3** | **4** | **2** | **48** | **45** | | |

## Deployed Soldier Muzzleloader White-tailed Deer Hunt

The eighth annual deployed soldier muzzleloader white-tailed deer hunt at Camp Ripley was held November 26 – 28. Soldiers that had most recently returned from a deployment were given priority for hunt permits. Fifty-two of the 80 eligible soldiers selected attended the hunt (Table 31). Temperatures were below average with light snow moving in on the last evening of the hunt. The last day of the hunt saw morning temps hovering in the low teens and winds from the north.

Table 31. Deployed soldier muzzleloader white-tailed deer hunt, Camp Ripley Training Center, Minnesota, 2011 – 2018.

| Year | Deer Harvested | Hunter Success | Bucks | Does | Fawns | Permits Issued | Number of Hunters | Dates | Largest Deer (Antler points / lbs.) |
|---|---|---|---|---|---|---|---|---|---|
| 2011 | 14 | 28% | 3 | 7 | 4 | 64 | 49 | Nov. 28 – 30 | 8 pts / 150 |
| 2012 | 49 | 86% | 15 | 25 | 9 | 73 | 57 | Nov. 26 – 28 | 8 pts / 166 |
| 2013 | 34 | 85% | 17 | 12 | 5 | 61 | 40 | Dec. 2 – 4 | 11 pts / 178 |
| 2014 | 29 | 61% | 11 | 14 | 4 | 71 | 47 | Dec. 1 – 3 | 10 pts / 175 |
| 2015 | 18 | 40% | 15 | 1 | 2 | 60 | 45 | Nov. 30 – Dec. 2 | 15 pts / 161 |
| 2016 | 17 | 41% | 6 | 7 | 4 | 75 | 41 | Nov. 28 – 30 | 11 pts / 170 |
| 2017 | 27 | 48% | 13 | 9 | 5 | 79 | 56 | Nov 27 – 30 | 12 pts / 169 |
| **2018** | **42** | **58%** | **10** | **22** | **10** | **80** | **52** | **Nov 26 – 28** | **10 pts / 165** |
| **Total** | **230** | | **90** | **97** | **43** | **563** | **387** | | |
| **Avg.** | **29** | **56%** | **11** | **12** | **5** | **70** | **48** | | |

## Military Member Archery White-tailed Deer Hunt

The 13th annual military member archery white-tailed deer hunt was held on October 10 – 11 in conjunction with the Disabled American Veteran firearm hunt on Camp Ripley. Military members were allowed to hunt in any non-restricted areas north of Cassino Road. One hundred fifty permits were available, 118 hunters applied and all were granted a permit to hunt. A total of 74 hunters participated and 13 white-tailed deer were harvested (Table 32).

Table 32. Military member archery white-tailed deer hunt, Camp Ripley Training Center, Minnesota, 2006 – 2018.

| Year* | Deer Harvested | Hunter Success | Bucks | Does | Fawns | Permits Issued | Number of Hunters | Dates | Largest Deer (Antler points / lbs.) |
|---|---|---|---|---|---|---|---|---|---|
| 2006 | 6 | 15% | 3 | 3 | 0 | 100 | 39 | Oct. 4 – 5 | 92 |
| 2007 | 10 | 17% | 1 | 6 | 3 | 123 | 59 | Oct. 3 – 4 | 175 |
| 2008 | 14 | 25% | 6 | 6 | 2 | 123 | 56 | Oct. 8 – 9 | 141 |
| 2009 | 11 | 22% | 3 | 7 | 1 | 126 | 51 | Oct. 7 – 8 | 198 |
| 2010 | 12 | 13% | 5 | 7 | 0 | 135 | 90 | Oct. 6 – 7 | 214 |
| 2011 | 2 | 3% | 0 | 2 | 0 | 89 | 53 | Oct. 5 – 6 | Unknown |
| 2012 | 23 | 23% | 5 | 12 | 6 | 132 | 96 | Oct. 3 – 4 | 182 |
| 2013 | 7 | 6% | 2 | 5 | 0 | 150 | 109 | Oct. 1 – 2 | 150 |
| 2014 | 8 | 9% | 3 | 4 | 1 | 151 | 88 | Oct. 7 – 8 | 10pts / 148 |
| 2015 | 10 | 13% | 6 | 4 | 0 | 135 | 77 | Oct. 7 – 8 | 10pts / |
| 2016 | 3 | 4% | 2 | 0 | 1 | 128 | 68 | Oct. 4 – 6 | Unknown |
| 2017 | 13 | 24% | 4 | unk | unk | 106 | 55 | Oct. 3 – 5 | 10pts / Unknown |
| **2018** | **13** | **18%** | **4** | **8** | **1** | **118** | **74** | **Oct 10 – 11** | **9pts / 152** |
| | | | | | | | | | |
| **Total** | **132** | | **44** | **64** | **15** | **1,616** | **915** | | |

*****2006–2012 permitted hunters were soldiers who had been mobilized to support the Global War on Terrorism since September 11, 2001.

## Youth Archery White-tailed Deer Hunt

The 17th annual youth archery white-tailed deer hunt was held October 7 – 8. Like past years, the participants were allowed to hunt in any non-restricted areas north of Cassino Road. The hunt was coordinated by the Minnesota Deer Hunters Association, the Minnesota State Archery Association, Camp Ripley and the DNR. A total of 80 permits were issued with 41 hunters participating, harvesting four white-tailed deer (Table 33).

Table 33. Youth archery white-tailed deer hunt, Camp Ripley Training Center, Minnesota, 2002 – 2018.

| Year | Deer Harvested | Hunter Success | Bucks | Does | Fawns | Permits Issued | Number of Applicants | Number of Hunters | Dates | Largest Deer (lbs.) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2003 | 10 | 7.7% | 4 | 5 | 1 | 150 | 216 | 132 | Oct. 11 – 12 | 118 |
| 2004 | 9 | 7.1% | 1 | 7 | 1 | 150 | 217 | 127 | Oct. 9 – 10 | 126 |
| 2005 | 20 | 15% | 8 | 12 | 0 | 152 | 219 | 133 | Oct. 8 – 9 | 196 |
| 2006 | 13 | 9.7% | 5 | 6 | 2 | 150 | 259 | 133 | Oct. 7 – 8 | 127 |
| 2007 | 19 | 14% | 6 | 5 | 8 | 150 | 234 | 136 | Oct. 6 – 7 | 141 |
| 2008 | 10 | 8.1% | 3 | 5 | 2 | 150 | 220 | 124 | Oct. 11 – 12 | 114 |
| 2009 | 12 | 7.5% | 2 | 7 | 3 | 150 | 240 | 130 | Oct. 10 – 11 | 120 |
| 2010 | 7 | 5% | 2 | 5 | 0 | 150 | 250 | 136 | Oct. 9 – 10 | 132 |
| 2011 | 9 | 6% | 3 | 4 | 2 | 175 | 229 | 153 | Oct. 8 – 9 | Unknown |
| 2012 | 10 | 7.2% | 5 | 3 | 2 | 175 | 252 | 139 | Oct. 6 – 7 | Unknown |
| 2013 | 10 | 7.3% | 4 | 3 | 3 | 175 | 273 | 137 | Oct. 12 – 13 | 131 |
| 2014 | 5 | 3% | 2 | 2 | 1 | 175 | 196 | 134 | Oct. 11 – 12 | 120 |
| 2015 | 5 | 7.6 % | 3 | 1 | 1 | 175 | 108 | 66 | Oct. 10 – 11 | 135 |
| 2016 | 2 | 3% | 2 | 0 | 0 | 175 | 86 | 66 | Oct. 8 – 9 | Unknown |
| 2017 | 3 | 9.8% | 2 | 1 | 0 | 175 | 75 | 41 | Oct 7 – 8 | Unknown |
| **2018** | **6** | **10.5%** | **1** | **5** | **0** | **175** | **80** | **57** | **Oct 11 – 13** | **Unknown** |
| **Total** | **163** | | **58** | **74** | **31** | **2,702** | **3,421** | **1,931** | | |
| **Average** | **10** | **8.4%** | **3** | **4** | **2** | | **201** | **114** | | |

## General Public Archery White-tailed Deer Hunt

The annual general public archery white-tailed deer hunt at Camp Ripley continues to be known as one of the largest and most anticipated archery hunts in the nation since its establishment in 1954. This hunt is administered by the Central Lakes College and the DNR. Hunters are allowed to apply for one of the two, two-day seasons in October each year. This year, the hunts were held on October 18 – 19 and October 27 – 28. Hunters were permitted to use a bonus tag and the harvest limit was increased to two deer. There were 2,883 permitted hunters with 2,365 hunters participating (Table 34) and 237 deer harvested during the two hunts. The 9.7% hunter success rate is slightly higher than the long-term average of 9.01%.


*Pictured: Dr. William Faber, Central Lakes College natural resources instructor, and student volunteers at Camp Ripley's general public archery white-tailed deer hunt, 2018.*

Table 34. General public archery white-tailed deer hunt, Camp Ripley Training Center, 1985 – 2018. (*Years when bonus tags were allowed; **Two deer limit)

| Year | Deer Harvested | Adult Bucks | % | Adult Does | % | Fawns | % | Permits Issued | # of Hunters | Hunter Success | 1st Season | 2nd Season | Largest Deer (lbs.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1985 | 278 | 118 | 42 | 113 | 41 | 47 | 17 | 5,000 | 3,996 | 7.0% | Oct. 12 – 13 | Oct. 27 – 28 | 257 |
| 1986 | 257 | 106 | 41 | 83 | 32 | 68 | 26 | 5,000 | 3,940 | 6.5% | Oct. 11 – 12 | Oct. 25 – 26 | 243 |
| 1987 | 284 | 122 | 43 | 91 | 32 | 71 | 25 | 5,000 | 4,112 | 6.9% | Oct. 10 – 11 | Oct. 24 – 25 | 250 |
| 1988 | 241 | 91 | 38 | 101 | 42 | 49 | 20 | 5,000 | 4,090 | 5.9% | Oct. 8 – 9 | Oct. 22 – 23 | 262 |
| 1989 | 215 | 95 | 44 | 75 | 35 | 45 | 21 | 4,000 | 3,136 | 6.9% | Oct. 17 – 18 | Oct. 28 – 29 | 226 |
| 1990 | 301 | 137 | 46 | 115 | 38 | 49 | 16 | 3,500 | 2,585 | 11.6% | Oct. 27 – 28 | Nov. 17 – 18 | 225 |
| 1991 | 219 | 87 | 40 | 90 | 41 | 42 | 19 | 4,000 | 2,217 | 9.9% | Oct. 19 – 20 | Nov. 30 – Dec. 1 | 232 |
| 1992 | 406 | 228 | 56 | 140 | 35 | 38 | 9 | 4,500 | 3,156 | 12.9% | Oct. 31 – Nov. 1 | Nov. 21 – 22 | 224 |
| 1993 | 287 | 147 | 51 | 82 | 29 | 58 | 20 | 5,000 | 4,127 | 7.0% | Oct. 21 – 21 | Oct. 30 – 31 | 237 |
| 1994 | 267 | 136 | 51 | 95 | 36 | 36 | 13 | 4,000 | 3,158 | 8.5% | Oct. 20 – 21 | Oct. 29 – 30 | 237 |
| 1995 | 247 | 102 | 41 | 100 | 41 | 45 | 18 | 4,500 | 3,564 | 6.9% | Oct. 19 – 20 | Oct. 28 – 29 | 256 |
| 1996 | 160 | 78 | 49 | 55 | 34 | 27 | 17 | 4,000 | 3,154 | 5.1% | Oct. 17 – 18 | Oct. 26 – 27 | 248 |
| 1997 | 142 | 67 | 47 | 57 | 40 | 18 | 13 | 3,000 | 2,316 | 6.1% | Oct. 16 – 17 | Oct. 25 – 26 | 243 |
| 1998 | 189 | 116 | 61 | 50 | 26 | 23 | 12 | 3,000 | 2,291 | 8.2% | Oct. 15 – 16 | Oct.31 – Nov. 1 | 249 |
| 1999 | 203 | 100 | 49 | 83 | 41 | 20 | 10 | 3,000 | 2,335 | 8.7% | Oct. 21 – 22 | Oct. 30 – 31 | 251 |
| 2000 | 375 | 228 | 61 | 109 | 29 | 38 | 10 | 4,000 | 3,128 | 12.0% | Oct. 19 – 20 | Oct. 28 – 29 | 247 |
| 2001 | 350 | 192 | 55 | 126 | 36 | 32 | 9 | 4,500 | 3,729 | 9.4% | Oct. 18 – 19 | Oct. 27 – 28 | 272 |
| 2002 | 324 | 186 | 57 | 102 | 31 | 36 | 11 | 4,500 | 3,772 | 8.6% | Oct. 17 – 18 | Oct. 26 – 27 | 235 |
| 2003 | 318 | 161 | 51 | 120 | 38 | 37 | 11 | 4,500 | 3,810 | 8.3% | Oct. 16 – 17 | Oct. 25 – 26 | 247 |
| **2004 | 484 | 218 | 45 | 206 | 43 | 60 | 12 | 4,521 | 3,836 | 12.4% | Oct. 21 – 22 | Oct. 30 – 31 | 235 |
| **2005 | 477 | 186 | 39 | 218 | 46 | 73 | 15 | 4,522 | 3,813 | 12.5% | Oct.20 – 21 | Oct.29 – 30 | 245 |
| **2006 | 514 | 165 | 32 | 241 | 47 | 108 | 21 | 5,009 | 4,351 | 11.8% | Oct. 19 – 20 | Oct. 28 – 29 | 244 |
| **2007 | 476 | 150 | 32 | 228 | 48 | 98 | 20 | 5,014 | 4,294 | 11.1% | Oct. 18 – 19 | Oct. 27 – 28 | 255 |
| **2008 | 516 | 183 | 35 | 220 | 43 | 113 | 22 | 5,005 | 4,167 | 11.9% | Oct. 19 – 20 | Oct. 26 – 27 | 234 |
| **2009 | 477 | 190 | 40 | 202 | 42 | 85 | 18 | 5,005 | 4,126 | 11.4% | Oct 15 – 16 | Oct. 31 – Nov. 1 | 265 |
| **2010 | 507 | 187 | 37 | 228 | 45 | 92 | 18 | 5,002 | 4,293 | 11.8% | Oct 20 – 21 | Oct. 30 – 31 | 253 |
| **2011 | 422 | 153 | 18 | 185 | 32 | 84 | 20 | 5,000 | 4,305 | 10.2% | Oct 20 – 21 | Oct. 29 – 30 | 215 |
| **2012 | 429 | 176 | 41 | 169 | 39 | 84 | 20 | 5,003 | 4,205 | 9.8% | Oct 18 – 19 | Oct. 27 – 28 | 215 |
| **2013 | 308 | 116 | 37 | 130 | 42 | 65 | 21 | 5,002 | 4,488 | 6.8% | Oct 26 – 27 | Nov. 2 – 3 | 223 |
| *2014 | 145 | 55 | 38 | 65 | 45 | 25 | 17 | 3,805 | 2,966 | 4.8% | Oct 15 – 16 | Oct. 25 – 26 | 207 |
| 2015 | 204 | 56 | 27 | 40 | 20 | 108 | 53 | 3,579 | 2,723 | 7.5 % | Oct 15 – 16 | Oct. 31 – Nov. 1 | 239 |
| 2016 | 113 | 55 | 49 | 13 | 12 | 44 | 40 | 2,995 | 2,270 | 5% | Oct 20 – 21 | Oct. 29 – 30 | 218 |

Table 34. General public archery deer hunt, Camp Ripley Training Center, 1985 – 2018. (*Years when bonus tags were allowed; **Two deer limit)

| Year | Deer Harvested | Adult Bucks | % | Adult Does | % | Fawns | % | Permits Issued | # of Hunters | Hunter Success | 1st Season | 2nd Season | Largest Deer (lbs.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *2017 | 263 | 142 | 54 | 97 | 37 | 24 | 9 | 2,570 | 2,011 | 13.1% | Oct 19 – 20 | Oct. 28 – 29 | UNK |
| **2018 | 237 | 103 | 44 | 101 | 43 | 33 | 13 | 2,883 | 2,365 | 9.7% | Oct. 18 – 19 | Oct. 27 – 28 | UNK |

## Disabled Veteran and Deployed Soldier Fishing Event

CRE, with the help of other organizations, came together for the seventh annual Trolling for the Troops fishing event. Professional fishing guides are teamed up with disabled and deployed veterans along with those currently serving or retired for a day of fishing. The event was held on July 31 – June 1. The event continues to be a huge success with support from the American Legion, Veterans of Foreign Wars, Disabled American Veterans, Minnesota National Guard and Upper Mississippi River Smallie Club. A Trolling for the Troops fishing event is being planned for 2019.


*Pictured: Trolling for the Troops fishing event at Camp Ripley's Hangar Conference Center, 2018.*

# Arden Army Hills Army Training Site

## Cultural Resources

By Patrick Neumann, Minnesota Department of Military Affairs

Arden Hills Army Training Site (AHATS) is a federally owned property leased to the MNARNG. As a federal property overseen by the MNARNG and funded by federal dollars, all of the same laws and regulations exist for managing cultural resources within the boundaries of AHATS that apply for all other MNARNG controlled properties.

AHATS has been surveyed for cultural resources in its entirety and no eligible resources are present at this time. There are also Advisory Council for Historic Preservation program comments regarding existing structures which completes the Section 106 process regarding historic structures for the MNARNG at AHATS. Any future construction at AHATS will be submitted to the Minnesota State Historical Preservation Office and consulting partners for review and will comply with all laws regarding cultural resources. Should any unknown cultural materials be encountered during construction, all construction activities in the vicinity will cease until a cultural survey can be completed.

## Land Use Management

By Mary Lee, Minnesota Army National Guard

The Operable Unit 2 (OU2) Land Use Control Remedial Design (LUCRD) New Brighton/Arden Hills Superfund Site passed the consistency test and was signed on September 27, 2010. Land Use Controls (LUC) are required as part of the remedies for soil, sediment and groundwater at specific areas within OU2. LUCs are needed because the current concentrations of various contaminants within these areas are above levels that allow for unlimited use or unrestricted exposure. There are no LUCs for military training; however some soil caps and digging restrictions are present on AHATS.

The MNARNG, as part of its community responsibility, wants to make AHATS available for nonmilitary users, including those under age 18. The exposure levels for those under 18 are more restrictive. In order to reach the exposure levels the LUCRD must be amended. OU2 LUCRD Revision 5 passed final consistency in March 2018. This revision changed a portion of the Ramsey County property to “recreational use.” Further amendments will need to be submitted for revisions to the LUCRD to the Minnesota Pollution Control Agency by the Army.

As a result, the conditions of the LUCRD must be honored by the MNARNG relative to their long-range planning, land use and land management practices on AHATS. To ensure compliance with the conditions of the LUCRD, MNARNG is hereby referencing the LUCRD and inserting a copy as an appendix to the Minnesota Army National Guard Arden Hills Army Training Site Sustainability Master Plan (MNARNG 2009) and the AHATS Integrated Natural Resource Management Plan (INRMP) (MNARNG

2018a), or by updating this annual report. It is understood that any future revisions to the LUCRD will automatically supersede any earlier editions.

# Natural Resources

Natural resource planning is an integral part of the conservation program for the MNARNG. The MNARNG uses the INRMP as the guidance document for implementing the conservation program. The planning process used in developing the INRMP focuses on using key stakeholders from the MNARNG, the DNR, the U.S. Fish and Wildlife Service and other organizations that have an interest in the MNARNG's conservation program. Together, these stakeholders represent the Integrated Natural Resources Management Planning Committee. The primary responsibility of the Planning Committee is to ensure that the INRMP not only satisfies the military mission but also provides a foundation for sound stewardship principles that adequately address the issues and concerns that are raised by all stakeholders. Annually, stakeholders discuss and review the INRMP for AHATS, and present their annual accomplishments and work plans for the next year.

## Vegetation Management

### Prescribed Fire

By Timothy Notch, Minnesota Department of Military Affairs

Prescribed fire is used at AHATS as a management tool, similar to Camp Ripley, to enhance the military training environment, also known as mission-scape, and for ecological purposes. Prescribed fire target areas include native prairie grass enhancement and restoration, reducing woody encroachment, invasive and noxious vegetation management, native plant seed production, brush control, fuel-hazard reduction, oak savanna management and to improve habitat for state threatened and endangered species and species in greatest conservation need. The management strategy for prescribed fire on AHATS is provided within the AHATS INRMP (MNARNG 2018a).

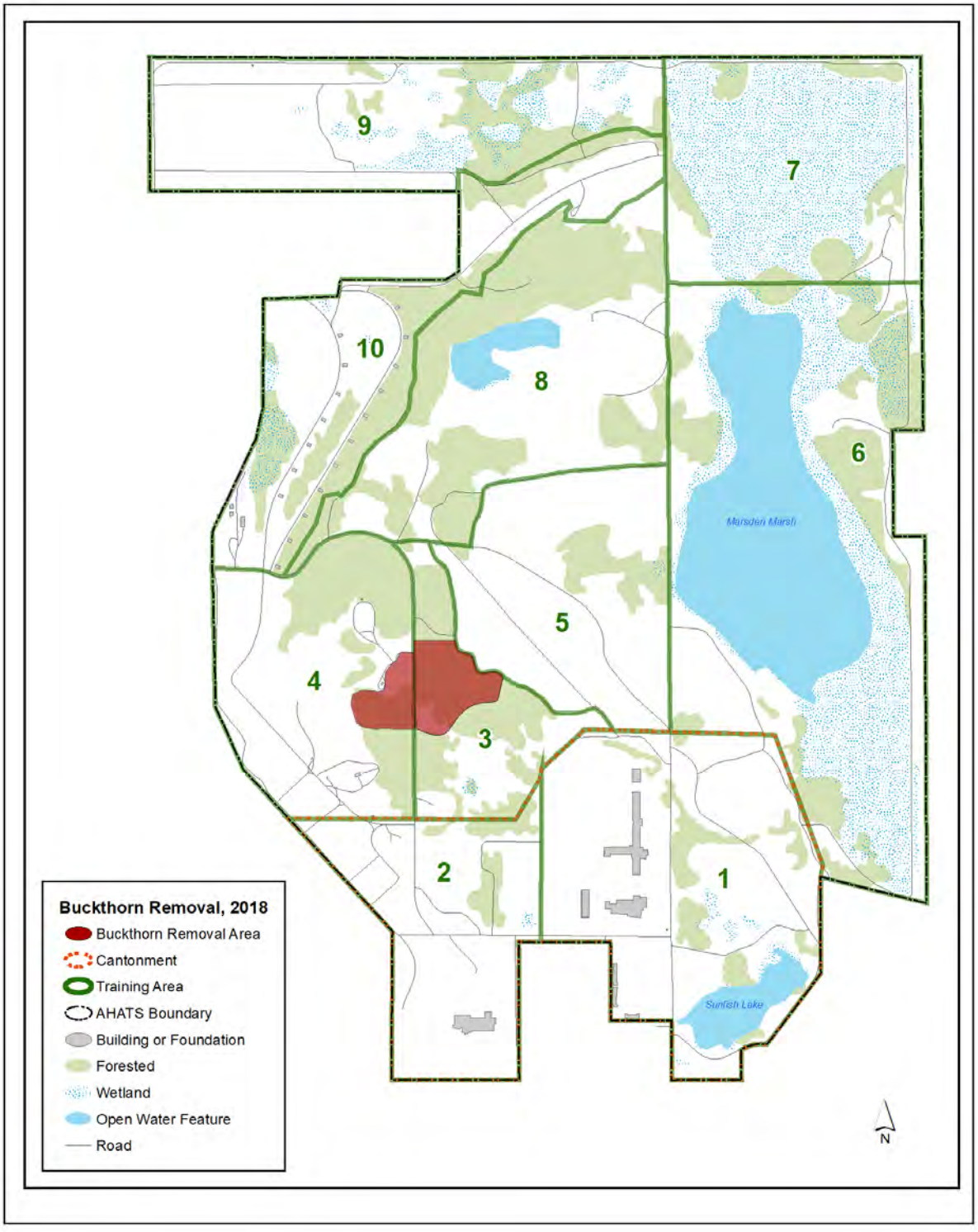
No units were burned in 2018. Continued efforts will be made to coordinate and maintain a fire program on AHATS.

### Terrestrial Invasive Species Control

By Jason Linkert, Minnesota Department of Military Affairs

Common buckthorn (*Rhamnus cathartica*) and glossy buckthorn (*Rhamnus frangula*) are restricted noxious weeds according to the Minnesota Department of Agriculture. They are both prolific forest invaders in Minnesota that outcompete and prevent the regeneration of native species such as oak in the forest understory. A contract with the Minnesota Department of Correction's Community Work Crew program was established to target dense monocultures of buckthorn in Training Areas 3 and 4. A total of 22 acres received cut stump treatment (Figure 44).

Figure 44. Terrestrial invasive woody vegetation treatment location, Arden Hills Army Training Site, 2018.



CRE and St. Cloud State University (SCSU) interns also treated buckthorn regeneration in previous cut over areas. Ten acres of buckthorn regeneration was treated in Training Areas 3 and 6. The herbicide triclopyr was tanked mixed in backpacks and foliar applied to target any stump re-sprouting. This treatment is most effective at removing buckthorn seedlings and not harming existing oak species regeneration. The site will require numerous chemical and mechanical treatments over the next few years to prevent stump sprouting and to restore the native oak savanna ecosystem.

CRE and SCSU interns re-treated an area with high densities of bristly locust (*Robinia hispida*) that received a carbide treatment in 2017. The one-acre site was divided to test the effectiveness of using the herbicide triclopyr in comparison to the herbicide aminopyralid.

## Water Resources

### Wetlands

Construction began on the 34th Infantry Division Arden Hills Readiness Center. The site encompasses 21 acres, north of Sunfish Lake and south of Marsden Marsh. The site was comprised of densely vegetated restored prairie, Type 2 wet meadow wetlands, and a small wooded area. Contouring and grading obligated a wetland bank credit withdrawal of 0.18 acres. Special care has been taken to ensure habitat protection, identification, and movement of the Blanding's turtle and any species of concern. Perimeter silt fence will be maintained and identification posters will be placed in the construction trailer.

## Wildlife

By Nancy J. Dietz and Brian J. Dirks, Minnesota Department of Natural Resources

### Species in Greatest Conservation Need

"Minnesota defines species in greatest conservation need (SGCN) as native animals, nongame and game, whose populations are rare, declining, or vulnerable to decline and are below levels desirable to ensure their long-term health and stability. Also included are species for which Minnesota has a stewardship responsibility. Stewardship species are those for which populations in Minnesota represent a significant portion of their North American breeding, migrating or wintering population, or species whose Minnesota populations are stable, but whose populations outside of Minnesota have declined or are declining in a substantial part of their range" (MNDNR 2015a).

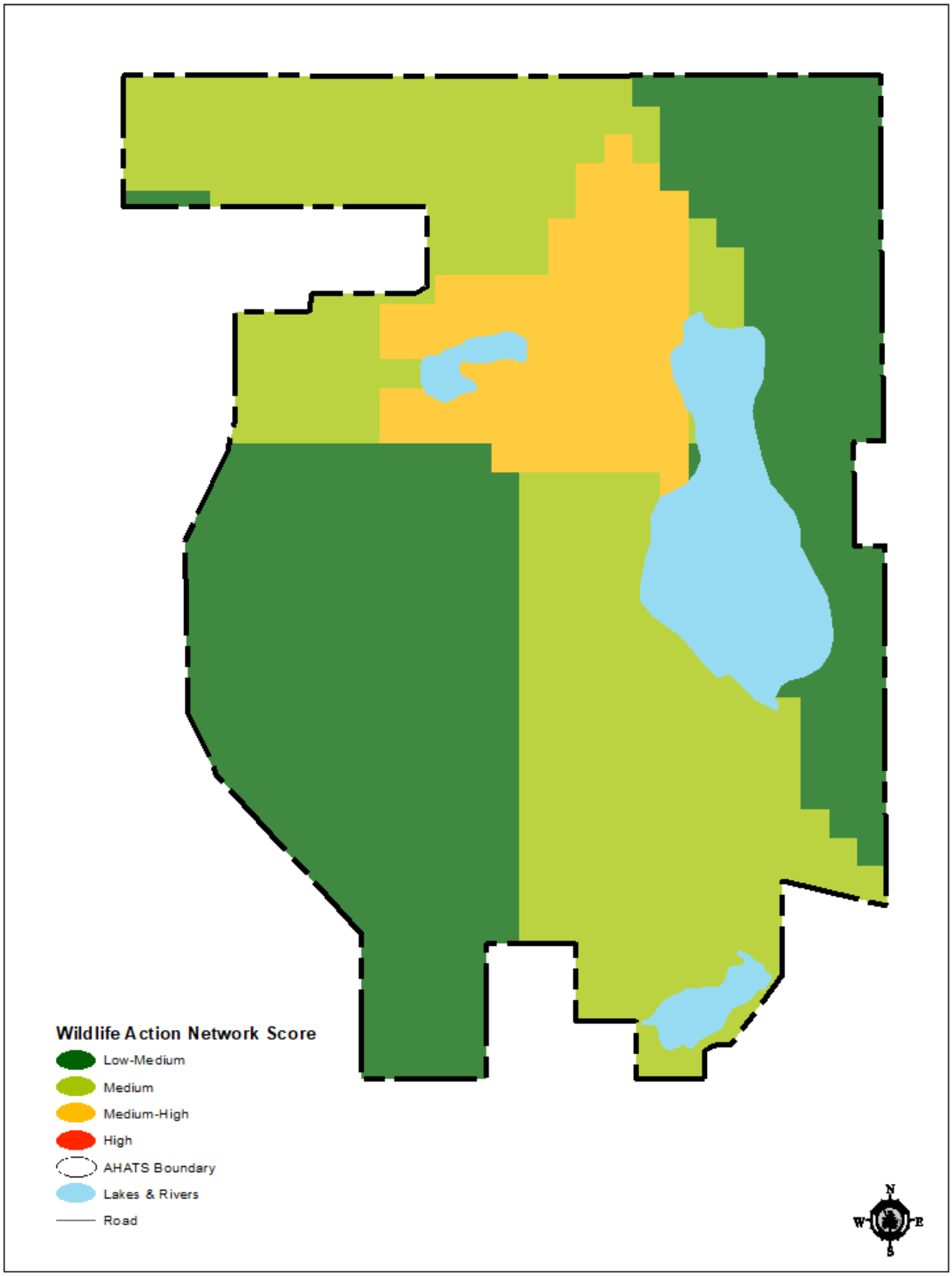
One of the federal requirements of the Comprehensive Wildlife Conservation Strategy is to manage SGCN by developing a wildlife action plan. *Minnesota's Wildlife Action Plan, 2015–2025*" (MNDNR 2015a) is Minnesota's response to the congressional mandate. The goal of the wildlife action plan is to: 1) ensure the long-term health and viability of Minnesota's wildlife, with a focus on species that are rare, declining or vulnerable to decline; 2) enhance opportunities to enjoy SGCN and other wildlife and to participate in conservation; and 3) acquire the resources necessary to successfully

implement the Minnesota Wildlife Action Plan (MNDNR 2015a). Additional AHATS surveys, monitoring and research will be directed toward identifying other SGCN species, and management or conservation actions that could be implemented to benefit these species.

Minnesota's Wildlife Action Plan uses two approaches to meet goal one above, habitat and species. The habitat approach is the most comprehensive and "emphasizes sustaining and enhancing terrestrial and aquatic habitats for SGCN" (MNDNR 2015a). To implement the habitat approach the Plan uses a Wildlife Action Network "composed of terrestrial and aquatic habitat cores and corridors to support biological diversity and ecosystem resilience with a focus on SGCN" (MNDNR 2015a). To develop the network, the analysis mapped habitats containing viable or persistent populations and species richness hotspots of SGCN. While the Wildlife Action Network is a broad system to guide conservation efforts, a scoring system was developed to identify Conservation Focus Areas. The Wildlife Action Network score for AHATS ranges from Low-Medium to Medium-High (Figure 45). Integrating Minnesota's Wildlife Action Plan information with the AHATS Integrated Natural Resources Management Plan can contribute to ongoing conservation actions that decrease the risk of future species listings.

Of the over 2,000 known native wildlife species in Minnesota, 346 species from all major taxonomic groups meet the definition of species in greatest conservation need. All federal and state endangered, threatened and special concern species are included on the SGCN list. Five taxonomic groups have one-third or more of the total species found in Minnesota as SGCN, they are: mammals (38%), reptiles (50%), amphibians (36%), tiger beetles (46%) and mussels (60%) (MNDNR 2015a). Fifty-four SGCN species occur on AHATS, including 44 SGCN bird species of which 23 are songbirds (Appendix A).

Figure 45. Wildlife Action Network score, Arden Hills Army Training Site, Minnesota, 2018.



## Birds

### Christmas Bird Count

The Christmas Bird Count (CBC) has been coordinated by the National Audubon Society since 1900, and has become the oldest continuous nationwide wildlife survey in North America (Sauer et al. 2008). Counts occur within predetermined 15-mile diameter circles located across North America, Mexico and South America. All of AHATS is found within the Saint Paul, north (CBC census code: MNSP) census circle. Each count is conducted during a single calendar day within two weeks of Christmas (December 14 to January 5). The Saint Paul north census was started in 1967, and the census has occurred 50 times (Minnesota Ornithologists' Union 2018b). CBC data is primarily used to track winter distribution patterns and population trends of various bird species.

The 2018 – 2019 CBC at AHATS occurred on Saturday, December 15, and was conducted by Saint Paul Audubon Society volunteers and Mary Lee, AHATS Environmental Protection Specialist. The temperature was 40 degrees Fahrenheit, with winds of 6 – 10 miles per hour, with no precipitation (Weather Underground 2018b). Six hundred and ten birds of 19 species were counted at AHATS during the annual CBC (Table 35).

Table 35. Christmas bird count data, Arden Hill Army Training Site, Minnesota, 2009 – 2018.

| Species | Scientific Name | Dec. 18, 2009 | Dec. 18, 2010 | Dec. 17, 2011 | Dec. 15, 2012 | Dec. 14, 2013 | Dec. 20, 2014 | Dec. 19, 2015 | Dec. 31, 2016 | Dec. 16, 2017 | Dec. 15, 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Canada goose | *Branta canadensis* | 28 | 20 | 2 | 25 | | | 8 | | | |
| Trumpeter swan | *Cygnus buccinator* | 7 | 2 | | 2 | | | | | 12 | |
| Wood duck | *Aix sponsa* | | | | | | | | | 1 | |
| American black duck | *Anas rubripes* | | | | | | | | | 1 | |
| Mallard | *Anas platyrhynchos* | ~1500 | ~1300 | ~800 | 300 | 625 | 205 | 375 | 35 | 228 | **417** |
| Lesser scaup | *Aythya affinis* | | | | | | | 1 | | | |
| Canvasback | *Aythya valisineria* | | 1 | | | | | | | | |
| Common goldeneye | *Bucephala clangula* | | 6 | | | 1 | | 5 | | 1 | |
| Common merganser | *Mergus merganser* | | | | | 1 | | | | | |
| Bald eagle | *Haliaeetus leucocephalus* | 1 | | 4 | 4 | 1 | 3 | 1 | 3 | 3 | **1** |
| Sharp-shined hawk | *Accipiter striatus* | | | | | | | | | | **1** |
| Red-tailed hawk | *Buteo jamaicensis* | 6 | 5 | 4 | 4 | 3 | 1 | 3 | 3 | 2 | **5** |
| Rough-legged hawk | *Buteo lagopus* | 1 | | | 1 | | 5 | | | 1 | |
| Wild turkey | *Meleagris gallopavo* | 13 | 9 | 22 | 17 | 10 | | 1 | | | |
| Ring-billed gull | *Larus delawarensis* | | | | 1 | | | 1 | | | |
| Rock pigeon | *Columba livia* | | 1 | 7 | | | | | | 2 | **15** |
| Mourning dove | *Zenaida macroura* | | | 13 | 8 | 3 | 5 | 48 | 4 | 1 | **1** |
| Great horned owl | *Bubo virginianus* | 1 | | 3 | 3 | | 3 | 1 | 1 | 1 | |
| Barred owl | *Strix varia* | | | | | | | 1 | | | |
| Red-bellied woodpecker | *Melanerpes carolinus* | 1 | | 1 | | 2 | 1 | 4 | 1 | 2 | **1** |
| Downy woodpecker | *Picoides pubescens* | 1 | 4 | 6 | | 6 | 10 | 3 | 3 | 4 | **5** |
| Hairy woodpecker | *Picoides villosus* | 1 | | 2 | 1 | 3 | 2 | 3 | 1 | 2 | |
| Pileated woodpecker | *Dryocopus pileatus* | | | | 1 | | | 3 | | | **1** |
| Northern shrike | *Lanius excubitor* | | 5 | 1 | 3 | 2 | 1 | 2 | | 1 | **1** |
| Blue jay | *Cyanocitta cristata* | | 2 | 6 | | 50 | 5 | 12 | 1 | 34 | **35** |
| American crow | *Corvus brachyrhynchos* | 25 | 39 | 16 | 45 | 71 | 100 | 29 | 51 | 72 | **43** |
| Common raven | *Corvux corax* | | | | | | | | | 1 | |
| Black-capped chickadee | *Parus atricaillus* | 9 | 10 | 62 | 11 | 48 | 47 | 13 | 20 | 25 | **37** |
| White-breasted nuthatch | *Sitta corolinensis* | | 2 | 8 | 4 | 5 | 6 | 6 | 2 | 4 | **7** |
| American robin | *Turdus migratorius* | | | | | | | | | | **10** |
| European starling | *Sturnus vulgaris* | | | | | | | 2 | | 1 | |

Table 35. Christmas bird count data, Arden Hill Army Training Site, Minnesota, 2009 – 2018.

| Species | Scientific Name | Dec. 18, 2009 | Dec. 18, 2010 | Dec. 17, 2011 | Dec. 15, 2012 | Dec. 14, 2013 | Dec. 20, 2014 | Dec. 19, 2015 | Dec. 31, 2016 | Dec. 16, 2017 | Dec. 15, 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| American tree sparrow | *Spizella arborea* | 3 | | 52 | 50 | 6 | 3 | 54 | 10 | | **8** |
| Dark-eyed junco | *Junco hyemalis* | | | | 15 | 2 | 6 | 7 | | 5 | **3** |
| Northern cardinal | *Cardinalis* | | | | 4 | 5 | | 7 | | 2 | **11** |
| House finch | *Carpodacus mexicanus* | | | | | | | 2 | | 3 | |
| American goldfinch | *Carduelis tristis* | | 1 | 20 | | 2 | | 7 | 3 | 13 | **5** |
| House sparrow | *Passer domesticus* | | | | 20 | 1 | | 1 | | | **3** |
| **# Observers** | | **Unknown** | **Unknown** | **5** | **3** | **4** | **6** | **8** | **6** | **9** | **12** |
| **TOTAL # INDIVIDUALS** | | **1,597** | **1,406** | **1,029** | **521** | **847** | **401** | **600** | **138** | **443** | **610** |
| **TOTAL # SPECIES** | | **14** | **15** | **18** | **20** | **20** | **16** | **27** | **14** | **25** | **19** |

## Breeding Bird Monitoring

As a natural oasis in a mostly metropolitan area, AHATS provides important breeding and migratory habitat for bird species in greatest conservation need (SGCN). Forty-four SGCN birds have been identified on AHATS (MNDNR 2015a), including 21 known breeding SGCN birds. Six SGCN songbirds (passerines) were recorded during songbird point count surveys.

Songbird surveys were conducted on 13 permanent plots (Figure 46) on June 7. Surveys have been conducted on these plots since 2001. A total of 139 birds consisting of 44 different species were recorded. Overall, the average number of birds per plot was 10.7 and the average number of species per plot was 9.3 (Table 38 and Figure 47).

Grassland plots (n=7) contained 25 bird species and 66 total birds. The highest diversity of songbird species in grassland plots occurred in 2017. This year the average number of birds found on grassland plots was 9.42 and the average number of species per plot was 7.85 (Table 36 and Figure 47). Population trends of three SGCN grassland songbirds are presented in Figure 48. According to the North American Breeding Bird Survey, Grasshopper sparrow (*Ammodramus savannarum*) populations declined by almost 3% per year between 1966 and 2014, resulting in a cumulative decline of 75%. On AHATS grasshopper sparrows (a SGCN) had been increasing in abundance since 2001, and were the most abundant grassland plot bird in 2011 but dropped to none in 2012 and 2017. For the first time, state endangered Henslow's sparrows were the second most abundant grassland species (see Henslow's sparrow section, pg. 171). Ten of the past 12 years, clay-colored sparrows (*Spizella pallida*) were the most abundant species recorded on grassland plots (Table 38). Tree and invasive shrub removal is used to limit encroachment of trees and brush into grasslands. Prescribed burning is an important tool to control woody encroachment and to restore and enhance native grasslands. For the first time since 2012, prescribed fire was used in 2016 to manage grasslands on AHATS; however, no prescribed fire was applied in 2017 – 2018. Woody vegetation encroachment is increasing on some of AHATS grasslands. This encroachment needs to be addressed to maintain habitat for grassland birds. Grassland birds benefit from the absence of trees due to the lack of perches for predators and brown-headed cowbirds (*Molothrus ater*), a brood parasite. Brushy grasslands are more suitable for edge species, such as the American goldfinch (*Carduelis tristis)*, which was the second most abundant bird in grassland plots in 2017.

An additional grassland SGCN bird, the bobolink (*Dolichonyx oryzivorus*), appeared on an AHATS survey plot for the first time in six years in 2017. Bobolink prefer breeding habitat of moderate to tall vegetation with both grasses and forbs, moderate vegetation densities, absence of woody plants with a moderately developed litter layer (Pfannmuller et al. 2017b). This species' population has a statistically valid decline documented, rare or declining habitat and habitat loss hence its SGCN designation. Also, Minnesota's population represents a significant portion of the North American breeding population. Bobolink were present on an AHATS grassland plot in 2002, 2003, 2005, 2008, 2011 and 2017; however, none were recorded in 2018.

Woodland plots (n=6) contained 32 species and 73 total birds. The average number of birds found on woodland plots was 12.1 and the average number of species per plot was 11 (Table 37 and Figure 47). The most abundant birds on woodland plots were blue jay (*Cyanocitta cristata*) and common yellowthroat (*Geothlypis trichas*) (Table 38). Invasive shrub removal benefits woodland species by releasing native understory species, increasing biodiversity and habitat for birds and other animals. Many native plant species can re-establish from existing seed banks and roots if undesirable plants are controlled (University of Minnesota 2019).

Figure 46. Permanent songbird survey plots, Arden Hills Army Training Site, Minnesota, 2001–2018.

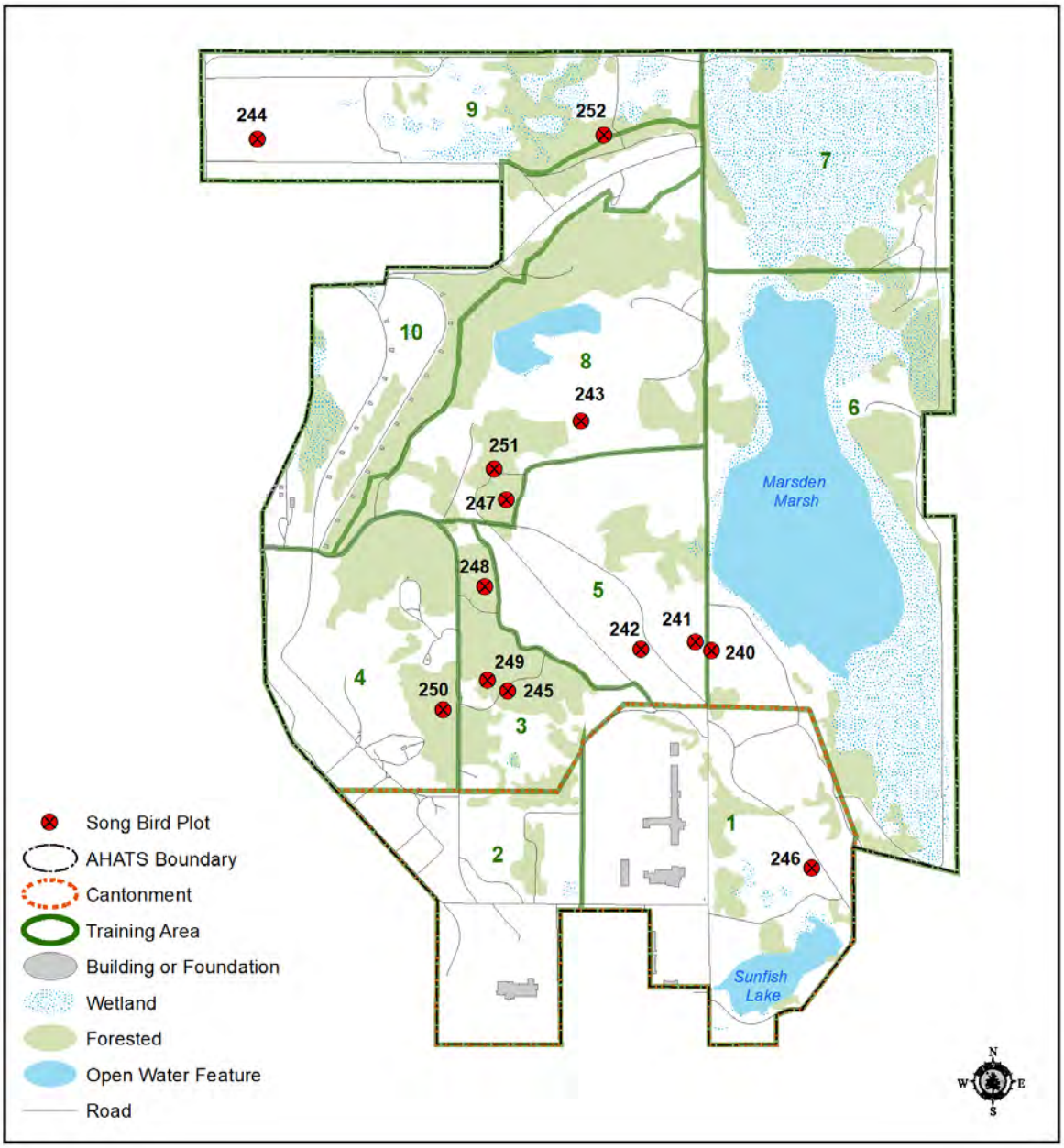


Table 36. Summary of songbird surveys in grassland plots, Arden Hills Army Training Site, Minnesota, 2001 – 2018.

| Grassland Plots | | | | | | |
|---|---|---|---|---|---|---|
| **Year** | **Field Surveyors** | **# of Plots Surveyed** | **Total # of Birds Documented** | **Total # of Species Documented** | **Average # of Birds per Plot** | **Average # of Species per Plot** |
| 2001 | DeJong | 7 | 37 | 18 | 5.28 | 4.28 |
| 2002 | DeJong | 7 | 62 | 22 | 8.86 | 9.57 |
| 2003 | DeJong | 7 | 39 | 17 | 5.57 | 4.57 |
| 2004 | Burggraff | 7 | 41 | 19 | 5.86 | 4.57 |
| 2005 | DeJong | 7 | 67 | 23 | 9.57 | 5.71 |
| 2006 | DeJong | 7 | 75 | 20 | 10.71 | 6.85 |
| 2007 | DeJong | 7 | 66 | 21 | 9.43 | 8.57 |
| 2008 | Dirks | 7 | 45 | 26 | 6.42 | 6.0 |
| 2009 | Dirks | 7 | 46 | 20 | 6.57 | 5.42 |
| 2010 | Dirks | 7 | 45 | 16 | 6.43 | 5.0 |
| 2011 | Dirks | 7 | 40 | 19 | 5.71 | 4.57 |
| 2012 | Dirks | 7 | 39 | 20 | 5.57 | 5.0 |
| 2013 | Dirks | 7 | 62 | 25 | 8.86 | 8.0 |
| 2014 | Dirks | 5 | 28 | 15 | 5.6 | 5.0 |
| 2015 | Dirks | 7 | 62 | 23 | 8.86 | 7.2 |
| 2016 | Dirks | 7 | 54 | 21 | 7.71 | 6.6 |
| 2017 | Dirks | 7 | 76 | 27 | 10.85 | 8.28 |
| **2018** | **Dirks** | **7** | **66** | **25** | **9.42** | **7.85** |

Table 37. Summary of songbird surveys in woodland plots, Arden Hills Army Training Site, Minnesota, 2001 – 2018.

| Woodland Plots | | | | | | |
|---|---|---|---|---|---|---|
| **Year** | **Field Surveyors** | **# of Plots Surveyed** | **Total # of Birds Documented** | **Total # of Species Documented** | **Average # of Birds per Plot** | **Average # of Species per Plot** |
| 2001 | Dirks | 7 | 81 | 25 | 11.57 | 8.28 |
| 2002 | Dirks | 7 | 78 | 28 | 11.14 | 9.14 |
| 2003 | Dirks | 6 | 84 | 31 | 14.00 | 11.0 |
| 2004 | Dirks | 6 | 88 | 36 | 14.66 | 12.33 |
| 2005 | Dirks | 6 | 73 | 28 | 12.12 | 9.83 |
| 2006 | Dirks | 6 | 74 | 32 | 12.33 | 10.5 |
| 2007 | Dirks | 6 | 90 | 34 | 15.00 | 11.66 |
| 2008 | Dirks | 6 | 64 | 25 | 10.66 | 9.66 |
| 2009 | Dirks | 6 | 73 | 25 | 12.16 | 10.5 |
| 2010 | Dirks | 6 | 67 | 26 | 11.2 | 10.3 |
| 2011 | Dirks | 6 | 79 | 29 | 13.2 | 11.66 |
| 2012 | Dirks | 6 | 71 | 36 | 11.8 | 10.33 |
| 2013 | Dirks | 6 | 69 | 27 | 11.5 | 10.5 |
| 2014 | Dirks | 5 | 62 | 28 | 12.4 | 11.0 |
| 2015 | Dirks | 6 | 67 | 30 | 11.2 | 9.8 |
| 2016 | Dirks | 6 | 68 | 24 | 11.3 | 9.3 |
| 2017 | Dirks | 6 | 91 | 31 | 15.2 | 13.0 |
| **2018** | **Dirks** | **6** | **73** | **32** | **12.16** | **11.0** |

Figure 47. Average number of songbird species per plot, Arden Hills Army Training Site, Minnesota, 2001 – 2018.

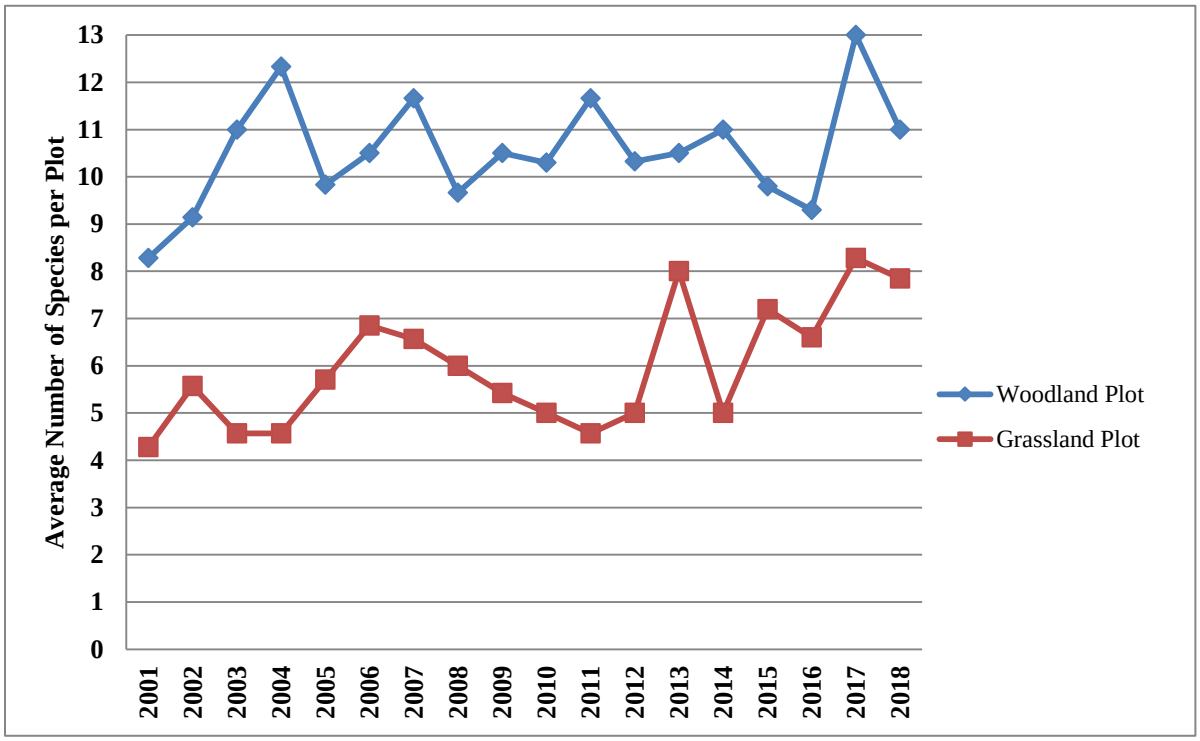



Figure 48. Selected grassland songbird species in greatest conservation need, Arden Hills Army Training Site, Minnesota, 2001 – 2018.

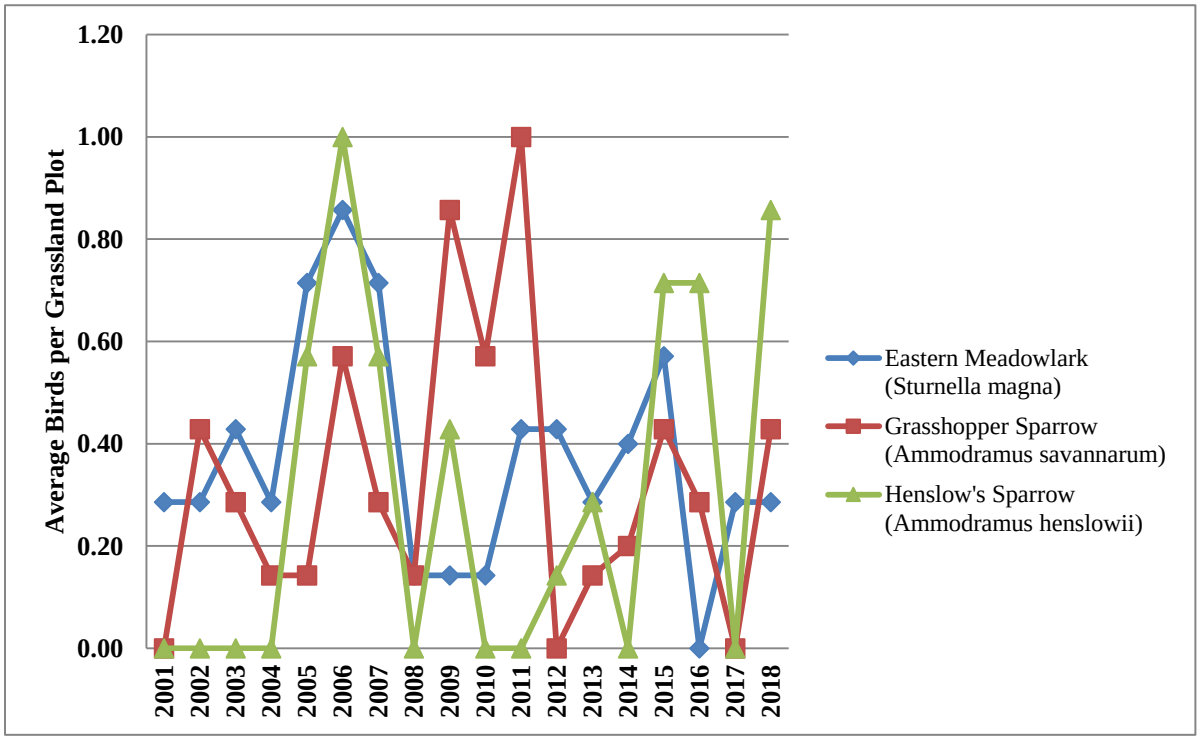


Table 38. Most abundant songbirds observed on breeding songbird plots, Arden Hills Army Training Site, Minnesota, 2006 – 2018. The number of birds documented is indicated in columns.

| Grassland Plots (n=7) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Common Name** | **Scientific Name** | **June 5, 2007** | **July 9, 2008** | **May 29, 2009** | **May 27, 2010** | **June 3&14, 2011** | **June 6, 2012** | **June 7, 2013** | **June 6, 2014[a]** | **May 27, 2015** | **June 2, 2016** | **May 31 & June 1, 2017** | **June 7, 2018** |
| Mourning dove | *Zenaida macroura* | | 2 | | | | | | | | | | |
| Eastern kingbird | *Tyrannus tyrannus* | 5 | 2 | 4 | | | | 4 | 2 | 5 | | | |
| American crow | *Corvus brachyrhynchos* | | | | | | | | | | | | |
| Tree swallow | *Tachycineta bicolor* | | | 4 | 5 | 3 | | 4 | | | 4 | 7 | **7** |
| Black-capped chickadee | *Poecile atricapillus* | | | | | | | | | | | | |
| House wren | *Troglodytes aedon* | | 4 | | | | 3 | | | | | | **5** |
| Sedge wren | *Cistothorus platensis* | | | | | | 3 | | | | | | |
| Eastern bluebird | *Sialia sialis* | 5 | 4 | 4 | | 3 | | | 2 | | | 7 | |
| Gray catbird | *Dumetella carolinensis* | | 2 | | | | 2 | | | | | | |
| Clay-colored sparrow | *Spizella pallida* | 11 | 6 | 6 | 11 | 4 | 4 | 10 | 4 | 8 | 5 | 10 | **4** |
| Field sparrow | *Spizella pusilla* | | 4 | | 4 | 3 | 5 | 6 | 2 | 4 | | 6 | |
| Vesper sparrow | *Pooecetes gramineus* | 4 | | | | | | | | | | | |
| Song sparrow | *Melospiza melodia* | | | | | | | | | | | | |
| Henslow's sparrow | *Ammodramus henslowii* | 4 | | 3 | | | | | | 5 | 5 | | **6** |
| Grasshopper sparrow | *Ammodramus savannarum* | | | 6 | 4 | 7 | | | | | | | |
| Brown thrasher | *Toxostoma rufum* | | | | | | | | | | 4 | | |
| Yellow warbler | *Dendroica petechia* | | | | | | | | | | 4 | | |
| Common yellowthroat | *Geothlypis trichas* | | | | | | 3 | | 4 | 7 | 5 | 7 | |
| Red-winged blackbird | *Agelaius phoeniceus* | | | | | | | | | | | | **5** |
| Eastern meadowlark | *Sturnella magna* | 5 | | | | 3 | 3 | | 2 | 4 | | | |
| Brewer's blackbird | *Euphagus cyanocephalus* | | | | | | | | | | | | |
| American goldfinch | *Carduelis tristis* | | 2 | | 5 | 3 | 3 | 7 | 3 | | 6 | 8 | **4** |
| **Woodland Plots (n=6)** | | | | | | | | | | | | | |
| Mourning dove | *Zenaida macroura* | | | | | | | | | | | | |
| Tree swallow | *Tachycineta bicolor* | | | 4 | | | | | | | | | |
| Red-bellied Woodpecker | *Melanerpes carolinus* | | | | | | | | | | | | **4** |
| Great crested flycatcher | *Myiarchus crinitus* | 4 | 3 | | | 6 | | 4 | 5 | 4 | 5 | | |
| Eastern wood-pewee | *Contopus virens* | 4 | 3 | 5 | | 5 | 4 | 6 | 3 | | 5 | 4 | |

Table 38. Most abundant songbirds observed on breeding songbird plots, Arden Hills Army Training Site, Minnesota, 2006 – 2018. The number of birds documented is indicated in columns.

| Woodland Plots, continued (n=6) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Common Name** | **Scientific Name** | **June 5, 2007** | **July 9, 2008** | **May 29, 2009** | **May 27, 2010** | **June 3&14, 2011** | **June 6, 2012** | **June 7, 2013** | **June 6, 2014[a]** | **May 27, 2015** | **June 2, 2016** | **May 31 & June 1, 2017** | **June 7, 2018** |
| Least flycatcher | *Empidonax minimus* | | | | | | | | | | | 4 | |
| Red-eyed vireo | *Vireo olivaceus* | | | 5 | 5 | | | 5 | | 6 | 4 | | |
| Blue jay | *Cyanocitta cristata* | | 6 | 6 | 6 | 6 | | 4 | | 7 | 4 | | **5** |
| Black-capped chickadee | *Poecile atricapillus* | 7 | | 3 | | 7 | 4 | | | | | | |
| White-breasted nuthatch | *Sitta carolinensis* | | 5 | | 5 | | 6 | 4 | | | | | **4** |
| House wren | *Troglodytes aedon* | 11 | | 3 | 6 | 6 | 6 | | | | | | |
| Blue-gray gnatcatcher | *Polioptila caerulea* | | | | | | | | 3 | | | | |
| American robin | *Turdus migratorius* | | 5 | 6 | | | | | | | | | |
| Gray catbird | *Dumetella carolinensis* | | 3 | | | | | | | 5 | | | |
| Rose-breasted grosbeak | *Pheuctius ludovicianus* | | | | | | | | | | | 4 | |
| Eastern towhee | *Pipilo erythrophthalmus* | | 3 | | | | | | | | | | |
| Red-eyed vireo | *Vireo olivaceus* | | | | | | | | | | | | **4** |
| Common yellowthroat | *Geothlypis trichas* | | | 5 | | 5 | 5 | | 6 | 4 | | 5 | **5** |
| Yellow warbler | *Dendroica petechia* | | | 3 | | | | | | | | | |
| Chestnut-sided warbler | *Vermivora ruficapilla* | | | | | | | | | | 4 | 4 | |
| American redstart | *Setophaga ruticilla* | | | | | | | | | | | 6 | |
| Chipping sparrow | *Spizella passerina* | | | | | | | | 3 | | | | |
| Song sparrow | *Melospiza melodia* | | 5 | | | | | | | | | | |
| Northern cardinal | *Cardinalis cardinalis* | 4 | 3 | 3 | | | | | | | | | |
| Indigo bunting | *Passerina cyanea* | | 3 | | | 4 | | 4 | | | 4 | | |
| Red-winged blackbird | *Agelaius phoeniceus* | 5 | 4 | 3 | | | | | 3 | | | | |
| Brown-headed cowbird | *Molothrus ater* | | 3 | | 5 | | 4 | | | | | | |
| Baltimore oriole | *Icterus galbula* | | | 4 | 5 | | 5 | 4 | 3 | | | | |
| American goldfinch | *Carduelis tristis* | 4 | | 4 | 4 | 4 | 4 | 5 | 4 | | 4 | 6 | **4** |

a Only five grassland and five woodland songbird plots were surveyed in 2014.

## Trumpeter Swan (*Cygnus buccinators*)

The DNR introduced a pair of wing-clipped trumpeter swans to Marsden Marsh in 1993, and again in 1994. Seven young free-flying wild swans were observed at the wetland during the summer of 1994, presumably after observing the presence of the introduced pair. A wild pair nested at AHATS in 1995, and subsequently raised two cygnets in the wetland. This made AHATS the first site in Ramsey County in approximately 150 years to support the production of cygnets from wild swans.

One pair of trumpeter swans was observed on both Sunfish Lake and Marsden Marsh. These pairs fledged five and no cygnets, respectively. Trumpeter swans had been listed as threatened in Minnesota but were reclassified in 2013 to a special concern species. Minnesota's population is a significant portion of the North American population. Each year AHATS is monitored for trumpeter swan presence and reproduction (Dirks et al. 2010) (Table 39).

Table 39. Trumpeter swans production, Arden Hills Army Training Site, Minnesota, since 1995.

| Year | Cygnets Fledged |
|---|---|
| 1995 | 2 |
| 1996 | 3 |
| 1997 | 1 |
| 1998 | 5 |
| 1999 | 6 |
| 2000 | 0 |
| 2001 | 1 |
| 2002 | 0 |
| 2003 | 2 |
| 2004 | 3 |
| 2005 | 2 |
| 2006 | 7 |
| 2007 | 5 |
| 2008 | 6 |
| 2009 | 1 |
| 2010 | 1 |
| 2011 | 1 |
| 2012 | 0 |
| 2013 | 0 |
| 2014 | 5 |
| 2015 | 5 |
| 2016 | 2 |
| 2017 | 7 |
| 2018 | **3** |
| **Total** | **62** |

## Common Loon (*Gavia immer*)

Although listed as a SGCN, Minnesota has more loons (roughly 12,000) than any other state except Alaska. Threats to loons include human disturbance and pollutants such as lead and mercury. The DNR monitors loon populations with the help of volunteers to improve understanding of what our state bird needs to maintain a strong, healthy presence here (MNDNR 2011).

Common loons have nested on AHATS wetlands and lakes in the past; however, no effort was made to document if any of those nesting attempts were successful. Common loons were observed on Sunfish Lake and Marsden Marsh, but no chicks were fledged at either location.

## Osprey (*Pandion haleaetus*)

During the nesting season, an osprey pair was observed on the nesting platform at North Hamline Gate (Figure 49), they fledged two chicks and both were banded (Table 40). The Marsden Marsh pair fledged three chicks but two were banded because the third chick was too small.

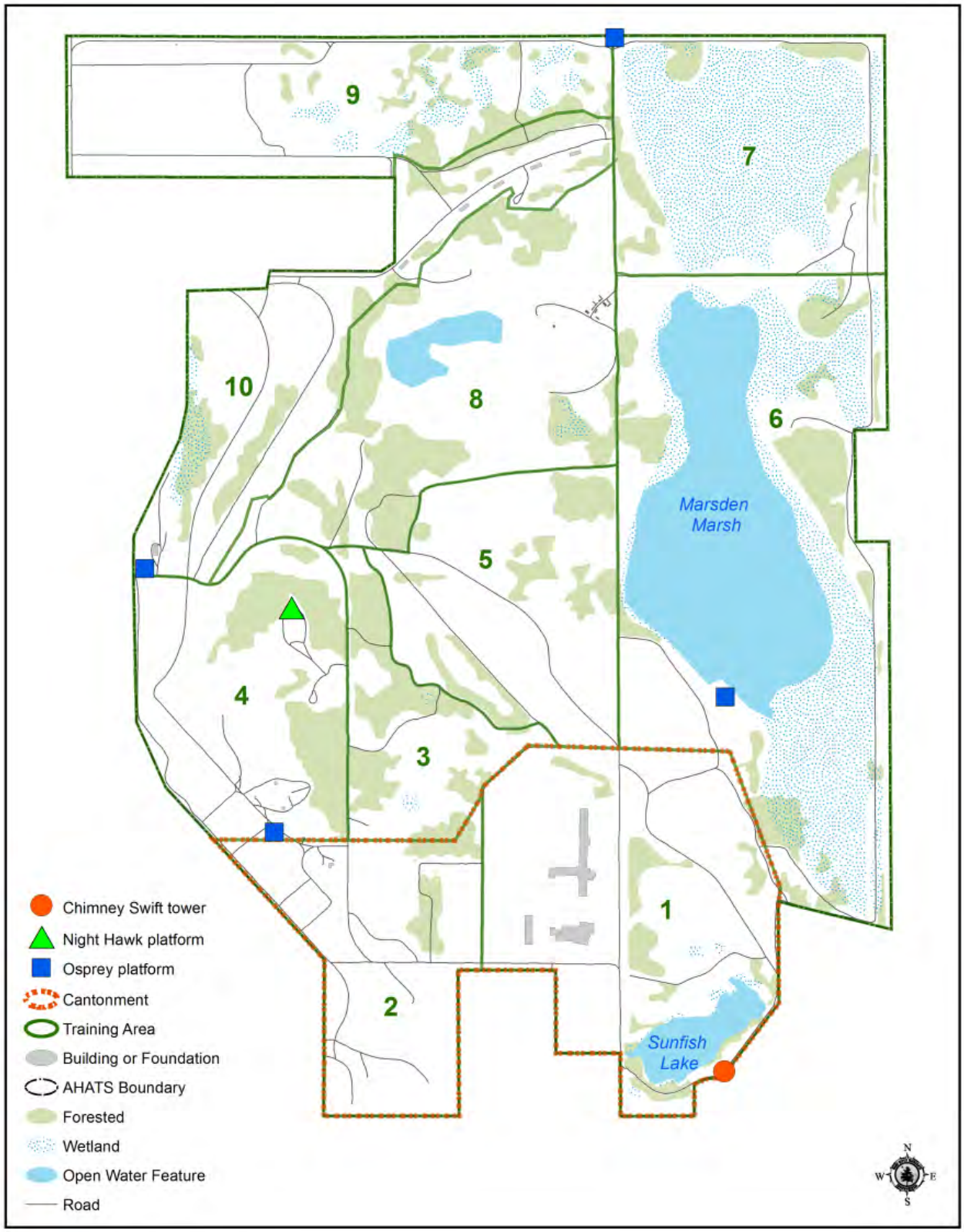
Banding occurred on July 9, in cooperation with Xcel Energy and volunteers Mark Martell (federal bird banding permittee) and Amber Burnette.

The two new artificial osprey platforms in Training Areas 4 and 10 (Figure 46, pg. 158), both installed in 2013, were not used.

Table 40. Osprey chicks raised, Arden Hills Army Training Site, Minnesota, since 2001.

| Year | Osprey Fledged |
|---|---|
| 2001 | 3 |
| 2002 | 4 |
| 2009 | 2 |
| 2010 | 2 |
| 2011 | 2 |
| 2012 | 2 |
| 2013 | 3 |
| 2014 | 2 |
| 2015 | 1 |
| 2016 | 5 |
| 2017 | 2 |
| **2018** | **5** |
| **Total** | **27** |

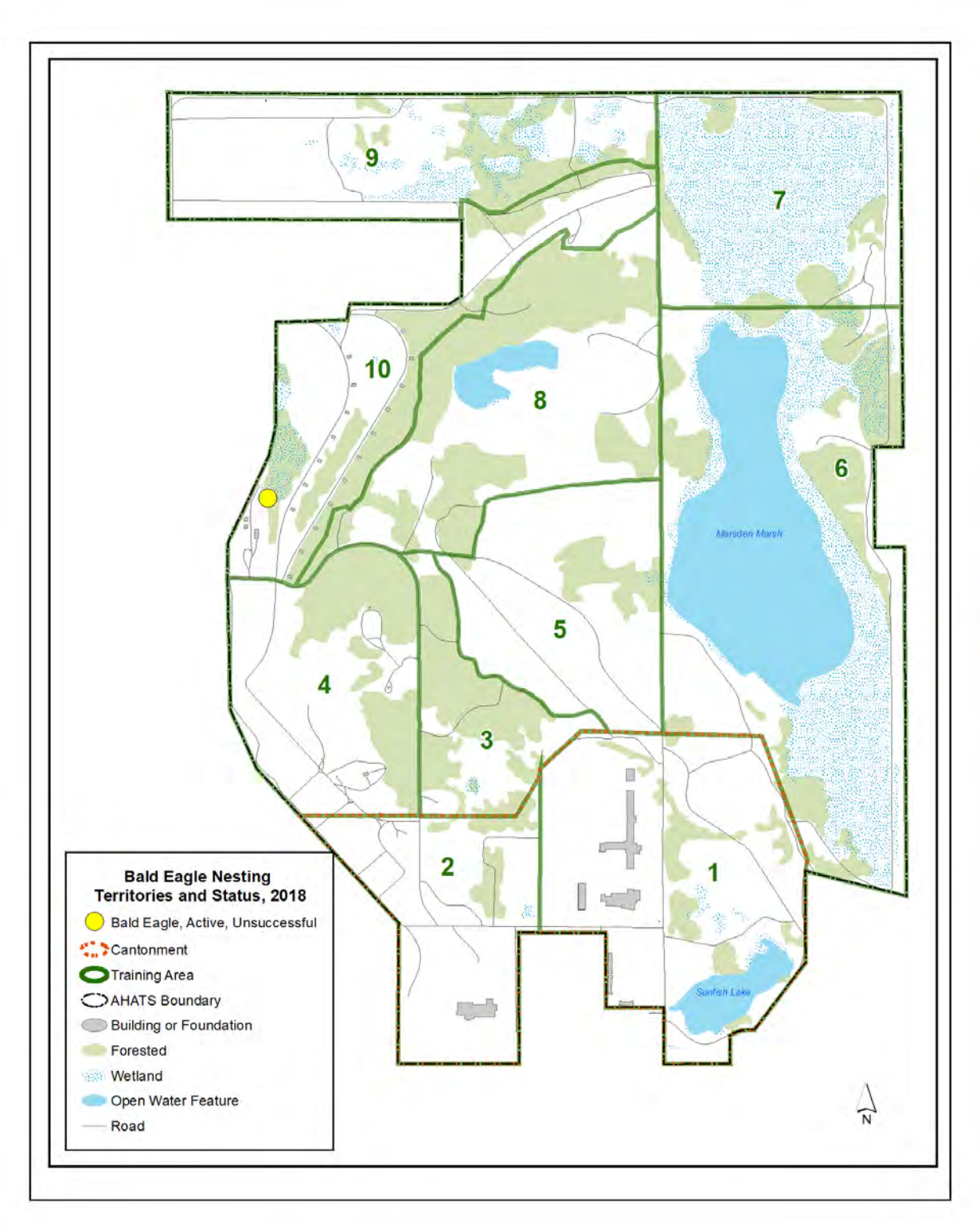
Figure 49. Osprey, chimney swift and common nighthawk nest structures, Arden Hills Army Training Site, since 2013.



## Bald Eagle (*Haliaeetus leucocephalus*)

In the lower 48 states, Minnesota has the most nesting pairs of bald eagles at approximately 1,300. Bald eagles are protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. Both of these acts prohibit killing, selling or otherwise harming or disturbing eagles, their nests or eggs. The U.S. Fish and Wildlife Service (USFWS) released Bald Eagle Management Guidelines for people who are engaged in recreation or land use activities around bald eagles. These guidelines provide information and recommendations regarding how to avoid disturbing bald eagles. A bald eagle nest was discovered on AHATS in the spring of 2017, the territory was active and produced one chick. In 2018, the territory was active, but no chicks were produced (Figure 50). A second nest was discovered near Marsden Marsh in the fall of 2018. This nest may be an alternate nest site or a new bald eagle pair's nest. In addition, recent surveys by the Saint Paul Audubon Society indicate that AHATS does provide winter habitat as bald eagles have been observed during the Christmas Bird Count in nine of the past 10 count years (Table 35, pgs. 154 – 155).

Figure 50. Bald eagle nesting territories and status, Arden Hills Army Training Site, Minnesota, since 2018.



American Kestrel (*Falco sparverius*)

American kestrels, a SGCN, have been observed on AHATS for many years and were listed as common in a 1991 assessment (U.S. Army 1991). However, in recent years, substantial population declines have occurred in Minnesota and across their range (MNDNR 2015a). Artificial nest boxes have been installed at AHATS in previous years by the Audubon Society and other local groups to enhance American kestrel populations.

AHATS environmental staff and volunteers began a kestrel project in 2016. The objectives for the study are to determine 1) if individuals remain in natal (where they were hatched) areas, and if so, for how long after hatching, 2) local movements within and around AHATS and the distance of movement, 3) if individuals use the same artificial nest box sites annually and 4) nest box location characteristics.

Adult kestrels were captured using bal chatri traps. Each bird was aged, if possible, sex determined, leg banded and measurements taken. Pre-fledging young were removed from artificial nest boxes, leg banded and returned to the nest box.

Fourteen artificial nest boxes were monitored (Table 41), of these six boxes were occupied and produced 28 fledglings.

*Pictured: Artificial nest box with American kestrel in flight, Arden Hills Army Training Site, Minnesota, 2018. Photograph courtesy of Amber Burnette.*

Table 41. American kestrel monitoring, Arden Hills Army Training Site, Minnesota, 2016 – 2018.

| Year | Total Artificial Nest Boxes | Number of Occupied Nest Boxes | Number of Successful Nest Boxes | Adults Banded | | Juveniles Banded | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Male | Female | Male | Female | Unknown |
| 2016 | 13 | 9 | 8 | 2 | 9 | 14 | 20 | 2 |
| 2017 | 14 | 10 | 6 | 6 | 2 | 19 | 7 | 2 |
| **2018** | **14** | **6** | **6** | **0** | **0** | **16** | **12** | **0** |
| **Total** | | **25** | **18** | **19** | | **92** | | **4** |

### Sandhill Crane (*Grus canadensis*)

Sandhill cranes are monitored through a project of the International Crane Foundation. The annual Midwest Crane Count has been conducted since 1976. The purpose of the count is to monitor the abundance and distribution of cranes in the upper Midwest (International Crane Foundation 2010). No sandhill crane observations were made in 2018.

### American Woodcock *(Scolopax minor)*

The American woodcock is a forest dwelling shorebird whose breeding distribution is primarily found in the forested regions of the state and along the Minnesota River valley (Pfannmuller et al. 2017a). Successful breeding occurs in shrubland and young forest habitats (McAuley et al. 2013). Woodcock is a Minnesota SGCN and was designated such due to a documented statistically valid population decline (MNDNR 2015a). Population trends are measured using woodcock singing-ground (peenting) surveys on established routes throughout its breeding range. Surveys demonstrated a decline of 0.8 % per year from 1968 to 2012 but surveys from 2002 to 2012 showed no trend (Pfannmuller et al. 2017a). A woodcock peenting survey occurred on the evenings of April 18 and April 25; four birds were heard.

### Common Nighthawk (*Chordeiles minor*)

The common nighthawk is a SGCN in Minnesota. Although nighthawks are not well monitored by breeding bird surveys, due to its crepuscular habits, research indicates their populations have experienced a 58% decline since 1970 (Rosenberg et al. 2016). The cause of population decline is not well understood but is believed to be related to loss of breeding habitat, pesticide use and nest predation. A wide variety of habitats are used but nesting occurs on the ground on a bare site in an open area (NatureServe 2009) or man-made structures where flat gravel roofs are found. However, construction standards have changed recently to flat, smooth or rubberized roofs (Pfannmuller et al. 2017d). Due to population declines, an artificial common nighthawk structure was constructed and installed in July 2011 (Figure 47, pg. 161). The artificial structure was not used in 2012 – 2018.

### Chimney Swift (*Chaetura pelagica*)

Chimney swifts are avian neotropical migrants that are exhibiting a decrease in population. They inhabit rural and urban habitats where suitable roosting and nesting sites are available along with abundant insect populations. These swifts nest primarily in chimneys but will also use the interior walls of silos, barns and uninhabited homes. Natural nest sites include the interior of hollow tree trunks and branches. Recently, populations have become vulnerable as chimney screening and demolition of buildings historically used for nesting/roosting reduces important habitat. In addition, newly constructed chimneys are lined with metal flue pipe which is too smooth for swifts to cling to and may potentially result in entrapment and cause bird deaths (NatureServe 2011). To help reduce population declines artificial nest/roost structures have been developed. A chimney swift tower was installed at AHATS in May 2011 (Figure 47, pg. 161). The artificial tower was not used in 2012 – 2018. A chimney swift was observed during the Saint Paul Audubon Society's butterfly count on July 7.

### Henslow's Sparrow (*Ammodramus henslowii*)

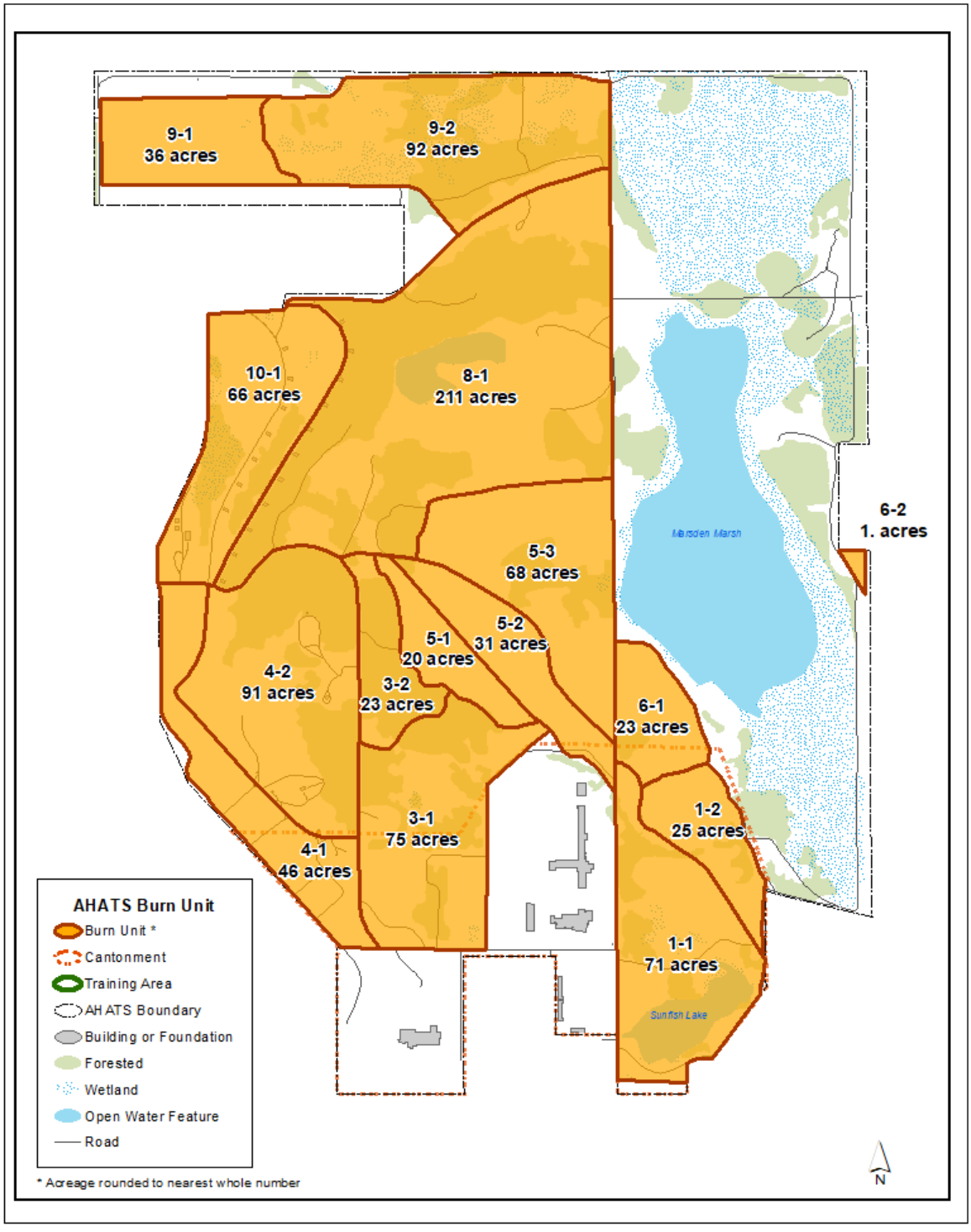
Henslow's sparrows, a SGCN, have been observed at AHATS nine of the past fifteen years during breeding bird surveys and were recorded the second most abundant grassland species in 2018 (Table 38). None were observed during 2008, 2010, 2011, 2014 and 2017. However, Henslow's were heard singing during the Audubon butterfly survey on July 8, 2017 in Training Area 5. Local populations can fluctuate considerably from year to year (Herkert et al. 2002). Henslow's sparrows usually breed in grasslands south and east of Minnesota. However, sightings increased in the region during the summer of 2005, the year they were first observed at AHATS. Although, considerable population fluctuations can occur from year to year (Herkert et al. 2002). Possible causes for increased sightings may be due to a temporary population increase, a temporary population shift from another area, or a true population increase. However, annual monitoring indicates that Henslow's sparrows are frequently using AHATS during breeding season.

Henslow's sparrows are listed as endangered by the DNR and six other states, but are not listed by the U.S. Fish and Wildlife Service. The nationwide population of this obligate grassland bird species has declined nearly 80% since 1966, due to grassland habitat destruction, degradation and/or reforestation (National Audubon Society 2007; Cooper 2012). The Army Priority List of At-Risk Species gives Henslow's sparrows a two priority ranking. This priority listing allows the Army to work to prevent species at-risk from being added to the federal threatened and endangered species list through proactive conservation measures (Balbach et al. 2010).

Management for this species should provide for large areas of suitable habitat, prevention of disturbance during the breeding season, and the control of succession (Herkert 2002). Suitable nesting habitat is tall (mean height is 59 centimeters), dense grass with a well-developed litter layer, averaging 7.1 centimeters in depth (Hanson 1994), and scattered tall forbs for perching. Periodic disturbance, such as prescribed fire, is essential to maintaining suitable habitat; even though it will likely reduce the suitability of the grassland during the treatment year. However, suitable habitat conditions need to

prevail near the treated plot. Trees and shrubs should be eliminated from grassland areas to discourage predators and nest parasites such as the brown-headed cowbird. Grasslands where Henslow's are located (Burn Units 1-1, 1-2, 5-2, 5-3, 6-1 and 9-1) should be burned or mowed on a minimum of a five-year rotation, since it may take several years for the habitat to regain suitable structure for breeding Henslow's sparrows (Dirks et al. 2010). Burn units 9-1 and 5-2 were burned 2016 (Figure 51). To allow some Henslow's habitat to remain each year, treatment of any of these grassland burn units should be separated by a minimum of three years. Habitat requirements and management for Henslow's sparrows will be included in the development of future habitat restoration plans.

Figure 51. Prescribed fire burn units, Arden Hills Army Training Site, Minnesota, 2016.



## Mammals

### Northern Long-eared Bat (*Myotis septentrionalis*)

By Nancy J. Dietz and Brian J. Dirks, Minnesota Department of Natural Resources

”Bats are a critical component of Minnesota’s ecosystems. A single bat may eat 1,000 insects per hour, and the state’s bats likely provide many millions of dollars in pest control each year (Boyles et al. 2011)” (Swingen et al. 2016). Eight species of bats have been documented in Minnesota: little brown myotis (*Myotis lucifugus*), northern long-eared bats (*Myotis septentrionalis*), big brown bats (*Eptesicus fuscus*), tricolored bats (*Perimyotis subflavus*), silver-haired bats (*Lasionycteris noctivagans*), eastern red bats (*Lasiurus borealis*), hoary bats (*Lasiurus cinereus*) and evening bats (*Nycticeius humeralis*). Four of Minnesota’s bat species hibernate in caves and mines (northern long-eared bat, tricolored bat, little brown myotis and big brown bat) during the winter, and disperse widely across the state in spring, summer and fall. Very little is known about the summer habitat use of these species” (Swingen et al. 2016, 2018).

Based upon 2007 and 2015 passive acoustic surveys and captures (Dirks and Dietz 2010; MNDNR and MNARNG 2016; Swingen et al. 2016 and 2018), AHATS is home to four bats that are designated state special concern species and SGCN, northern long-eared bat, tricolored bat, little brown myotis and big brown bat. Three additional bats are SGCN only, silver-haired bat, eastern red bat and hoary bat.

The northern long-eared bat is federally listed as a threatened species under the Endangered Species Act. Threatened species are animals or plants that are likely to become endangered in the foreseeable future. The U.S. Fish and Wildlife Service (USFWS) determined, in December 2017, that the petition to list the tricolored bat presented substantial scientific information that federal listing may be warranted. Therefore, a status review was initiated and a determination will be made whether to propose listing tricolored bats under the Endangered Species Act (USFWS 2018d).

#### Passive Acoustic Bat Survey

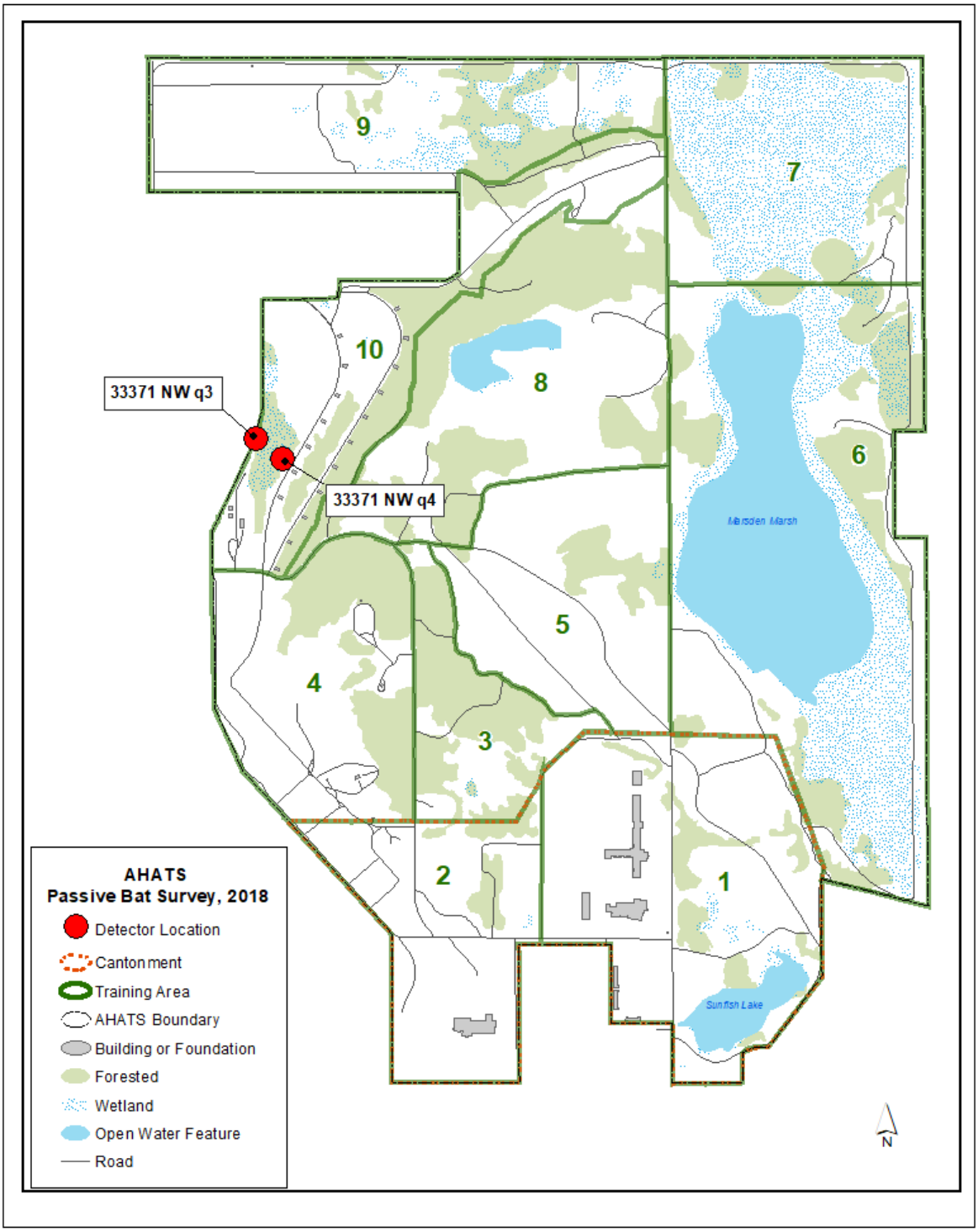
Recording bat echolocation “calls” is the most efficient and least intrusive way of identifying different species of bats in a given area (USGS 2014). However, acoustic bat surveys have many variables that contribute to the quantity and quality of echolocation recordings. Bats can be characterized by the “volume” of their echolocation calls, some bats are “shouting” bats and others are “whispering” bats. For example, big brown bats and little brown myotis are shouters, and emit sounds at 110 decibels (if we could hear them) similar to the loudness of a smoke alarm. However, northern long-eared bats produce sounds of 60 decibels, similar to the level of human conversation. Therefore, shouting bats can be heard by the detector at greater distances than whispering bats. Shouting bats can overpower the calls of the whispering bats, such as northern long-eared bat, when they are near the detector together. Northern long-eared bats therefore are more difficult to detect than other bats.

How sound attenuates in the atmosphere can also influence the quantity and quality of calls recorded and the zone of reception, the physical space where the bat can be detected. Weather conditions such as temperature, wind, humidity and air pressure affect bat activity and call quantity and quality. Also, structural clutter, such as vegetation, can block the path of the calls. In addition, calls recorded can be partial or parts of two species of bats, making bat identification difficult.

The objective for the 2017 and 2018 passive acoustic bat survey was to place detectors in habitats suited for evening bats and to identify locations where they occur. The first evening bat capture in Minnesota was at AHATS in 2016 (MNDNR and MNARNG 2017). Passive acoustic bat surveys were conducted using Pettersson D500X full spectrum detectors from July 24 to August 2 and July 24 to August 8 (Figure 52). Site 33371NWq3 (10 nights) recorded 9,746 call files and 33371NWq4 (16 nights) had 1,696 call files. In 2017, calls were reviewed and analyzed by the University of Minnesota-Duluth, Natural Resources Research Institute using Kaleidoscope Pro (version 4.0.4) and Sonobat (version 4.0.6) automated analysis software. Automated full spectrum software has not been approved by the U.S. Fish and Wildlife Service for use in identifying presence of northern long-eared bats.

Northern long-eared bat, evening bat and tricolored bat calls were positively identified by Kaleidoscope Pro software at two sites in 2017; however, only tricolored bat calls were identified by Sonobat at these sites. Presence of all Minnesota bat species from passive full spectrum acoustic surveys in 2017 have been confirmed either through captures or zero-crossing acoustic bat surveys (MNDNR and MNARNG 2016, 2017). Qualitative analysis of the evening bat call files are pending to confirm if they are regular visitors to AHATS. Automated analysis of 2018 passive full spectrum acoustic surveys is also pending.

Figure 52. Passive acoustic bat survey, Pettersson D500X full spectrum detector, Arden Hills Army Training Site, Minnesota, 2018.



## Plains Pocket Mouse (*Perognathus flavescens*)

The plains pocket mouse is listed as a state special concern species. AHATS is the site of the only known plains pocket mouse population in Ramsey County and is the largest known population of pocket mice in the state. First documented at AHATS in 1995, this species has been located in only 13 other counties in Minnesota (MNDNR 2009). The closest pocket mouse capture was in Anoka County, 10.5 miles from AHATS.

At AHATS, plains pocket mice are found in a gravel pit near Marsden Lake. The preferred habitat for the plains pocket mouse contains well-drained sandy soils, with sparse, grassy or brushy vegetation (MNDNR Rare Species Guide 2009; Higgins et al. 2000). The vegetation around the gravel pit area is gradually becoming thicker due to lack of disturbance. At AHATS, thicker vegetation is more commonly inhabited by meadow voles and *Peromyscus* species. In order to maintain the amount of suitable habitat available for the plains pocket mouse at AHATS, vegetation manipulations need to be conducted. In October 2003, an ATV was used to drag a chain link harrow to partially remove vegetation in a 2,700 meter squared (0.67 acre) parcel of land north of pocket mouse capture sites (Dirks and DeJong 2004) (Figure 53). Plains pocket mice were live trapped in the 2003 disturbance area in both 2004 (Dirks and DeJong 2005) and 2009 (Dirks and Dietz 2010). Again, in October 2010, a similar location was disturbed using a grader to remove less than six inches of top soil to disturb the area and provide the necessary sparsely vegetated habitat (Figure 53). This work was conducted by Ramsey County Public Works during a training exercise. Plains pocket mice hibernate in underground burrows in winter. Excavated summer burrows in Minnesota were all parallel to the surface at a depth of six to eight inches; burrows for winter hibernation are deeper (Hibbard and Beer 1960). In 2011, the disturbed area was encroached by long-spine sandbur (*Cenchrus longispinus*).

Live traps (n=65) were placed in the area of past occupancy of plains pocket mouse (Figure 54) and left closed for seven nights so pocket mice could get acclimated to the traps in their environment. Traps were opened and baited on June 12 and trapping occurred on six nights during the next two weeks ending on June 22. Six meadow jumping mice (*Zapus hudsonius*), five meadow voles (*Microtus pennnsylvanicus*), and four white-footed deer mice (*Peromyscus spp*.) were captured. No plains pocket mice were captured in 390 trap nights. The habitat in the trapping area has become too densely vegetated for plains pocket mouse. The vegetation density at two-thirds of the small mammal capture locations was 75 – 100%. Future trapping efforts should focus on lightly vegetated (less than 25%) locations near the gravel pit. Human intervention is needed to prevent natural succession at this site to maintain its openness (Birney and Monjeau 1997; Birney 1999).

Figure 53. Plains pocket mouse habitat enhancement, Arden Hills Army Training Site, Minnesota, 2003 and 2010.

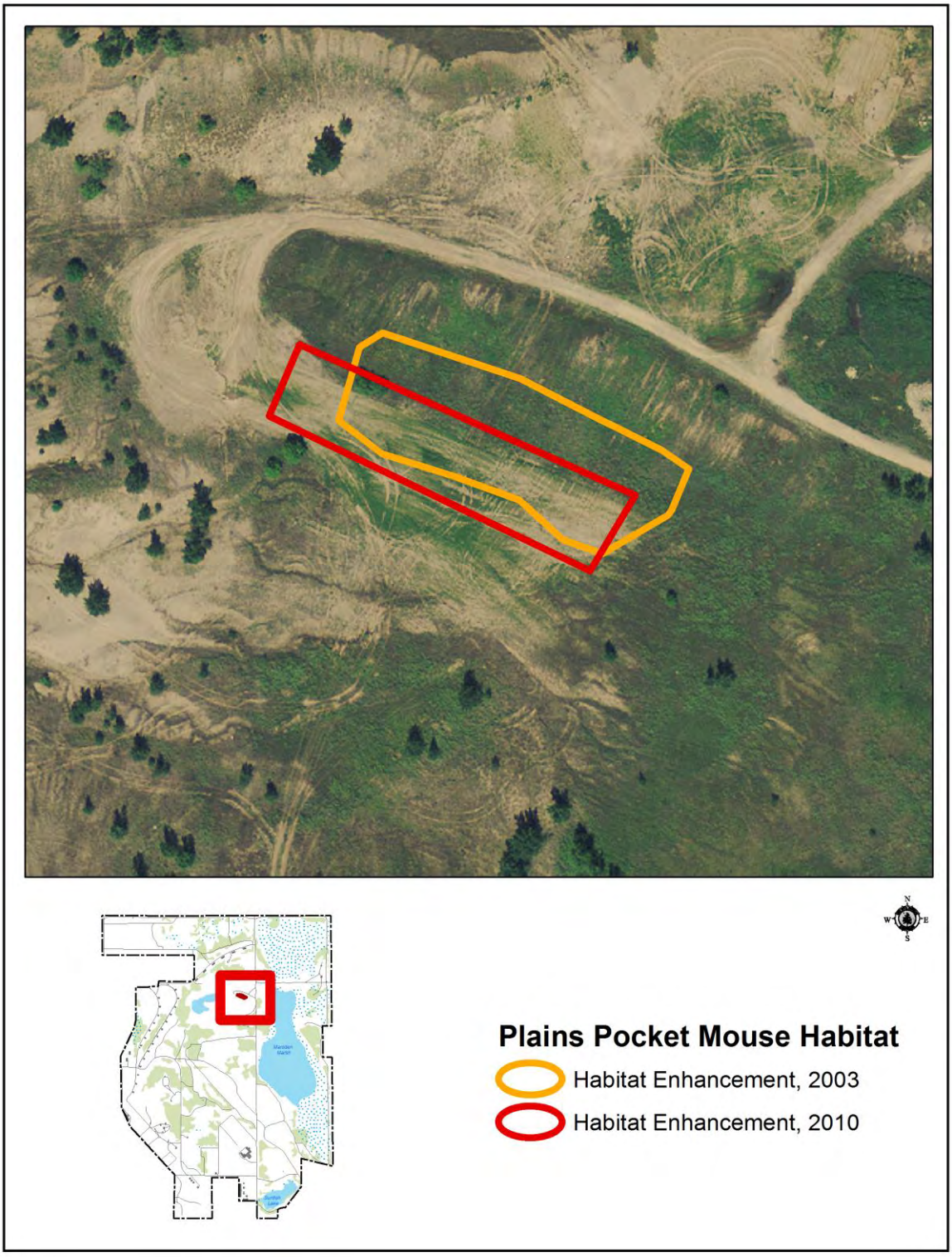
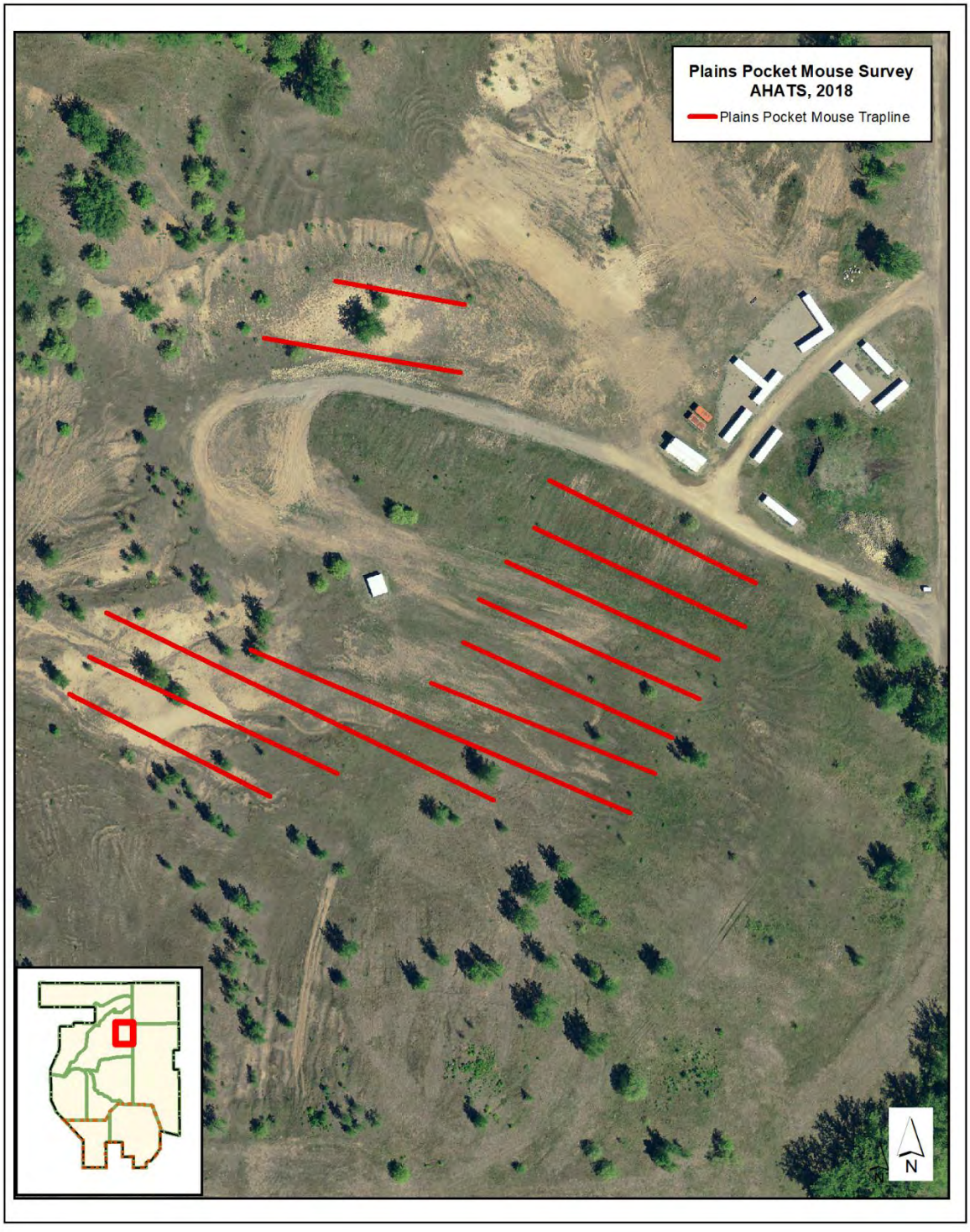


Figure 54. Plains pocket mouse live trap locations, Arden Hills Army Training Site, Minnesota, June 2018.



## Beaver (*Castor Canadensis*)

Beaver are an important part of the natural ecosystems at AHATS. This species can have a large effect on the environment in which it lives. In a natural system, beavers create or enlarge wetland areas which trap nutrients and help to reduce flooding by holding and slowly releasing water. However, problems occur in localized areas when beavers plug road culverts, flooding and damaging roads. When this occurs, a cooperative effort between the AHATS environmental office, the DNR and AHATS Department of Public Works (DPW) is initiated to identify problem areas and implement solutions.

All problem areas are inspected by the AHATS environmental office and possible solutions are provided to AHATS Department of Public Works. Some areas require the removal of beaver through trapping. AHATS beaver removal is conducted by a nuisance beaver trapper at the direction of Camp Ripley's DNR researchers or AHATS environmental staff. No beaver were removed from AHATS during 2016 – 2018.

Many problem areas can be addressed through the use of damage control structures, such as Clemson levelers and beaver deceivers. These devices have been used successfully at AHATS in the past, when installed correctly. However, these devices do require maintenance and eventually fail and/or need to be replaced.

Beaver ponds and wetlands throughout AHATS provide habitat for Blanding's turtles and numerous reptiles and amphibians; as well as provide feeding areas for a variety of wildlife and habitat for waterfowl and other birds. Therefore, it is important that these wetlands not be permanently drawn down or drawn down in fall or winter in order to install these devices. Installation should occur after a temporary drawdown in spring or summer, or during natural low-water levels. Research in east-central Minnesota investigated the effects of a controlled drawdown on Blanding's turtle populations. The incidence of mortality was high after the drawdown due to predation, road mortality and winterkill (Dorff Hall and Cuthbert 2000).

## White-tailed Deer (*Odocoileus virginianus*) Aerial Survey

Historically, winter white-tailed deer populations at the AHATS and Twin Cities Army Ammunition Plant (TCAAP) properties have fluctuated from an estimated high of 400 in the late 1960s (Jordan et al. 1997) to 30 in 2001 and 2003. Overpopulation of white-tailed deer may negatively impact vegetation and efforts to restore oak savannah, impact the vegetative structure required for military training and cause hazards due to vehicle collisions along perimeter roadways. Aerial white-tailed deer surveys are conducted annually to track population changes. Since 1999, the number of white-tailed deer counted during winter surveys had increased to a high of 124 in 2007, but has recently declined (Table 42). No aerial survey was conducted in 2017 because there was insufficient snow cover, a requirement for an accurate survey. Thirty-nine white-tailed deer were counted during the 2018 aerial deer survey.

Table 42. Aerial surveys of white-tailed deer, Twin Cities Army Ammunition Plant and Arden Hills Army Training Site, Minnesota, 1999 – 2018.

| Year | 1999 | 2000 | 2001 | 2003 | 2004 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2013 | 2014 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Deer Counted | 41 | 47 | 30 | 30 | 47 | 84 | 124 | 87 | 104 | 72 | 61 | 41 | 64 | 6**6** | **39** |

a No count was conducted in 2002, 2005, 2012, 2015 and 2017.

Although the properties are fenced, deer are not completely restricted from moving in and out of AHATS and TCAAP. Since control of the deer population at AHATS and the surrounding area occurs primarily on the training site, management of this population will rely primarily on archery hunting pressure. As the number of white-tailed deer increased since 2003, the number of hunts and total number of white-tailed deer harvested also increased to keep the herd from becoming too large (See Hunting Programs section in this document for hunt data summaries, pg. 199). The overall reduction in deer numbers is partially due to the harvest of deer in the fall of 2009, 2010, 2012, 2014, 2015, 2016, 2017 and 2018 when 66, 52, 53, 42, 25, 25, 30 and 36 deer were harvested, respectively. These are the largest total number of deer harvested since hunts began in 2003. This indicates that hunting pressure has aided reduction in deer numbers and continues to be necessary to reduce and/or maintain the deer population.

## Reptiles and Amphibians

### Blanding's Turtle (*Emys blandingii*)

The Blanding's turtle is listed as a state threatened species by the DNR. AHATS is part of a Blanding's turtle priority area as designated by the DNR. Priority areas are the most important areas in the state for management, protection and research of Minnesota's Blanding's turtle population. In July 2012, the U.S. Fish and Wildlife Service (USFWS) was petitioned to include Blanding's turtles as threatened or endangered. The USFWS determined, in July 2015, that the petition presented substantial information that federal listing of Blanding's turtles may be warranted. Therefore, a status review was initiated and a determination will be made whether to propose listing Blanding's turtles under the Endangered Species Act (USFWS 2019a). This species depends upon a variety of wetland types and sizes, and uses sandy upland areas and roadways for nesting. Because nest predation is extremely high, road surveys are conducted in known Blanding's habitats to find and protect nests. However, surveys of Blanding's turtles have only occasionally occurred at AHATS.

Blanding's turtle roadside surveys were conducted for 11 evenings from June 4 to June 21. Nesting seasons generally range from early-May to mid-July (Congdon et al. 1983). Roads were surveyed by conducting searches by vehicle through areas of known and potential nesting activity. One truck was used to run circular routes throughout AHATS. Any observed Blanding's turtle tracks were investigated in efforts to locate the turtle and areas away from roads were occasionally checked for nesting females. Five Blanding's turtle observations were recorded, with the first sighting occurring on June 7 (AP). This non-gravid female was observed for two consecutive days. A gravid female (BOX) was

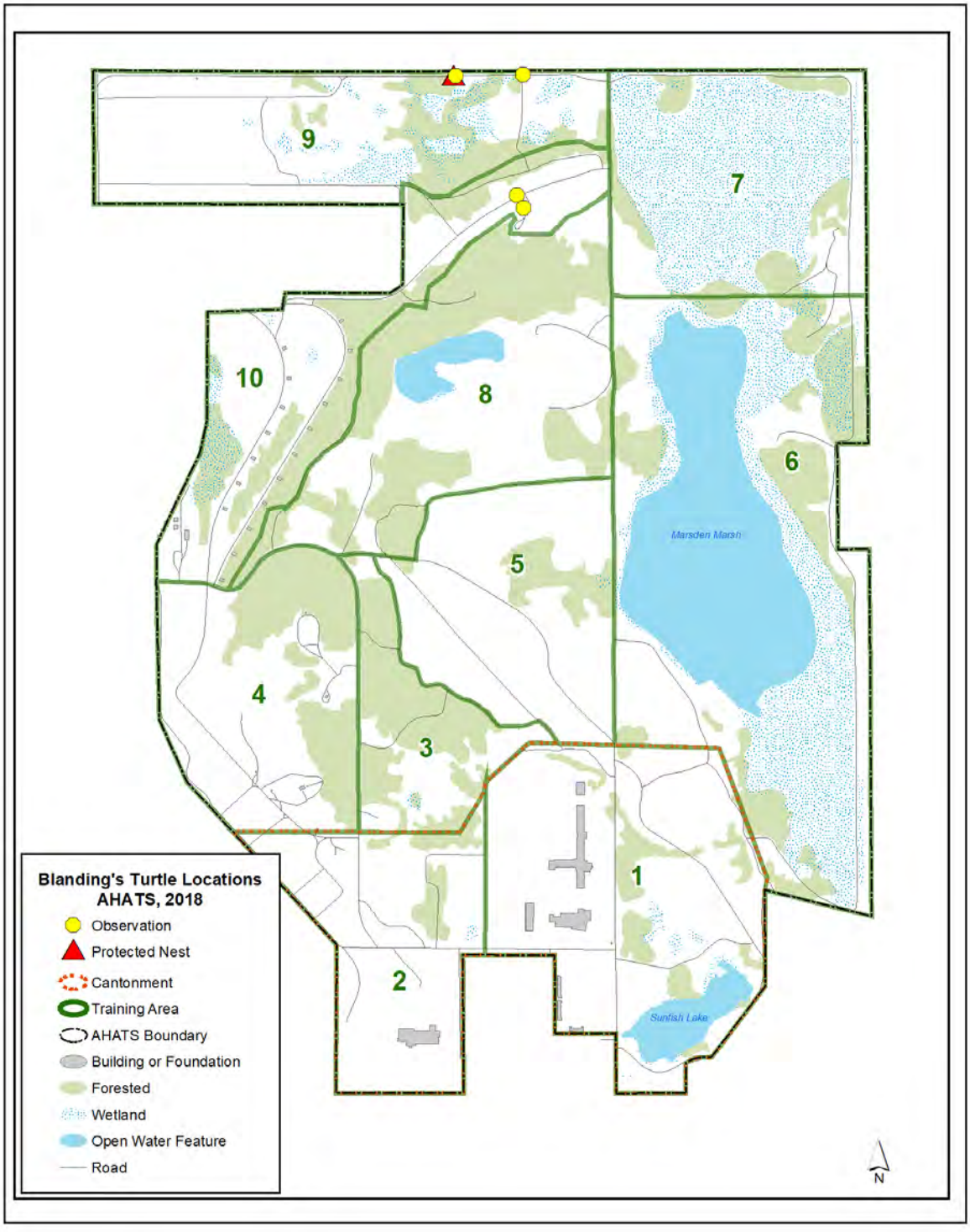
observed three consecutive evenings. This female during its first observation was suspected to be marked at the “O” scute but the marking was determined to be a chip rather than an identifying mark. This turtle was marked after nest completion on June 14 as BOX. Standard protocol is to watch the turtle and determine if it is nesting. If the female is nesting, surveyors wait until nest completion and identify the turtle. If the female is not nesting, the surveyor may continue road surveys and return to check the status of the female.

One nest was protected in 38 hours of effort (BOX) (Figure 55). After data collection, a 1 X 1 meter metal cage was placed over the center of the nest and the cage was dug into the ground about three to four inches to prevent predation. Two yellow posts with reflective tape were then positioned to face oncoming traffic to eliminate vehicle disturbance.

Typically, hatchlings emerge 75 – 110 days after the date of nest completion (Congdon et al. 1983). Five hatchlings were observed on August 26 and nest incubation was 73 days. This nest was protected and monitored through mid-September and was excavated when no evidence of additional hatchling emergence existed in early October. Nest chamber excavation revealed one whole egg that may have been infertile and an estimated 13 hatched egg remains.

Camp Ripley’s DNR researchers believe that roadside Blanding’s turtle surveys missed the peak nesting period and in the future surveys should begin prior to June 1.

Figure 55. Blanding's turtle locations, Arden Hills Army Training Site, Minnesota, 2018.



## Anuran Surveys

Since 1993, frog and toad calling surveys have been conducted at AHATS as part of a larger statewide survey. The statewide survey began due to growing concern, for the past two decades, over declining amphibian populations worldwide. Frog and toad abundance estimates are documented by the index level of their chorus, following Minnesota Herpetological Society guidelines (Moriarty, unpublished). If individual songs can be counted and there is no overlap of calls, the species is assigned an index value of 1. If there is overlap in calls the index value is 2 and a full chorus is designated a 3. Anuran surveys are performed at 10 stops. The routes are surveyed three times from April through July (Figure 56).

Surveys were conducted during three survey time periods on April 29, June 4 and June 22. Site #7 was not surveyed during all time periods and site #8 was not surveyed during the second time period. Boreal chorus frogs (*Pseudacris maculata*) and wood frogs (*Lithobates sylvaticus*) were detected during the first time period (Figure 57). The second time period had a diversity of species: boreal chorus frogs, gray treefrogs (*Hyla versicolor*), Cope's gray treefrogs (*Dryophytes chrysoscellis*), green frogs (*Lithobates clamitans*) and American toads (*Anaxyrus americanus*) were detected (Figure 58). Spring peepers (*Pseudacris crucifer*) were not detected during any survey period but have been detected in four of the last seven years. Population trends in 2009 indicated a detectible decrease in the proportion of statewide routes where spring peepers were heard. However, there were no detectible statewide trends for spring peepers in 2015. Interpretation of AHATS results can be difficult due to years when the anuran survey was not conducted, particularly during the third survey period.

Figure 56. Anuran survey stops, Arden Hills Army Training Site, Minnesota, since 2003.

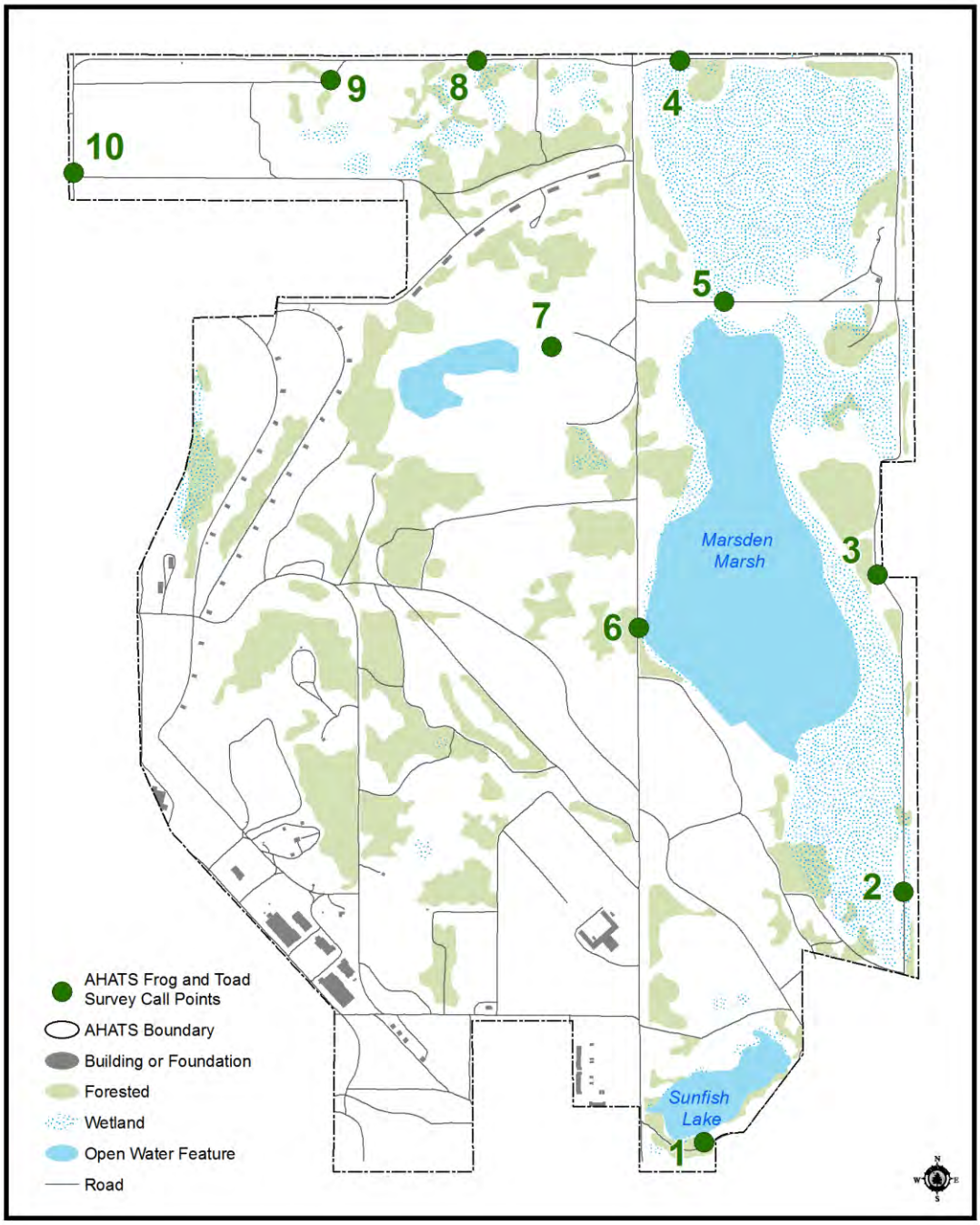


Figure 57. Average anuran index value during the first survey period, Arden Hills Army Training Site, Minnesota, 2003, 2004, and 2008 – 2018. Surveys were not conducted from 2005 – 2007.

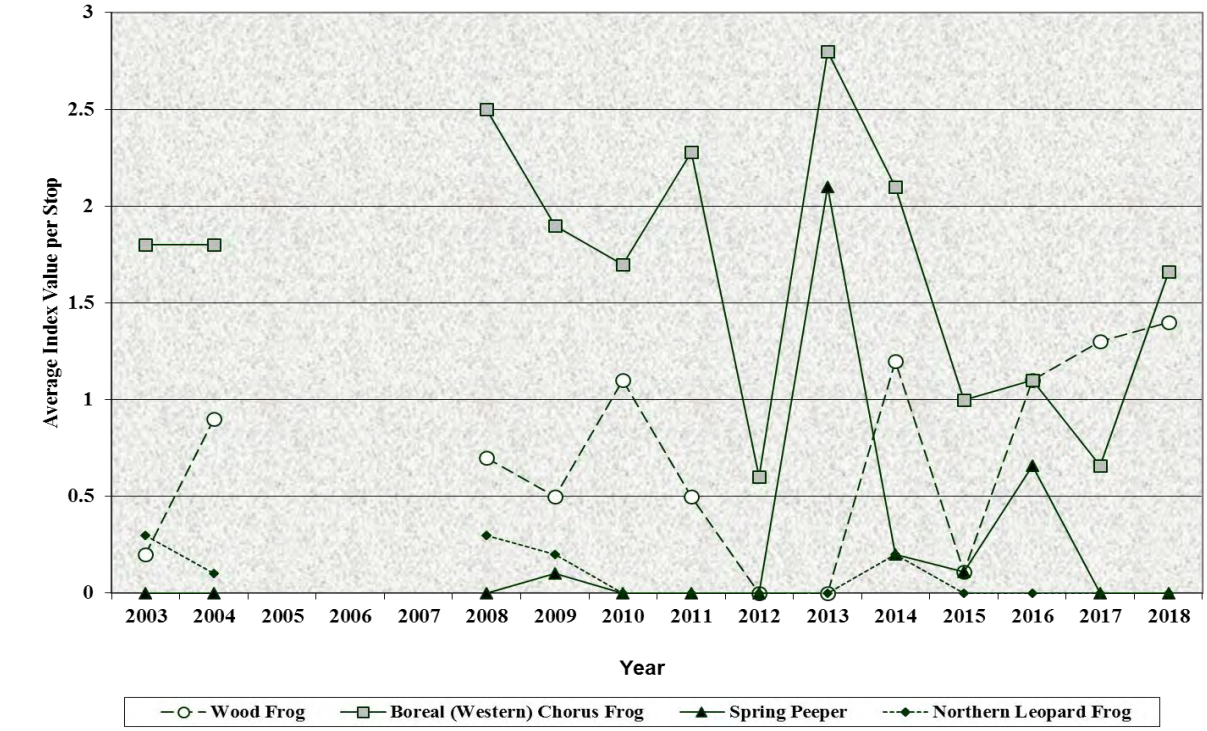
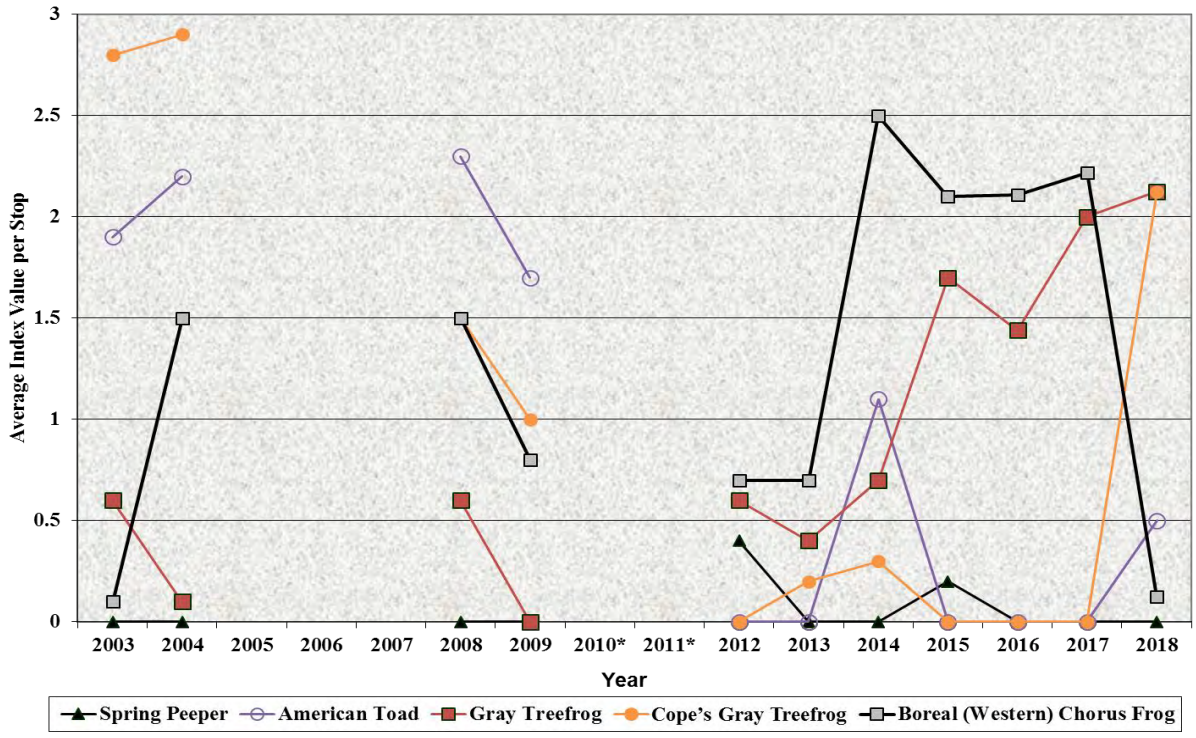



Figure 58. Average anuran index value during the second survey period, Arden Hills Army Training Site, Minnesota, 2003, 2004, 2008, 2009 and 2012 – 2018. Surveys were not conducted from 2005 – 2007, 2010 and 2011.



### Snake Fungal Disease

Snake fungal disease (SFD) is an emerging skin infection in wild snakes. The disease is caused by the fungus *Ophidomyces ophiollcola* and was first discovered in 2006 in New Hampshire. As of August 2017, the fungus had been detected in 23 states, including Minnesota, and one Canadian Province (MNDNR 2018; Thompson et al. 2018). The fungus resides in the soil. Once a snake has contracted the fungus, incubation is 30 – 37 days and clinical signs can occur in 12 days. One locally known affected species is garter snakes (*Thamnophis spp.*). Clinical signs include facial swelling, crusty scales, skin lesions and scattered subcutaneous nodules (lumps) or ulcerations (Cornell University 2018; MNDNR 2018; Thompson et al. 2018). The fungus can be spread into the environment by infected animals particularly by animals that share den sites. Snakes survive an average of 90 days with SFD and have a 40% mortality rate. The number of snakes submitted to wildlife health labs with fungal dermatitis has been increasing substantially (MNDNR 2018; Thompson et al. 2018).

Snakes play a vital role in food webs as both prey and predator. They are an important food item for many mammals and bird species and consume rodents that can damage agricultural crops and carry diseases that affect humans and other animals; however, snakes can reduce local incidence of tick borne diseases by consuming rodents and other small mammals infested with ticks that transmit diseases (Thompson et al. 2018).

Camp Ripley's DNR researchers partnered with the Department of Defense (DoD) Partners in Amphibian and Reptile Conservation (PARC) to sample for SFD at AHATS. DoD PARC provided snake sampling supplies and training. Camp Ripley and AHATS environmental staff captured and sampled three common garter snakes (*Thamnophis sirtalis*). Samples were submitted for testing and results from the lab are pending. Laboratory analysis results will be available in 2019.

## Insects

### Butterfly Survey

The Saint Paul Audubon Society conducted their annual survey for butterflies at AHATS on July 7. Sixteen species were recorded for a total of 143 individuals. In 2017 and 2018, the diversity of butterfly species decreased significantly from 2015, which is second highest species diversity observed (Table 43). The number of individual butterflies observed was slightly below the average of 163 since 2002. Monarchs (*Danaus plexippus*), common wood nymphs (*Cercyonis pegala*) and great spangled fritillaries (*Speyeria cybelle*) were the most abundant butterflies. Monarchs have been observed every year since 2002. Great spangled fritillaries and common wood nymphs have been observed in 16 of the past 17 years, and in 15 of the past 17 years, respectively (Table 43).

Table 43. Number of butterflies, Arden Hills Army Training Site, Minnesota, Saint Paul Audubon Society, 2002 – 2018.

| Common Name | Scientific Name | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Black swallowtail | *Papilio polyxenes* | | | | 1 | 1 | 1 | | | | | | | | | | | |
| Eastern tiger swallowtail | *Papilio glaucus* | | | | 2 | | | 2 | 1 | | 1 | 2 | | 1 | 2 | 2 | | **1** |
| Swallowtail species | *species undetermined* | | 1 | | | | | | | | 2 | | | | | | | |
| Checkered white | *Pontia protodica* | | | | | | | | | | | | | | | | | |
| Cabbage white | *Pieris rapae* | 5 | | | 1 | | 5 | 5 | 2 | 2 | 5 | | | | 9 | 2 | 10 | **1** |
| "Whites" | *Pieris species* | | | | 1 | | | | | | 1 | | | | | 1 | | |
| Clouded sulphur | *Colias philodice* | 2 | 8 | | 2 | 6 | 42 | | | 10 | | 6 | | | 1 | 2 | 5 | **5** |
| Orange sulphur | *Colias eurytheme* | 35 | 1 | 1 | 1 | | 30 | | | 6 | | 20 | 1 | 4 | 1 | 7 | 1 | |
| Dainty sulphur | *Nathalis iole* | | | | | | | | | | | | | | | | | |
| Sulphur species | *species undetermined* | | | | | | | | | 15 | | 3 | 2 | | | 5 | | |
| American copper | *Lycaena phlaeas* | 3 | | | | 2 | 2 | 2 | | | | | | | | 1 | | |
| Gray copper | *Lycaena dione* | 1 | 8 | | | | | | | | | | | | | | | |
| Bronze copper | *Lycaena hyllus* | | | | | | | | | | | | | | | | | |
| Edward's hairstreak | *Satyrium edwardsii* | | 1 | | | | | | | | | | | | | | | |
| Coral hairstreak | *Satyrium titus* | 1 | 1 | 1 | | | | | | | | 1 | | | 1 | | | |
| Banded hairstreak | *Satyrium calanus* | | 1 | | | | | | 1 | | | | 2 | 2 | | | | |
| Striped hairstreak | *Satyrium liparops* | | | | | | 1 | | | | | | | | | | | |
| Hairstreak species | *species undetermined* | | 2 | | | | | | 1 | | | | 3 | 1 | 3 | | | |
| Eastern tailed-blue | *Everes comyntas* | 10 | 4 | | 6 | 32 | 34 | | | 2 | 1 | 5 | 11 | 1 | 2 | 5 | 14 | **2** |
| Western tailed-blue | *Cupido amyntula* | | | | | | | | | | | | 1 | | | | | |
| Blues species | *Species undetermined* | | | | | | | | | | | | | | 1 | 1 | | |
| Spring azure | *Celastrina ladon* | | | | | | | | 8 | 6 | | | | | 2 | 1 | 1 | |
| 'Summer' spring azure | *Celastrina ladon neglecta* | 1 | 3 | | | | | | 8 | 1 | | | 1 | | | 1 | | |
| Variegated fritillary | *Euptoieta claudia* | | 1 | | | | | | | | | | | | | | | |
| Great spangled fritillary | *Speyeria cybele* | 11 | 40 | 9 | 16 | 5 | 13 | 2 | 4 | 17 | | 15 | 2 | 2 | 8 | 1 | 4 | **18** |
| Aphrodite fritillary | *Speyeria aphrodite* | 4 | do | 19 | 10 | 14 | 2 | 2 | 4 | | | 5 | | 2 | 10 | 1 | | |
| Regal fritillary | *Speyeria idalia* | | | | | | | | | | | | | | | | | |
| Silver-bordered fritillary | *Boloria selene* | | | | | | | | | | | | | | | | | |
| Fritillary species | *species undetermined* | 10 | 14 | 14 | | 14 | 28 | | 14 | 10 | | 10 | | | 26 | 15 | 10 | **14** |
| Silvery checkerspot | *Chlosyne nycteis* | | | 1 | | | | | | | | | | | | | | |
| Pearl crescent | *Phyciodes tharos* | | | 1 | | | | | | | | | | | | | | |
| Northern crescent | *Phyciodes selenis* | | 7 | 2 | | 1 | | | 1 | | | | | 10 | 23 | 1 | 1 | |
| Northern pearl crescent | *Phyciodes selenis/tharos* | | | | 1 | 1 | 7 | 2 | | | | | | | | | | |
| Crescent species | *species undetermined* | 2 | 4 | | | | | | 6 | 1 | 16 | 2 | 1 | | 7 | | | |
| Baltimore checkerspot | *Euphydryas phaeton* | | 6 | 13 | 5 | 4 | 10 | 1 | 3 | 1 | | | | | | | | |
| Question mark | *Polygonia interrogationis* | 1 | | | | 2 | | | | | | 1 | | | | | | |
| Silvery checkerspot | *Chlosyne nycteis* | | | 1 | | | | | | | | | | | 3 | | 2 | |
| Eastern comma | *Polygonia comma* | | 1 | | | 3 | | 2 | | 5 | | 1 | | | | | | |

Table 43. Number of butterflies, Arden Hills Army Training Site, Minnesota, Saint Paul Audubon Society, 2002 – 2018.

| Common Name | Scientific Name | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gray comma | *Polygonia progne* | | | | | | | | | 2 | | | | | 1 | | | |
| Comma species | *species undetermined* | | | | | | | | | | | | | | | | | |
| Mourning cloak | *Nymphalis antiopa* | 2 | 5 | 2 | 5 | | 3 | 2 | 1 | 2 | 2 | | | 3 | 1 | 3 | 1 | |
| American lady | *Vanessa virginiensis* | 2 | 1 | | 1 | | 4 | | | | | | | | | | | |
| Painted lady | *Vanessa cardui* | | | | | | | | | 1 | | | | | | | | |
| Vanessa species | *species undetermined* | 1 | | | | | | | | | | | | | | | | |
| Red admiral | *Vanessa atalanta* | | 3 | | | 2 | 11 | | | 3 | | 3 | 1 | | 2 | 1 | 1 | **3** |
| American lady | *Vanessa virginiensis* | | | | | | | | | | | | | | 1 | | 1 | |
| Common buckeye | *Junonia coenia* | 1 | | | 1 | | 6 | | | | | | 3 | | | | | |
| White admiral | *Limenitis arthemis arthemis* | | | | | | | 3 | | | | | | | 6 | | | |
| Red-spotted purple | *(Limenitis a . astyanax )* | | | | | | | 1 | 1 | | | | | | 1 | | | |
| Viceroy | *Limenitis archippus* | 2 | 5 | | 1 | | | 2 | | | 1 | | 4 | | | 4 | 1 | **2** |
| Hackberry emperor | *Asterocampa celtis* | | | | | | 2 | | | | | | | | 6 | | | |
| Northern pearly-eye | *Enodia anthedon* | 4 | 7 | 1 | 5 | 9 | 5 | | | 2 | | 1 | | 2 | 1 | 3 | | **1** |
| Eyed brown | *Satyrodes eurydice* | 15 | 22 | 3 | 5 | 32 | 26 | 1 | | 4 | | | | 1 | | | 9 | **1** |
| Little wood satyr | *Megisto cymela* | | | | | | | 2 | 7 | 2 | 7 | 1 | | 3 | 10 | | | |
| Common ringlet | *Coenonympha tullia* | | | | | | | 6 | 11 | | | | 6 | | 3 | | | |
| Common wood nymph | *Cercyonis pegala* | do | 10 | 10 | 36 | 10 | 17 | | 44 | 57 | 7 | 26 | | 22 | 58 | 20 | 19 | **20** |
| Monarch | *Danaus plexippus* | 10 | 11 | 1 | 17 | 64 | 38 | 4 | 10 | 3 | 3 | 7 | 2 | 11 | 3 | 1 | 5 | **55** |
| Silver-spotted skipper | *Epargyeus clarus* | 2 | 1 | 1 | 1 | 2 | 2 | | 2 | | 1 | 8 | 7 | 7 | 6 | | 5 | **5** |
| Northern cloudywing skipper | *Thorybes pylades* | | | | | | | | 1 | | | | | | | | | |
| Least skipperling | *Ancyloxypha numitor* | | | | | | | | 1 | | | 1 | | | | | | |
| European skipper | *Thymelicus lineola* | | do | 2 | 1 | | 5 | 23 | 32 | 17 | 74 | 2 | 1 | 2 | 29 | 2 | | **1** |
| Peck's skipper | *Polites peckiums (=coras)* | | | | | | | 2 | | | 1 | | | | | | | |
| Northern cloudy skipper | *Thorybes pylades* | | | | | | | | | | | | | | | | | |
| Tawny-edged skipper | *Polites themistocles* | | | | | | 1 | | | | | 1 | | | | | | |
| Long dash | *Polites mystic* | | | | | | 1 | | | | | | | | | | | |
| Delaware skipper | *Atrytone logan* | 7 | 11 | 1 | 4 | 7 | 2 | | | | | | | | | | 3 | **9** |
| Northern broken -dash | *Wallengrenia egeremet* | | 2 | | | 3 | 15 | | | | | 3 | | | | | 1 | **1** |
| Mulberry wing | *Poanes massasoit* | 1 | 1 | 3 | 1 | 6 | 1 | | | | | 1 | 1 | | | 2 | 3 | |
| Hobomok skipper | *Poanes hobomok* | | | | | | | | | | 1 | | | | 1 | | | **3** |
| Dion skipper | *Euphyes dion* | | | | | | 1 | | | | | | | | | | | |
| Black dash | *Euphyes conspicua* | | | | | | 3 | | | | | | | | | | | |
| Dun skipper | *Euphyes vestris* | | 3 | | | 8 | 4 | | | 2 | | | | | | 3 | 7 | |
| Skipper species | *species undetermined* | | | 1 | | 4 | 2 | 2 | 1 | 3 | 2 | 2 | | 1 | 3 | 5 | | |
| Grass skipper species | *species undetermined* | | | | | | | | | | | | | 1 | | | | 1 |
| **Total Species** | | **26** | **32** | **17** | **23** | **20** | **32** | **18** | **22** | **23** | **13** | **20** | **17** | **15** | **31** | **20** | **20** | **16** |
| **Total Individuals** | | | | **17** | **12** | **32** | **48** | **66** | **15** | **17** | **12** | **12** | **49** | **76** | **23** | **90** | **10** | **14** |

## Monarch Butterfly (*Danaus plexippus*)

Monarch butterflies are found throughout the United States. Eastern populations migrate vast distances of over 3,000 miles between United States, Canada and central Mexico from breeding grounds to overwintering locations, across multiple generations each year. Adults in a summer generation live for two to six weeks while migratory generations live up to nine months. Monarchs from northern latitude breeding grounds that emerge after mid-August begin to migrate south towards overwintering grounds where they have never been before. When this migratory generation begins the northward journey into the southern United States, this generation lays eggs and nectars as they breed and migrate north. The generation that re-populates the northern latitude breeding grounds the following spring is the second and third generation of the previous falls' generation (Monarch Joint Venture 2015).

Observations of monarchs have occurred annually since 2001 at AHATS; however, the number of individuals observed had declined since 2007, but the 2018 survey had 55 observations, the third highest number of observations since 2001 (Table 43). Populations of monarchs are declining in both the eastern and western portions of their North American range. Monarchs are now being considered for protection under the federal Endangered Species Act (ESA). The U.S. Fish and Wildlife Service (USFWS) is currently conducting a species status assessment to describe the viability of monarch populations which will support ESA decisions. The USFWS anticipates an ESA listing decision by June 2019. The major population threats are breeding, migration and overwintering habitat losses. Insecticides used to control insects are also harmful to monarchs. In addition, herbicides used to control weeds can affect milkweed populations, the only plant that female monarchs use to lay eggs and the only plant its' caterpillars eat (Monarch Joint Venture 2015).

*Pictured: Monarch (Danaus plexippus) caterpillar, Arden Hills Army Training Site, Minnesota, July 8, 2017. Photograph courtesy of Maurice Whalen, Saint Paul Audubon Society volunteer.*

Best management practices for monarch populations on AHATS should include avoiding mowing ditches when monarch larvae are present, late April to mid-August, particularly locations

where common milkweed (*Asclepias syriaca*) is present. In addition, limiting insecticide and herbicide use would be beneficial.

## Bumble Bee and Tiger Beetle Survey

By Erica Hoaglund and Nancy J. Dietz, Minnesota Department of Natural Resources

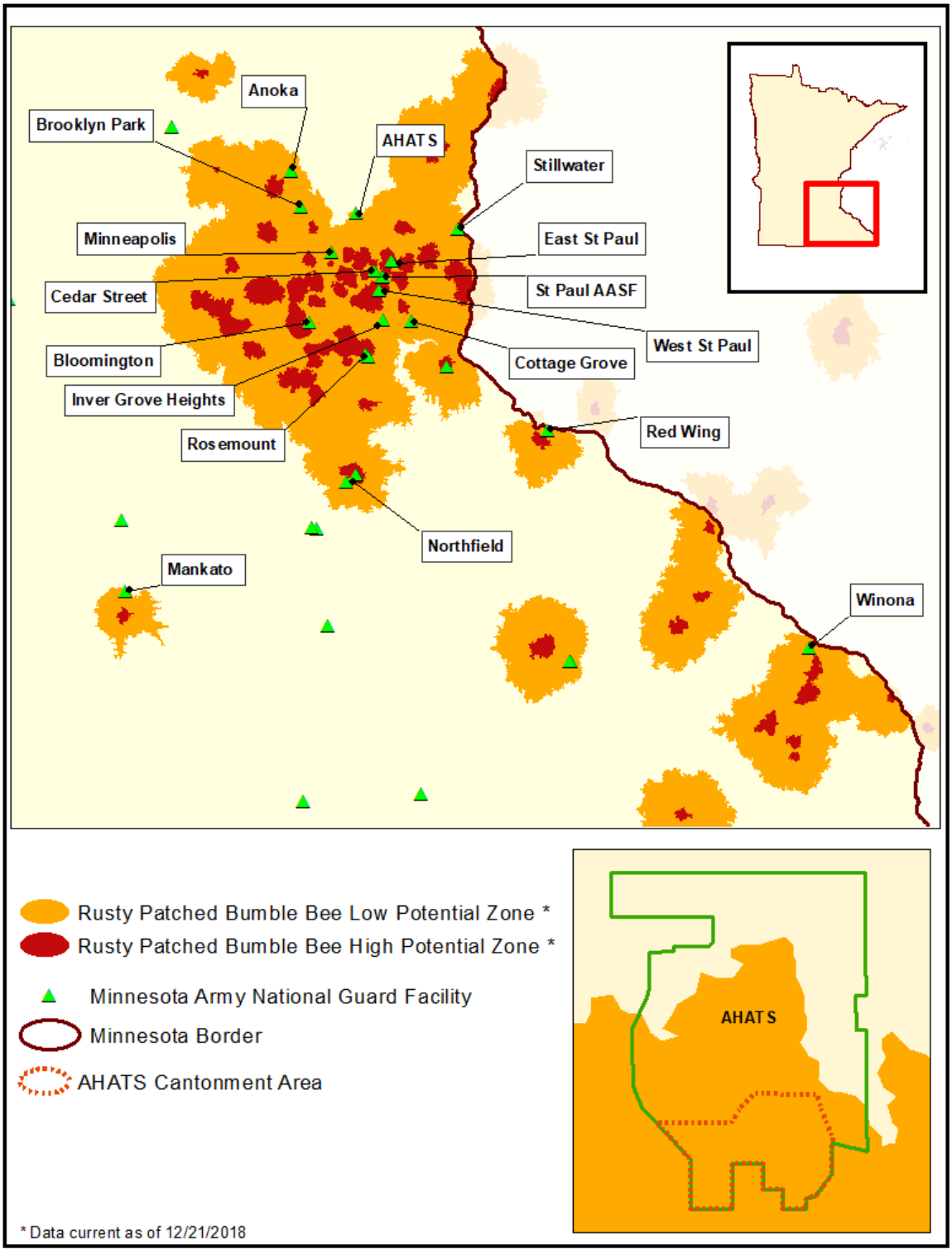
Historically about 400 native bee species occurred in Minnesota. However, little is known about bees because the most recent state species list was published in 1919. Bumble bees are a group of insect pollinators. Pollinators are critical to the agricultural economy and natural habitats and ecosystems as 90% of the world's flowering plants rely on animal pollinators. "Pollination happens when wind, water and wildlife carry pollen from the anther (male part) to the stigma (female part) of plants" (Hatfield et al. 2012; MNDNR 2017c). Threats to bumble bee populations include habitat fragmentation, grazing, pesticide use, genetic diversity, pests and diseases, competition with honey bees and climate change (Hatfield et al. 2012). The economic value of pollination services provided by native insects (mostly bees) is estimated at $3 billion dollars annually in the United States (USFWS 2019e).

On March 21, 2017, the rusty patched bumble bee was listed as federally endangered under the Endangered Species Act. Rusty patched bumble bee abundance and distribution has declined by 90% since the late 1990s. None of the single threats above are causing the rusty patched population decline, but the threats working in concert are likely causing the decline (USFWS 2019e).

Rusty patched bumble bee range includes AHATS. Rusty patched bumble bee observations occurred in 2016 – 2018 within 7.5 miles of AHATS (Bumble Bee Watch 2018). The south half of AHATS is in a USFWS low potential zone (Figure 59, map inset). These zones are areas of maximum dispersal potential for known rusty patched bumble bee locations since 2007. These zones are used to determine where non-lethal survey methods and a scientific recovery permit for surveys are recommended. No lethal bumble bee survey techniques have been used on AHATS.

Rusty patched bumble bee potential zones include a significant number of MNARNG Readiness Centers across the state (Figure 59). Six Readiness Centers in the Minneapolis/Saint Paul area are located within USFWS high potential zones where rusty patched bumble bees are likely to be present. Sixteen Readiness Centers are found within low potential zones. No bumble bee surveys nor assessment of habitat availability have occurred at MNARNG Readiness Centers.

Figure 59. Rusty-patched bumble bee potential zones and Arden Hills Army Training Site Readiness Center locations.



The diversity of habitats found in the relatively small area that encompasses AHATS, as well as it's relatively intact and minimally disturbed status within the urban context of Arden Hills make it a valuable biodiversity hotspot. Several species of state-listed plants and animals have been known to occur on AHATS; however, invertebrates are a historically under surveyed wildlife group lacking an abundance of historical data. Efforts at documenting the rare bumble bee and tiger beetle species (Table 44) in AHATS have thus been underway recently to help fill in this knowledge gap.

Table 44. Rare tiger beetle and bumble bee species, Minnesota 2018.

| Group | Common Name | Scientific Name | MN Status* | Fed Status |
|---|---|---|---|---|
| Bumble bees | American | *Bombus pensylvanicus* | SGCN* | None |
| Bumble bees | Ashton cuckoo | *Bombus bohemicus* | SGCN* | None |
| Bumble bees | Golden northern | *Bombus fervidus* | SGCN* | None |
| Bumble bees | Rusty patched | *Bombus affinis* | SGCN* | Endangered |
| Bumble bees | Yellow-banded | *Bombus terricola* | SGCN* | Species of Concern |
| Tiger beetles | Ghost | *Ellipsoptera lepida* | Threatened | None |
| Tiger beetles | Northern barrens | *Cicindela patruela patruela* | Special Concern | None |

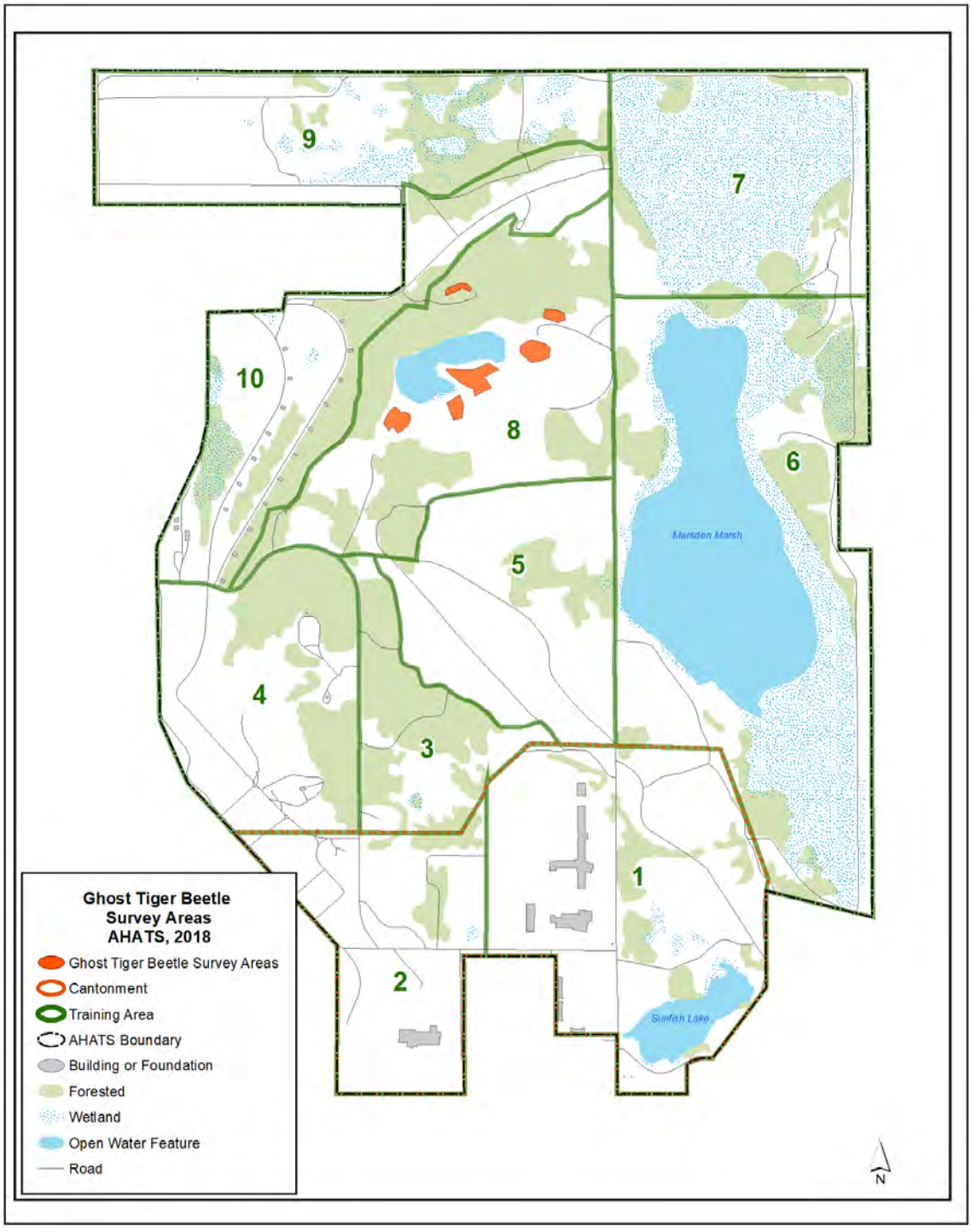
*SGCN = Species in Greatest Conservation Need, *Minnesota Wildlife Action Plan 2015 – 2025*.

Understanding the invertebrate diversity on a managed site is critical if it is to be maintained or enhanced by management activities. Especially given the isolated nature of AHATS within the urban landscape it is doubly important to understand the rare invertebrates that are found there. Rare invertebrate species are often extremely sensitive to habitat disturbance and are easily unintentionally lost while managing for more resilient features of a managed landscape. Once the occurrence, distribution and habitat associations of the rare invertebrate species on AHATS are understood land management can be planned to protect and preserve this diversity.

On July 7, Minnesota Audubon Volunteers and DNR researchers conducted a survey of the bumble bees (*Bombus spp.*), butterflies and moths (Lepidoptera), and tiger beetles on AHATS (Figure 60). Weather conditions were favorable for the survey; sunny with a high of 85 degrees Fahrenheit (F). The low temperature the night before was 57 degrees F.

Environmental staff and volunteers conducted wandering transect surveys attempting to document the species listed above and butterflies and moths in suitable habitat across AHATS. Floral resources were abundant in surveyed areas; insects were seen nectaring on leadplant and species of bee balm, mint, vetch and milkweed. Additionally, targeted surveys for the ghost tiger beetle (*Ellipsoptera lepida,* formerly *Cicindela lepida*) were conducted by a smaller group in the sandy hills and flats around the gravel pit pond (Figure 60). All butterflies, moths, bumble bees and tiger beetles that were observed were either netted or photographed for expert identification.

Figure 60. Ghost tiger beetle survey areas, Arden Hills Army Training Site, Minnesota, 2018.



Five species of bumble bees were documented during the survey (Table 45), however target species in this group were not detected.

Table 45. Bumble bee species detected, Arden Hills Army Training Site, Minnesota, 2017–2018.

| Common Name | Scientific Name | Habitat Associations | 2017 | 2018 |
|---|---|---|---|---|
| Black and Gold bumble bee | *Bombus auricomus* | Thought to use open farmland and grassland exclusively. Nests are small and at the soil surface. | X | X |
| Brown-belted bumble bee | *Bombus griseocollis* | Prefers open habitats but will readily visit urban gardens and parks. Nests underground or at soil surface. | X | X |
| Common Eastern bumble bee | *Bombus impatiens* | Habitat generalist occurring from woods to grasslands and farms to gardens. Nests underground. | X | X |
| Half-black bumble bee | *Bombus vagans* | Thought to be a habitat generalist known to use edges, woods, grasslands and urban areas with nectar resources. Generally nests below ground. | | X |
| Red-belted bumble bee | *Bombus rufocinctus* | Edge species commonly found near to within wooded habitat. Generally nests on the soil surface or up off the ground. | X | X |
| Boreal bumble bee | *Bombus borealis* | Thought to be fairly closely associated with forested habitats and forested edges. Nests underground. | X | |
| Lemon cuckoo bumble bee | *Bombus citrinus* | Nest parasite on B. impatiens, B. vagans and B. bimaculatus so likely exhibits similar habitat associations as its host species. | X | |

Three species of tiger beetle were documented (Table 46), one of which was a target species; the ghost tiger beetle. Ghost tiger beetles had not been seen (despite targeted searches since the last observation) in approximately 18 years on AHATS, and were feared extirpated from Minnesota entirely.

Table 46. Tiger beetle species detected, Arden Hills Army Training Site, Minnesota, 2018.

| Common Name | Scientific Name | Habitat Associations |
|---|---|---|
| Big sand tiger beetle | *Cicindela formosa* | Common in suitable habitat, widespread species preferring large areas of open sand with sparse vegetation. |
| Festive tiger beetle | *Cicindela scutellaris* | Common in suitable habitat, prefers dry, exposed sand patches in grasslands and woodlands. |
| Ghost tiger beetle | *Ellipsoptera (Cicindela) lepida* | Extremely rare in MN. Prefer dry, fine, light colored sand pans with little vegetation. Often described as dune specialists. |

The rediscovery of the ghost tiger beetle at AHATS this July was extremely significant and exciting. The population at AHATS is the most recent observation for this species in the state, and renews hope that they remain in other sites with similar characteristics.

The rediscovery of the ghost tiger beetle presents a unique stewardship opportunity for AHATS. The ghost tiger beetle and many other Minnesota tiger beetle species require or prefer open soil/sand, as such, the maintenance and protection of open soil/sand conditions is a critical management consideration for this species. Management must both protect and maintain these microhabitats on the landscape; but, it must do so through carefully planned and implemented work that avoids unintended negative impacts to this species.

Tiger beetles are so dependent on open sand conditions because open soil/sand is a necessary component of two critical life phases; reproduction and feeding. Tiger beetles, like many beetles, begin their lives as eggs that hatch into grub-like larvae that live subterranean lives. Larval ghost tiger beetles spend 2 – 3 years buried in the sand in burrows up to three meters deep (Dewey 2009). Like adults, larvae eat other insects. They lay in wait in their burrows at the bottom of a shallow sloping sand pit. The burrow opening is blocked by the larva's large armored head until an insect happens by, when they grab it with large mandibles and devour it inside the burrow (Dewey 2009). Larvae do not leave their burrows until they metamorphose into adults; feeding, hibernation, molting and pupation are all done in the larval burrow which is constructed at the site of egg deposition (Dewey 2009). A complete ghost tiger beetle life cycle takes 3 – 4 years to complete; this is one of their ecological traits that contribute to their rarity, making them very sensitive to catastrophic disturbance, especially during their larval stage. Ghost tiger beetles mate in mid- to late summer after which females lay about 50 eggs in individual holes in the sand (Dewey 2009). The larvae generally reach their second instar by the first winter and their third by the second winter, the third year is generally when adults emerge, mate, lay eggs and die (Dewey 2009).

*Pictured: Open soil/sand habitat critical to tiger beetle life phases, Arden Hills Army Training Site, 2018.*

Adult ghost tiger beetles tend to be secretive, solitary and crepuscular (Dewey 2009). The light mottled appearance of their dorsal surface along with thin, light colored legs and a tendency to freeze in place when approached can make them a difficult species to survey. We found it to hold true at AHATS that they are best targeted for surveys in the morning and evening, they are thought to hide during the heat of the day.

It becomes apparently quickly that in order to maintain ghost tiger beetles on the landscape both their habitats and individual members of a population must be protected and managed. Occupied sites should generally be thought of as sanctuaries where limited human presence and

disturbance are allowed. However, this need must be balanced with the need to maintain open, sandy, dry habitats. This species seemed to occur in flat, sandy plains that are rarely entered or disturbed, such is the case at AHATS. It is hypothesized that these habitats are currently maintained mostly by the extreme temperature and droughty soils found on them. It is likely too hot and dry for all but the most tenacious of plant species.

*Pictured: Ghost toger beetle (Ellipsoptera (Cicindela) lepida), Arden Hills Army Training Site, July 7, 2018. Photograph courtesy of Christopher E. Smith.*

Specific habitat management considerations for the area in AHATS occupied by the ghost tiger beetle are:

- Protect area from human disturbance. Limit survey or exploratory visits to the fewest number feasible with the fewest people present.
- Protect the soils from major disturbance such as stabilization and/or excavation. This will protect the beetles during their long, immobile larval phase.
- Ensure that vegetation around the periphery of sand pan habitats does not encroach on the open sand and that surrounding trees do not shade the area so much that its microhabitat characteristics are lost.
- Do not use insecticides or pesticides known to impact insects in the vicinity of the population.
- Do not add artificial lighting to the area. This species' crepuscular habits make it very sensitive to artificial lighting.
- Protect against major water level changes in the nearby quarry pond. Larvae cannot tolerate inundation.

## Outreach and Recreation

By Mary Lee, Minnesota Army National Guard

### Hunting Programs

AHATS hosted its 10th annual soldier archery turkey hunt on May 9 – May 11 and May 12 – 14. The hunt was organized and conducted by the environmental office. Fourteen hunters participated in two, three-day turkey hunts. One hunter was successful, for an overall 7% success rate (Table 47).

Table 47. Soldier archery turkey hunt, Arden Hills Army Training Site, Minnesota, 2009 – 2018.

| Year | Turkeys Harvested | Hunter Success | Permits Issued | Number of Hunters | Dates | Largest Turkey (lbs.) |
|---|---|---|---|---|---|---|
| 2009 | 2 | 25% | 8 | 8 | April 15 – 17 | 20.9 |
| 2010 | 5 | 100% | 10 | 5 | April 14 – 16 | Unknown |
| | 2 | 33% | 10 | 6 | April 21 – 23 | |
| 2011 | 2 | 33% | 10 | 6 | April 15 – 17 | 22 |
| | 1 | 25% | 10 | 4 | April 18 – 20 | |
| 2012 | 2 | 33% | 10 | 6 | April 21 – 22 | 23 |
| | 3 | 50% | 10 | 6 | April 28 – 29 | |
| 2013 | 1 | 25% | 20 | 4 | April 20 – 21 | Unknown |
| | 4 | 40% | 17 | 10 | April 27 – 28 | |
| 2014 | 5 | 29% | 20 | 17 | May 8 – 10 | Unknown |
| | 1 | 33% | 20 | 3 | May 11 – 13 | |
| 2015 | 0 | 0 | 20 | 10 | April 15 – 17 | Unknown |
| | 4 | 40% | 20 | 10 | April 25 – 27 | |
| 2016 | 3 | 25% | 22 | 12 | April 29 – May | 23 |
| | 0 | 0 | 9 | 4 | May 9 – 11 | |
| 2017 | 1 | 10% | 0 | 10 | May 10 – 12 | Unknown |
| | 0 | 0 | 0 | 6 | May 13 – 15 | |
| **2018** | **1** | **12.5%** | **16** | **8** | **May 9 – 11** | **18** |
| | **0** | **0** | **15** | **6** | **May 12 – 14** | |

## Soldier Archery White-tailed Deer Hunt

The 13th annual soldier archery white-tailed deer hunt was held on October 15 – 17, October 26 – 28, November 7 – 9 and December 7 – 9. Forty permits for the first three hunts and 10 permits for the last hunt were issued to current military members and Minnesota veterans (Table 48).

Table 48. Soldier archery white-tailed deer hunt, Arden Hills Army Training Site, Minnesota, 2006 – 2018.

| Year | Deer Harvested | Bucks | Does | Fawns | Number of Hunters |
|---|---|---|---|---|---|
| 2006 | 7 | 2 | 5 | 0 | 33 |
| 2007 | 13 | 4 | 5 | 4 | 55 |
| 2008 | 21 | 7 | 10 | 4 | 102 |
| 2009 | 30 | 8 | 6 | 16 | 104 |
| 2010 | 35 | 13 | 20 | 2 | 110 |
| 2011 | 24 | 8 | 12 | 4 | 79 |
| 2012 | 43 | 18 | 23 | 2 | 101 |
| 2013 | 19 | 10 | 8 | 1 | 70 |
| 2014 | 29 | 15 | 7 | 7 | 78 |
| 2015 | 22 | 8 | 10 | 4 | 81 |
| 2016 | 20 | 6 | 11 | 3 | 87 |
| 2017 | 22 | 9 | 11 | 1 | 74 |
| **2018** | **27** | **11** | **13** | **3** | **85** |

## Volunteer Archery White-tailed Deer Hunt

Volunteers that support the soldier hunts are allowed an opportunity to hunt at AHATS during the last soldier hunt on December 7 – 9. Nine white-tailed deer were harvested during the combined soldier/volunteer hunt (Table 49).

Table 49. Volunteer archery white-tailed deer hunt, Arden Hills Army Training Site, Minnesota, 2003 – 2018.

| Year | Deer Harvested | Bucks | Does | Fawns | Number of Hunters | Dates |
|---|---|---|---|---|---|---|
| 2003 | 13 | 6 | 6 | 1 | 18 | Nov. 28 – 30 |
| 2004 | 6 | 4 | 2 | 0 | 19 | Nov. 26 – 28 |
| 2005 | 9 | 6 | 2 | 1 | 26 | Nov. 25 – 2 |
| 2006 | 19 | 9 | 6 | 4 | 26 | Nov. 24 – 26 |
| 2007 | 30 | 10 | 15 | 5 | 35 | Nov. 23 – 25 |
| 2008 | 22 | 3 | 17 | 2 | 33 | Nov. 28 – 30 |
| 2009 | 28 | 11 | 8 | 9 | 31 | Nov. 27 – 29 |
| 2010 | 17 | 3 | 6 | 8 | 20 | Nov. 26 – 28 |
| 2011 | 11 | 5 | 3 | 2 | 24 | Dec. 2 – 4 |
| 2012 | 10 | 5 | 5 | 0 | 26 | Nov. 30 – Dec. 2 |
| 2013 | 8 | 5 | 3 | 0 | 33 | Dec. 6 – 8 |
| 2014 | 13 | 6 | 5 | 2 | 31 | Dec. 12 – 14 |
| 2015 | 3 | 2 | 1 | 0 | 38 | Dec. 11 – 13 |
| 2016 | 5 | 1 | 2 | 1 | 26 | Dec. 9 – 11 |
| 2017 | 8 | 4 | 3 | 1 | 28 | Dec. 8 – 10 |
| **2018** | **9** | **3** | **4** | **2** | | **Dec. 7 – 9** |

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# Literature Cited


Balbach, H., M. Perez-Martinez, and E. Keane. 2010. The Army Priority List of At-Risk Species, 2009 – 2010 Status Update. Construction Engineering Research Laboratory, Champaign, IL. ERDC/CERL TR–10–21. 30 pp.

Bednar, Joshua D., Nicholas G. Walton, Alexis R. Grinde, and Gerald J. Niemi. 2016. Summary of Breeding Bird Trends in the Chippewa and Superior National Forests of Minnesota – 1995–2016. Natural Resources Research Institute Technical Report NRRI/TR-2016/36.

Bednarz, J.C. and J.J. Dinsmore. 1982. Nest-sites and habitat of red-shouldered and red-tailed hawks in Iowa. Wilson Bull. 94(1):31-45.

Beaudry, F., and M. L. Hunter, Jr. 2009. Seasonally Dynamic Habitat Use by Spotted (*Clemmys guttata*) and Blanding's Turtles (*Emydoidea blandingii*) in Maine. Journal of Herpetology 43(4), 636 – 645.

Bessken, C. M. 2000. Missouri Department of Conservation Endangered Species Guidesheet: Cerulean Warbler. August 17, 2000. http://www.conservation.state.mo.us/nathis/endangered/endanger/cwarbler/.

Birney, E. C. 1999. Status of the Plains Pocket Mouse (*Perognathus flavescens*) at the Twin Cities Army Ammunition Plant, 1999. Final report submitted to the Nongame Wildlife Program, Minnesota Department of Natural Resources. 10 pp + illustrations.

Birney, E. C., and J. A. Monjeau. 1997. Plains Pocket Mouse (*Perognathus flavescens*) at the Twin Cities Army Ammunition Plant. Report submitted to the Minnesota Department of Natural Resources. 8 pp. + illustrations.

Bluebird Recovery Program of Minnesota. 2017a. History of the Bluebird Recovery Program. http://bbrp.org/about-us/. Accessed 18 October 2017.

Bluebird Recovery Program of Minnesota. 2017b. Directory Results 2005 – 2014. http://bbrp.org/2016-report-forms/directory-results/. Accessed 18 October 2017.

Boyles, J. G., P. M. Cryan, G. F. McCracken, and T. K. Kunz. 2011. Economic importance of bats in agriculture. Science 332:41–42.

Britzke, E.R., and C. Herzog. 2009. Webinar December 2009 - The Use of Acoustic Transects to Document Changes in Bat Distribution and Abundance. https://corpslakes.erdc.dren.mil/employees/bats/refs.cfm. Accessed 23 January 2019.

Buehler, David A., James J. Giocomo, Jason Jones, Paul B. Hamel, Christopher M. Rogers, Tiffany A. Beachy, Dustin W. Varble, Charles P. Nicholson, Kirk L. Roth, Jennifer Barg, Raleigh J. Robertson, Joseph R. Robb, and Kamal Islam. 2008. Cerulean Warbler Reproduction, Survival, and Models of Population Decline. Journal of Wildlife Management 72: 646–653.

Bumble Bee Watch. 2018. Bumble Bee Sightings Map. https://www.bumblebeewatch.org/app/#/bees/map. Accessed 16 January 2018.

Camp Ripley Environmental Office. 2009. Minnesota Army National Guard and Camp Ripley Training Site, Integrated Cultural Resources Management Plan, 2009 – 2013. Camp Ripley Environmental Office, Minnesota Department of Military Affairs, Little Falls, MN. 188 pp.

Chadde, S.W. 2013. Minnesota Flora, an illustrated guide to the vascular plants of Minnesota. A Bogman Guide. 781 pp.

Compton, B. W. 2007. Status Assessment for the Blanding's Turtle (*Emydoidea blandingii*) in the Northeast. Draft report to US Fish and Wildlife Service.

Congdon, J. D., D. W. Tinkle, G. L. Breitenbach, and R. C. van Loben Sels. 1983. Nesting Ecology and Hatchling Success in the Turtle, *Emydoidea blandingii*. Herpetolgica 39: 417 – 429.

Congdon, J.D. and D.A. Keinath. 2006. Blanding's Turtle (*Emydoidea blandingii*): a technical conservation assessment. USDA Forest Service, Rocky Mountain Region. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5182075.pdf. Accessed 23 January 2019.

Congdon, J. D., Graham, T. E., Herman, T. B., Lang, J. W., Pappas, M. J., and Brecke, B. J. 2008. *Emydoidea blandingii* (Holbrook 1838)—Blanding's Turtle. Conservation Biology of Freshwater Turtles and Tortoises. Chelonian Research Monographs (5), 15 – 1.

Cooper, Tom R. 2012.Status Assessment and Conservation Plan for the Henslow's Sparrow (*Ammodramus henslowii*). Version 1.0. Bloomington, MN: U.S. Department of the Interior, Fish and Wildlife Service. https://www.fws.gov/midwest/es/soc/birds/pdf/HESP_SAandConsPlan11Oct2012.pdf

Cornell University. 2018. Animal Health Diagnostic Center. Disease Fact Sheet, Snake Fungal Disease. https://cwhl.vet.cornell.edu/disease/snake-fungal-disease. Accessed 14 November 2018.

Crocoll, S.T. and J.W. Parker. 1989. The breeding biology of broad-winged and red-shouldered hawks in western New York. The Journal of Raptor Research 23:125-139.

Crocoll, S.T. 1994. Red-shouldered hawk (*Buteo lineatus*). In A. Poole and F. Gills, editors. The Birds of North America, No. 107. The Academy of Natural Sciences Philadelphia, PA, and the American Ornithologists' Union, Washington, D.C.

Damon, R. A., and W. R. Harvey. 1987. Experimental Design, ANOVA, and Regression. Cambridge: Harper and Row.

Daubenmire, R. 1959. A Canopy-coverage Method of Vegetational Analysis.Northwest Science 33: 43 – 64.

Dewey, T. 2009. Cicindela lepida. Animal Diversity. https://animaldiversity.org/accounts/Cicindela_lepida/ Accessed November 20, 2018.

Dirks, B. and J. DeJong. 2002. 2001 Annual Animal Survey Report for the Minnesota Army National Guard, Camp Ripley Training Site and Arden Hills Army Training Site. Minnesota Department of Natural Resources, Camp Ripley Training Site, Little Falls. 91 pp.

Dirks, B. and J. DeJong. 2004. Animal Surveys at the Camp Ripley and Arden Hills Minnesota Army National Guard Training Sites – 2003 Annual Report. Minnesota Department of Natural Resources Camp Ripley Series Report No. 13.

Dirks, B. and J. DeJong. 2005. Animal Surveys at the Camp Ripley and Arden Hills Minnesota Army National Guard Training Sites – 2004 Annual Report. Minnesota Department of Natural Resources Camp Ripley Series Report No. 14.

Dirks, B., and J. DeJong. 2007. Animal Surveys at the Camp Ripley and Arden Hills Minnesota Army National Guard Training Sites – 2006 Annual Report. Minnesota Department of Natural Resources Camp Ripley Series Report No. 16.

Dirks, B., J. DeJong, N. Dietz, and P. Perry. 2010. *Draft* Protected Species Management Plan for Camp Ripley Army National Guard Training Site, Little Falls, MN and Arden Hills Army Training Site, Arden Hills, MN. Minnesota Department of Natural Resources, Camp Ripley Series Report No. 20, Little Falls, MN.

Dirks, B., N. Dietz, and J. DeJong. 2008. Camp Ripley and Arden Hills Minnesota Army National Guard Training Sites – Conservation Program Report, 2007 Annual Report. Minnesota Department of Natural Resources Camp Ripley Series Report No. 17.

Dirks, B., and N. Dietz. 2009. Camp Ripley and Arden Hills Minnesota Army National Guard Training Sites Conservation Program Report – 2008 Annual Report, January 1 – December 31, 2008. Minnesota Department of Natural Resources Camp Ripley Series Report No. 18, Saint Paul, MN.

Dirks, B., and N. Dietz. 2010. Camp Ripley and Arden Hills Minnesota Army National Guard Training Sites Conservation Program Report – 2009 Annual Report, January 1 – December 31, 2009. Camp Ripley Series Report No. 19, Little Falls, USA. 245 pp.

Dirks, B., and N. Dietz. 2011. Camp Ripley and Arden Hills Minnesota Army National Guard Training Sites Conservation Program Report – 2010 Annual Report, January 1 – December 31, 2009. Camp Ripley Series Report No. 20, Little Falls, USA. 218 pp.

Dirks, B., N. Dietz, R. Baker, and M. Swingen. 2016. Summary of Bat Research in Camp Ripley Training Center and Arden Hills Army Training Site, MN 2016. NRRI Technical Report No. NRRI/TR-2016-42E.

Dorff Hall, C. and F. J. Cuthbert. 2000. Impact of a Controlled Wetland Drawdown on Blanding's Turtles in Minnesota. Chelonian Conservation and Biology 3(4):643 – 649.

Dorff, C., and G. E. Nordquist. 1993. Animal Surveys at the Minnesota Army National Guard Camp Ripley Training Site, 1991 – 1992. Final Report. Nongame Wildlife and Natural Heritage Programs, Minnesota Department of Natural Resources, Saint Paul, MN. 82 pp.

Erb, J., C. Humpal, and B. Sampson. 2018. Minnesota Wolf Population Update 2017. http://files.dnr.state.mn.us/wildlife/wolves/2017/survey-wolf.pdf. Accessed 23 January 2018.

Frick, W. F., J. F. Pollock, A. C. Hicks, K. E. Langwig, D. S. Reynolds, G. G. Turner, C. M. Butchkoski, and T. H. Kunz. 2010. An Emerging Disease Causes Regional Population Collapse of a Common North American Bat Species. Science 329:679 – 682.

Garshelis, D. L., P. L. Coy, and K. V. Noyce. 2004. Ecology and Population Dynamics of Black Bears in Minnesota. In Summaries of Wildlife Research Findings 2003, eds. M. W. Don Carlos, R. O. Kimmel, J. S. Lawrence, and M. S. Lenarz, 120 – 126. Minnesota Department of Natural Resources. 230 pp.

Hansen, D.C. 1994. The Butterflies of Camp Ripley. Minnesota Department of Natural Resources and Camp Ripley Environmental Office. 65 pp.

Hanson, Lynelle G. 1994. The Henslow's Sparrow (*Ammodramus henslowii*) of Minnesota: Population Status and Breeding Habitat Analysis. MS thesis, Central Michigan University.

Hatfield, R., S. Jepsen, E. Mader, S.H. Black, and M. Shepherd. 2012. Conserving Bumble Bees, Guidelines for Creating and Managing Habitat for America's Declining Pollinators. The Xerces Society for Invertebrate Conservation. 32 pp.

Hawk Ridge Bird Observatory. 2019. Golden Eagle. https://www.hawkridge.org/raptor/golden-eagle/. Accessed 29 Jan 2019.

Hazard, E.B. 1982. The Mammals of Minnesota. James Ford Bell Museum of Natural History, University of Minnesota Press, Minneapolis, Minnesota. 280 pp.

Henneman, C. 2006. Habitat associations of red-shouldered hawks in central Minnesota landscapes. Master of Science, University of Minnesota. 56 pp.

Herkert, J. R. 1998 (revised 2002). Effects of management practices on grassland birds: Henslow's Sparrow. Northern Prairie Wildlife Research Center, Jamestown, ND. 17 pages. https://pubs.usgs.gov/unnumbered/70159918/report.pdf Accessed 23 January 2019.

Hibbard, E. A. and J. R. Beer. 1960. The plains pocket mouse in Minnesota. Flicker 32:89-94.

International Crane Foundation. 2019. https://www.savingcranes.org/education/annual-midwest-crane-count/. Accessed 23 January 2019.

Jacobs, J.P. and E.A. Jacobs. 2002. Conservation assessment for Red-shouldered Hawk (*Buteo lineatus*) National Forest of north central states. USDA Forest Service Eastern Region, Milwaukee, Wisconsin, USA.

Janssen, R. 1987. Birds in Minnesota. University of Minnesota Press, Minneapolis. 352 pp.

John, J. 2018. Warblers in trouble due to South American deforestation http://wildlife.org/warblers-in-trouble-due-to-south-american-deforestation/ Accessed 8 January 2019.

Jordan, P. A., D. G. Paron, and T. Pharis. 1997. Impact of Winter Browsing by Deer on Oak Regeneration at the Twin Cities Army Ammunition Plant, 1996 – 97. Department of Fisheries and Wildlife, University of Minnesota. 7 p.

King, J.C. 2008. Red-shouldered Hawk (*Buteo lineatus*) distribution, productivity, parasite intensity, and nesting habitat on Marinette County Forest in northeast Wisconsin. MS thesis. University of Wisconsin-Stevens Point. Stevens Point, Wisconsin, USA.

Kramer, Gunnar R.,David E. Andersen,David A. Buehler,Petra B. Wood,Sean M. Peterson,Justin A. Lehman,Kyle R. Aldinger,Lesley P. Bulluck,Sergio Harding,John A. Jones,John P. Loegering,Curtis. Population trends in *Vermivora* warblers are linked to strong migratory connectivity. Proceeding of the National Academy of Sciences of the United States of America. https://www.pnas.org/content/115/14/E3192. Accessed 4 December 2018.

Larson, K. 2017. 1994 – 2015 Minnesota Frog and Toad Calling Survey (MNFTCS), 2015 Survey Report. Minnesota Department of Natural Resources, Nongame Wildlife Program, Minnesota. 2 pp.

McAuley, Daniel G., Daniel M. Keppie and R. Montague Whiting Jr. 2013. American Woodcock (*Scolopax minor*), version 2.0. In The Birds of North America (P. G. Rodewald, editor). Cornell Lab of Ornithology, Ithaca, New York, USA. https://doi.org/10.2173/bna.100. Accessed 5 December 2017.

Minnesota Army National Guard. 2009. Minnesota Army National Guard, Arden Hills Army Training Site, Sustainability Master Plan, Final Report. 78 pages plus appendices.

Minnesota Army National Guard. 2017. Camp Ripley's Integrated Wildland Fire Management Plan. Camp Ripley Army Training Center, Little Falls, MN.

Minnesota Army National Guard. 2018a. Arden Hills Army Training Site, Integrated Natural Resources Management Plan Update, 2018. Camp Ripley, Little Falls, Minnesota.

Minnesota Army National Guard. 2018b. Camp Ripley Training Center, Integrated Natural Resources Management Plan Update, 2018. Camp Ripley, Little Falls, Minnesota.

Minnesota Army National Guard. 2019. Integrated Cultural Resources Management Plan Update for Sites and Training Installations of the Minnesota Army National Guard, Fiscal Years 2019 – 2023. Camp Ripley, Little Falls, Minnesota.

Minnesota Department of Natural Resources. 2009. Rare Species Guide – Plains Pocket Mouse. http://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=AMAFD01020. Accessed 8 September 2009.

Minnesota Department of Natural Resources. 2011. The Minnesota Department of Natural Resources. Common loon (*Gavia immer*). http://www.dnr.state.mn.us/birds/commonloon.html. Accessed 12 December 2011.

Minnesota Department of Natural Resources. 2013a. Miller Lake (#49 – 51p) Public Waters Work Permit #2013 – 0125. 3 pp.

Minnesota Department of Natural Resources. 2013b. The Minnesota Department of Natural Resources. Species Profile – Northern Myotis (*Myotis septentrionalis*) http://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=AMACC01150. Accessed 11 December 2013.

Minnesota Department of Natural Resources. 2013c. Fungus Dangerous to Bats Detected at 2 Minnesota State Parks. Press Release 9 August 2013.

Minnesota Department of Natural Resources. 2015a. Minnesota's Wildlife Action Plan 2015 – 2025, Working with Partners for Wildlife Conservation. 150 pages + appendices.

Minnesota Department of Natural Resources. 2015b. The Minnesota Department of Natural Resources. Gray Wolf. http://www.dnr.state.mn.us/mammals/wolves/mgmt.html. Accessed 13 January 2015.

Minnesota Department of Natural Resources. 2016a. Rare Species Guide, Gray Wolf. http://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=AMAJA01030. Accessed 6 January 2016.

Minnesota Department of Natural Resources. 2016b. White-nose Syndrome and Minnesota's Bats. http://www.dnr.state.mn.us/wns/index.html. Accessed 26 January 2016.

Minnesota Department of Natural Resources. 2016d. Wild Bee Pollinator Surveys in Prairie–Grassland Habitats. September 2016. 20 pp.

Minnesota Department of Natural Resources. 2017a. The Minnesota Department of Natural Resources Eastern Bluebird (*Sialia sialis*). http://www.dnr.state.mn.us/birds/easternbluebird.html. Accessed 18 October 2017.

Minnesota Department of Natural Resources. 2017c. Minnesota's Pollinators. http://www.dnr.state.mn.us/pollinators/index.html. Accessed 4 January 2017.

Minnesota Department of Natural Resources. 2018a. The Minnesota Department of Natural Resources. Amphibian and Reptile Diseases, Snake Fungal Disease. https://www.dnr.state.mn.us/reptiles_amphibians/disease.html. Accessed 14 November 2018.

Minnesota Department of Natural Resources. 2018b. The Minnesota Department of Natural Resources. Minnesota's List of Endangered, Threatened, and Special Concern Species. https://files.dnr.state.mn.us/natural_resources/ets/endlist.pdf. Accessed 20 November 2018.

Minnesota Department of Natural Resources. 2018c. The Minnesota Department of Natural Resources. Rare Species Guide, Cerulean Wabler (*Setophaga cerulea*). https://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=ABPBX03240. Accessed 3 December 2018.

Minnesota Department of Natural Resources. 2018d. The Minnesota Department of Natural Resources. Rare Species Guide, Four-toed Salamander. https://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=AAAAD08010. Accessed 19 November 2018.

Minnesota Department of Natural Resources. 2018e. The Minnesota Department of Natural Resources. Rare Species Guide, Prairie Moonwort (*Botrychium campestre*) and Least Moonwort (*Botrychium simplex*) https://www.dnr.state.mn.us/rsg/index.html. Accessed 20 November 2018.

Minnesota Department of Natural Resources. 2018f. The Minnesota Department of Natural Resources. Rare Species Guide, Trumpeter Swans (*Cygnus buccinator*). https://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=ABNJB02030. Accessed 17 October 2018.

Minnesota Department of Natural Resources. 2018g. The Minnesota Department of Natural Resources. Rare Species Guide, Tubercled Rein Orchid (*Platanthera flava var. herbiola*). https://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=PMORC1Y082. Accessed 26 November 2018.

Minnesota Department of Natural Resources. 2019. Red-shouldered hawk forest management guidelines. https://www.dnr.mn.us/eco/nongame/projects/redhawk_guidelines.html. Accessed 23 January 2019.

Minnesota Department of Natural Resources and Minnesota Army National Guard. 2012. Minnesota Army National Guard, Camp Ripley Training Center and Arden Hills Army Training Site, 2011 Conservation Program Report, January 1 – December 31, 2011. Compiled by Nancy J. Dietz and Brian J. Dirks, Camp Ripley Series Report No. 21, Little Falls, Minnesota, USA. 223 pp.

Minnesota Department of Natural Resources and Minnesota Army National Guard. 2013. Minnesota Army National Guard, Camp Ripley Training Center and Arden Hills Army Training Site, 2013 Conservation Program Report, January 1 – December 31, 2012. Compiled by Nancy J. Dietz and Brian J. Dirks, Camp Ripley Series Report No. 22, Little Falls, Minnesota, USA. 221 pp.

Minnesota Department of Natural Resources and Minnesota Army National Guard. 2014. Minnesota Army National Guard, Camp Ripley Training Center and Arden Hills Army Training Site, 2013 Conservation Program Report, January 1 – December 31, 2013. Compiled by Nancy J. Dietz and Brian J. Dirks, Camp Ripley Series Report No. 23, Little Falls, Minnesota, USA. 205 pp.

Minnesota Department of Natural Resources and Minnesota Army National Guard. 2015. Minnesota Army National Guard, Camp Ripley Training Center and Arden Hills Army Training Site, 2014 Conservation Program Report, January 1 – December 31, 2014. Compiled by Nancy J. Dietz and Brian J. Dirks, Camp Ripley Series Report No. 24, Little Falls, Minnesota, USA. 208 pp.

Minnesota Department of Natural Resources and Minnesota Army National Guard. 2016. Minnesota Army National Guard, Camp Ripley Training Center and Arden Hills Army Training Site, 2015 Conservation Program Report, January 1 – December 31, 2015. Compiled by Nancy J. Dietz and Brian J. Dirks, Camp Ripley Series Report No. 25, Little Falls, Minnesota, USA. 206 pp.

Minnesota Department of Natural Resources and Minnesota Army National Guard. 2017. Minnesota Army National Guard, Camp Ripley Training Center and Arden Hills Army Training Site, 2016 Conservation Program Report, January 1 – December 31, 2016. Compiled by Nancy J. Dietz and Brian J. Dirks, Camp Ripley Series Report No. 26, Little Falls, Minnesota, USA. 207 pp.

Minnesota Ornithologists' Union. 2018a. Minnesota Christmas Bird Count, Pillager. http://moumn.org/CBC/locations.php?cid=49. Accessed 2 January 2018.

Minnesota Ornithologists' Union. 2018b. Minnesota Christmas Bird Count, Saint Paul (North). http://moumn.org/CBC/locations.php?cid=228. Accessed 2 January 2018.

Monarch Joint Venture. 2015. Monarch Life Cycle and Monarch Migration. http://monarchjointventure.org/monarch-biology/monarch-migration/. Accessed 23 December 2015.

Monarch Watch. 2018. Monarch Watch. Tagging Monarchs https://monarchwatch.org/tagging/. Accessed 12 December 2018.

Moriarty, J. No date. Instructions for Minnesota Frog and Toad Survey. Minnesota Herpetological Society. Unpublished.

Moriarty, J.J. and C.D. Hall. 2014. Amphibians and Reptiles in Minnesota. Minnesota Department of Natural Resources, St. Paul Minnesota. 370 pp.

National Audubon Society. 2014. Henslow's Sparrow. http://climate.audubon.org/birds/henspa/henslows-sparrow. Accessed 23 January 2019.

National Eagle Center. 2017. Golden Eagle Project. https://www.nationaleaglecenter.org/golden-eagle-project/golden-eagles-in-minnesota/. Accessed 27 March 2017.

NatureServe. 2018. Common Nighthawk (*Chordeiles minor*). NatureServe Explorer: An online encyclopedia of life. Version 7.1 (2 February 2009). Last updated: March 2018. http://explorer.natureserve.org/index.htm. Accessed 23 January 2019.

NatureServe. 2018. Chimney swift (*Chaetura pelagica*). NatureServe Explorer: An online encyclopedia of life. Version 7.1 (2 February 2009). Last updated: March 2018. http://explorer.natureserve.org/index.htm. Accessed 23 January 2019.

North American Bluebird Society. 2017a. North American Bluebird Society History. http://www.nabluebirdsociety.org/nabs-history/. Accessed 23 January 2019.

North American Bluebird Society. 2017b. North American Bluebird Society Gilbertson Bluebird Nest Box. http://www.nabluebirdsociety.org/nestboxes/gilbertson.htm. Accessed 18 October 2017.

Petranka, J.W. 1998. Salamanders of the United States and Canada. Smithsonian Institution Press, Washington D. C. 587 pp.

Pfannmuller, L., G. Niemi, J. Green, B. Sample, N. Walton, E. Zlonis, T. Brown, A. Bracey, G. Host, J. Reed, K. Rewinkel, and N. Will. 2017a. The First Minnesota Breeding Bird Atlas (2009 – 2013). Species Accounts: American woodcock, *Scolopax minor*, Population Abundance. https://mnbirdatlas.org/species/american-woodcock/. Accessed 5 December 2017.

Pfannmuller, L., G. Niemi, J. Green, B. Sample, N. Walton, E. Zlonis, T. Brown, A. Bracey, G. Host, J. Reed, K. Rewinkel, and N. Will. 2017b. The First Minnesota Breeding Bird Atlas (2009 – 2013). Species Accounts: Bobolink, *Dolichonyx oryzivorus*. https://mnbirdatlas.org/species/bobolink/. Accessed 5 December 2017.

Pfannmuller, L., G. Niemi, J. Green, B. Sample, N. Walton, E. Zlonis, T. Brown, A. Bracey, G. Host, J. Reed, K. Rewinkel, and N. Will. 2017c. Species Accounts: Cerulean Warbler, *Setophaga cerulean*, Population Abundance.https://mnbirdatlas.org/species/cerulean-warbler/. Accessed 20 November 2017.

Pfannmuller, L., G. Niemi, J. Green, B. Sample, N. Walton, E. Zlonis, T. Brown, A. Bracey, G. Host, J. Reed, K. Rewinkel, and N. Will. 2017d. Species Accounts: Common Nighthawk, *Chordeiles minor*, Population Abundance. https://mnbirdatlas.org/species/common-nighthawk/. Accessed 20 November 2017.

Pfannmuller, L., G. Niemi, J. Green, B. Sample, N. Walton, E. Zlonis, T. Brown, A. Bracey, G. Host, J. Reed, K. Rewinkel, and N. Will. 2017e. Species Accounts: Golden-winged Warbler, *Vermivora chrysoptera*, Population Abundance. https://mnbirdatlas.org/species/golden-winged-warbler/. Accessed 20 November 2017.

Pfannmuller, L., G. Niemi, J. Green, B. Sample, N. Walton, E. Zlonis, T. Brown, A. Bracey, G. Host, J. Reed, K. Rewinkel, and N. Will. 2017f. The First Minnesota Breeding Bird Atlas (2009 – 2013). Species Accounts: Red-eyed Vireo, *Vireo olivaceus*, Population Abundance. https://mnbirdatlas.org/species/red-eyed-vireo/.

Rosenberg, Kenneth V., Sara E. Barker, and Ronald W. Rohrbaugh. 2000. An Atlas of Cerulean Warbler Populations. Ithaca: Cornell Lab of Ornithology.

Rosenberg, Kenneth V., Judith A. Kennedy, Randy Dettmers, Robert P. Ford, Debra Reynolds, John D. Alexander, Carol J. Beardmore, Peter J. Blancher, Roxanne E. Bogart, Gregory S. Butcher, Alaine F. Camfield, Andrew Couturier, Dean W. Demarest, Wendy E. Easton, Jim J. Giocomo, Rebecca Hylton Keller, Anne E. Mini, Arvind O. Panjabi, David N. Pashley, Terrell D. Rich, Janet M. Ruth, Henning Stabins, Jessica Stanton, and Tom Will. 2016. Partners in Flight Landbird Conservation Plan: 2016 Revision for Canada and Continental United States. Partners in Flight Science Committee.http://www.partnersinflight.org/wp-content/uploads/2016/08/pif-continental-plan-final-spread-single.pdf

Sauer, J. R., D. K. Niven, J. E. Hines, D. J. Ziolkowski, Jr, K. L. Pardieck, J. E. Fallon, and W. A. Link. 2017. The North American Breeding Bird Survey, Results and Analysis 1966 - 2015. Version 2.07.2017 USGS Patuxent Wildlife Research Center, Laurel, MD. https://www.mbr-pwrc.usgs.gov/bbs/bbs.html. Accessed 25 January 2019.

Standing, K. L., Herman, T. B., and I. P. Morrison. 1999. Nesting Ecology of Blanding's Turtle (*Emydoidea blandingii*) in Nova Scotia, the Northeastern Limit of the Species' Range. Canadian Journal of Zoology 77 (10): 1609 – 1614.

Streby, H. M., J. P. Loegering, and D. E. Andersen. 2012. Spot mapping underestimates song-territory size and use of mature forest by breeding Goldenwinged Warblers in Minnesota, USA. Wildlife Society Bulletin 36:40–46.

Streby, H. M., R. W. Rohrbaugh, D. A. Buehler, D. E. Andersen, R. Vallender, D. I. King, and T. Will. 2016. Research on Golden-winged Warblers: Recent progress and current needs. Pp. 217–227 in H. M. Streby, D. E. Andersen, and D. A. Buehler (editors). Golden-winged Warbler ecology, conservation, and habitat management. Studies in Avian Biology (no. 49), CRC Press, Boca Raton, Florida.

Swingen, M., R. Baker, T. Catton, K. Kirschbaum, G. Nordquist, B. Dirks, and R. Moen. 2016. Summary of 2016 Northern Long-eared Bat Research in Minnesota. NRRI Technical Report No. NRRI/TR-2016/41. University of Minnesota Duluth.

Swingen, M., R. Moen, R. Baker, G. Nordquist, T. Catton, K. Kirschbaum, B. Dirks, and N. Dietz. 2018. Summary of 2017 Bat Research in Minnesota. NRRI Technical Report No. NRRI/TR-201740. University of Minnesota Duluth.

Thompson, N.E., E.W. Lankau and G.M. Rogal. U.S. Geological Survey. Snake Fungal Disease in North America: U.S. Geological Survey Updates. https://doi.org/10.3133/fs20173064. Accessed 14 November 2018.

Turner, G. G., D. M. Reeder, and J. T. H. Coleman. 2011. A five-year Assessment of Mortality and Geographic Spread of White-nose Syndrome in North American Bats and a Look to the Future. Bat Research News 52:13 – 27.

University of Minnesota. 2018. Minnesota Bee Atlas. What is the Minnesota Bee Atlas. https://extension.umn.edu/natural-resources-volunteers/minnesota-bee-atlas. Accessed 17 December 2018.

University of Minnesota. 2019. Woody vegetation control. https://extension.umn.edu/planting-and-growing-guides/woody-vegetation-control. Accessed 25 January 2019.

U.S. Department of Agriculture. 2009. Executive Order #13112. Federal Laws and Regulations. http://www.invasivespeciesinfo.gov/laws/execorder.shtml. Accessed 7 January 2009.

U.S. Fish and Wildlife Service. 2015. Gray Wolves in the Western Great Lakes States. https://www.fws.gov/midwest/wolf/. Accessed 13 January 2015.

U.S. Fish and Wildlife Service. 2016a. Environmental Conservation Online System, Northern long-eared Bat (*Myotis septentrionalis*). http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A0JE#crithab. Accessed 26 January 2016.

U.S. Fish and Wildlife Service. 2016b. Gray Wolves Delisted in Western Great Lakes Distinct Population Segment. U.S. Fish and Wildlife Service. https://www.fws.gov/midwest/wolf/archives/2011FinalDelisting/index.htm. Accessed 14 February 2019.

U.S. Fish and Wildlife Service. 2018a. Bald Eagle, Bald Eagle Breeding Pairs 1990 – 2006. https://www.fws.gov/midwest/eagle/population/nos_state_tbl.html. Accessed 14 February 2019.

U.S. Fish and Wildlife Service. 2018b. Federal Laws that Protect Bald Eagles – Bald and Golden Eagle Protection Act, USFWS, Midwest Region. https://www.fws.gov/midwest/eagle/protect/laws.html. Accessed 14 February 2019.

U.S. Fish and Wildlife Service. 2018c. Northern Long-Eared Bat (*Myotis septentrionalis*) Fact Sheet. U.S. Fish and Wildlife Service, Endangered Species, Midwest Region. https://www.fws.gov/midwest/endangered/mammals/nleb/nlebfactsheet.html. Accessed 14 February 2019.

U.S. Fish and Wildlife Service. 2018d. USFWS Endangered Species, Northern long-eared Bat (*Myotis septentrionalis*) Status. https://www.fws.gov/Midwest/endangered/mammals/nleb/index.html. Accessed 14 February 2019.

U.S. Fish and Wildlife Service. 2019a. Ecological Services, Status Reviews for Five Midwestern Reptiles and Amphibians July 1, 2015, Positive 90-Day Findings. http://www.fws.gov/midwest/es/soc/Batch90DayJuly2015.html. Accessed 14 February 2019.

U.S. Fish and Wildlife Service. 2019b. Endangered Species Act of 1973, Digest of Federal Resource Laws of Interest to the U.S. Fish and Wildlife Service. https://www.fws.gov/laws/lawsdigest/esact.html. Accessed 14 February 2019.

U.S. Fish and Wildlife Service. 2019c. Fish and Wildlife Service Reopens Comment Period on Revising the List of Endangered and Threatened Wildlife for the Gray Wolf in the Eastern United States. U.S. Fish and Wildlife Service. https://www.fws.gov/policy/library/2011/2011-21839.pdf. Accessed 14 February 2019.

U.S. Fish and Wildlife Service. 2019d. National Bald Eagle Management Guidelines. USFWS, Region 3. Last updated: March 8, 2016. https://www.fws.gov/northeast/ecologicalservices/eaglenationalguide.html. Accessed 13 February, 2019.

U.S. Fish and Wildlife Service. 2019e. Rusty Patched Bumble Bee (*Bombus affinis*), Status: Endangered. https://www.fws.gov/midwest/endangered/insects/rpbb/. Accessed 14 February 2019.

U.S. Fish and Wildlife Service. 2019f. Species of Concern: Golden-winged Warbler, Finding on Petition to List under the Endangered Species Act. https://www.fws.gov/midwest/es/soc/birds/GoldenWingedWarbler/GWWA90DayFinding.html. Accessed 14 February 2019.

U.S. Geological Survey. 2014. Identifying Bats by Sound. https://www.usgs.gov/news/identifying-bats-sound. Accessed September 2014.

U.S. National Archives and Records Administration. 2013. Federal Register. Department of Interior, Fish and Wildlife Service. Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List the Eastern Small-footed Bat and the Northern Long-Eared Bat as Endangered or Threatened Species; Listing the Northern Long-Eared Bat as an Endangered Species. 50 CFR Part 17, Vol. 78, No. 191, October 2, 2013.

Welch, R. J. 1987. Food habits of the Red-shouldered Hawk in Wisconsin. Passenger Pigeon 49:81-91.

White-nose Syndrome Response Team. 2019. Where Is WNS Now? https://www.whitenosesyndrome.org/static-page/where-is-wns-now. Accessed 25 January 2019.

Weather Underground. 2018a. Weather History, Brainerd, Minnesota, June 2018 and March to May 2018. Wunderground. https://www.wunderground.com/history/monthly/us/mn/brainerd/KBRD/date/2018-5. Accessed 7 December 2018.

Weather Underground. 2018b. Weather History, St. Paul, Minnesota, December 15, 2018. Wunderground. https://www.wunderground.com/history/daily/us/mn/st.-paul/KSTP/date/2018-12-15. Accessed 20 December 2018.

Woodford, J.E., C.A. Eloranta, and A. Rinaldi. 2008 Nest density, productivity, and habitat selection of Red-shouldered Hawks in a contiguous forest. Journal of Raptor Research. 42:79-86.

Xerces Society. 2019. Bumble bees: yellowbanded bumble bee (*Bombus terricola*), threats and conservation needs https://xerces.org/yellow-banded-bumble-bee/. Accessed 14 February 2019.

# Appendix A. Animal Species in Greatest Conservation Need, Camp Ripley Training Center and Arden Hills Army Training Site, Minnesota (Updated December 2018).

| Taxa | Scientific Name | Common Name | State Status | Federal Status | Camp Ripley Record | Arden Hills Record |
|---|---|---|---|---|---|---|
| *All state-listed species and federally listed species that occur in Minnesota are automatically SGCN. Additional non-listed (NL) species are SGCN based on specific criteria and expert opinion. The exception is the federally threatened gray wolf. Because the Minnesota population has met the federal recovery goal and the federal listing has been challenged, the decision was made to not list the wolf as a SGCN at this time. STATE CONSERVATION STATUS: Endangered (END): The species is threatened with extinction throughout all or a significant portion of its range within Minn**esota.** Threatened (THR): The species is likely to become endangered within the foreseeable future throughout all or a significant portion of its range within Minnesota. Special concern (SPC): The species, although not endangered or threatened, is extremely uncommon in Minnesota, or has unique or highly specific habitat requirements and deserves careful monitoring of its status**. FEDERAL CONSERVATION STATUS:** Endangered (E): The species is in danger of extinction throughout all or a significant portion of its range. Threatened (T): The species is likely to become endangered in the foreseeable future throughout all or a sig**nificant portion of its range.** Proposed (P): A species that is proposed in the Federal Register to be listed under Section 4 of the Endanger**ed Species Act. Candidate (C):** The US Fish and Wildlife Service has sufficient information on the species biological status and threats to propose them as endangered or threatened under the Endangered Species Act, but development of a proposed listing regulation is precluded by other higher priority listing activities. RECORD CODE: Presence (P)* | | | | | | |
| Amphibians | *Acris blanchardi* | Blanchard's Cricket Frog | END | | |
| Amphibians | *Ambystoma maculatum* | Spotted Salamander | SPC | | |
| Amphibians | *Anaxyrus cognatus* | Great Plains Toad | SPC | | |
| Amphibians | *Hemidactylium scutatum* | Four-toed Salamander | SPC | | |
| Amphibians | *Lithobates palustris* | Pickerel Frog | NL | | |
| Amphibians | *Necturus maculosus* | Mudpuppy | SPC | | |
| Amphibians | *Notophthalmus viridescens* | Eastern Newt | NL | | P |
| Amphibians | *Plethodon cinereus* | Eastern Red-backed Salamander | NL | | |
| Bees | *Bombus affinis* | Rusty Patched Bumble Bee | NL | | |
| Bees | *Bombus bohemicus* | Ashton Cuckoo Bumble Bee | NL | | |
| Bees | *Bombus terricola* | Yellowbanded Bumble Bee | NL | | P |
| Bees | *Bombus fervidus* | Golden Northern Bumble Bee or Yellow Bumble Bee | NL | | P |
| Bees | *Bombus pensylvanicus* | American Bumble Bee | NL | | P |
| Birds | *Accipiter gentilis* | Northern Goshawk | SPC | | P |

| Taxa | Scientific Name | Common Name | State Status | Federal Status | Camp Ripley Record | Arden Hills Record |
|---|---|---|---|---|---|---|
| Birds | *Aechmophorus occidentalis* | Western Grebe | NL | | | |
| Birds | *Aegolius funereus* | Boreal Owl | SPC | | | |
| Birds | *Ammodramus bairdii* | Baird's Sparrow | END | | | |
| Birds | *Ammodramus henslowii* | Henslow's Sparrow | END | | | P |
| Birds | *Ammodramus leconteii* | Le Conte's Sparrow | NL | | P | |
| Birds | *Ammodramus nelsoni* | Nelson's Sparrow | SPC | | P | |
| Birds | *Ammodramus savannarum* | Grasshopper Sparrow | NL | | P | P |
| Birds | *Anas acuta* | Northern Pintail | NL | | P | |
| Birds | *Anas rubripes* | American Black Duck | NL | | P | |
| Birds | *Anthus spragueii* | Sprague's Pipit | END | C | | |
| Birds | *Antrostomus vociferus* | Eastern Whip-poor-will | **NL** | | P | |
| Birds | *Asio flammeus* | Short-eared Owl | SPC | | | |
| Birds | *Athene cunicularia* | Burrowing Owl | END | | | |
| Birds | *Aythya affinis* | Lesser Scaup | NL | | P | P |
| Birds | *Bartramia longicauda* | Upland Sandpiper | NL | | P | |
| Birds | *Botaurus lentiginosus* | American Bittern | NL | | P | P |
| Birds | *Buteo lineatus* | Red-shouldered Hawk | SPC | | P | P |
| Birds | *Buteo swainsoni* | Swainson's Hawk | NL | | | |
| Birds | *Calcarius ornatus* | Chestnut-collared Longspur | END | | P | |
| Birds | *Calidris pusilla* | Semipalmated Sandpiper | NL | | P | |
| Birds | *Calidris canutus rufa* | Rufa Red Knot | NL | T | | |
| Birds | *Catharus fuscescens* | Veery | NL | | P | P |
| Birds | *Chaetura pelagica* | Chimney Swift | NL | | P | P |
| Birds | *Charadrius melodus* | Piping Plover | END | E/T | | |
| Birds | *Chlidonias niger* | Black Tern | NL | | P | P |
| Birds | *Chondestes grammacus* | Lark Sparrow | SPC | | P | P |
| Birds | *Chordeiles minor* | Common Nighthawk | NL | | P | P |
| Birds | *Circus cyaneus* | Northern Harrier | NL | | P | |
| Birds | *Cistothorus platensis* | Sedge Wren | NL | | P | P |
| Birds | *Coccothraustes vespertinus* | Evening Grosbeak | NL | | | |
| Birds | *Coccyzus americanus* | Yellow-billed Cuckoo | NL | | P | P |
| Birds | *Coccyzus erythropthalmus* | Black-billed Cuckoo | **NL** | | P | |

| Taxa | Scientific Name | Common Name | State Status | Federal Status | Camp Ripley Record | Arden Hills Record |
|---|---|---|---|---|---|---|
| | | | | | | |
| Birds | *Contopus cooperi* | Olive-sided Flycatcher | NL | | P | P |
| Birds | *Coturnicops noveboracensis* | Yellow Rail | SPC | | P | P |
| Birds | *Cygnus buccinator* | Trumpeter Swan | SPC | | P | P |
| Birds | *Dolichonyx oryzivorus* | Bobolink | NL | | P | P |
| Birds | *Empidonax virescens* | Acadian Flycatcher | SPC | | | |
| Birds | *Falcipennis canadensis* | Spruce Grouse | NL | | | |
| Birds | *Falco peregrinus* | Peregrine Falcon | SPC | | P | |
| Birds | *Falco sparverius* | American Kestrel | NL | | P | P |
| Birds | *Gallinula galeata* | Common Gallinule | SPC | | | |
| Birds | *Gavia immer* | Common Loon | NL | | P | P |
| Birds | *Haemorhous purpureus* | Purple Finch | NL | | P | |
| Birds | *Hylocichla mustelina* | Wood Thrush | NL | | P | P |
| Birds | *Ixobrychus exilis* | Least Bittern | NL | | P | |
| Birds | *Lanius ludovicianus* | Loggerhead Shrike | END | | | |
| Birds | *Leucophaeus pipixcan* | Franklin's Gull | SPC | | | |
| Birds | *Limnodromus griseus* | Short-billed Dowitcher | NL | | P | |
| Birds | *Limosa fedoa* | Marbled Godwit | SPC | | | |
| Birds | *Limosa haemastica* | Hudsonian Godwit | NL | | | |
| Birds | *Megaceryle alcyon* | Belted kingfisher | NL | | P | P |
| Birds | *Melanerpes erythrocephalus* | Red-headed Woodpecker | **NL** | | P | P |
| Birds | *Mergus merganser* | Common Merganser | NL | | P | P |
| Birds | *Nycticorax nycticorax* | Black-crowned Night-heron | NL | | P | P |
| Birds | *Oporornis agilis* | Connecticut Warbler | NL | | P | P |
| Birds | *Parkesia motacilla* | Louisiana Waterthrush | SPC | | | |
| Birds | *Pelecanus erythrorhynchos* | American White Pelican | SPC | | P | |
| Birds | *Phalaropus tricolor* | Wilson's Phalarope | THR | | P | P |
| Birds | *Picoides arcticus* | Black-backed Woodpecker | NL | | | |
| Birds | *Pipilo erythrophthalmus* | Eastern Towhee | **NL** | | P | P |
| Birds | *Podiceps auritus* | Horned Grebe | END | | P | |
| Birds | *Podiceps grisegena* | Red-necked Grebe | NL | | P | |
| Birds | *Podiceps nigricollis* | Eared Grebe | NL | | P | |

| Taxa | Scientific Name | Common Name | State Status | Federal Status | Camp Ripley Record | Arden Hills Record |
|---|---|---|---|---|---|---|
| | | | | | | |
| Birds | *Poecile hudsonicus* | Boreal Chickadee | NL | | | |
| Birds | *Progne subis* | Purple Martin | SPC | | P | P |
| Birds | *Protonotaria citrea* | Prothonotary Warbler | NL | | | |
| Birds | *Rallus elegans* | King Rail | END | | | |
| Birds | *Rallus limicola* | Virginia Rail | NL | | P | P |
| Birds | *Scolopax minor* | American Woodcock | **NL** | | P | P |
| Birds | *Setophaga caerulescens* | Black-throated Blue Warbler | NL | | P | |
| Birds | *Setophaga castanea* | Bay-breasted Warbler | NL | | P | P |
| Birds | *Setophaga cerulea* | Cerulean Warbler | SPC | | P | |
| Birds | *Setophaga citrina* | Hooded Warbler | SPC | | P | |
| Birds | *Setophaga tigrina (Dendroica)* | Cape May Warbler | NL | | P | P |
| Birds | *Spiza americana* | Dickcissel | NL | | P | P |
| Birds | *Spizella pusilla* | Field Sparrow | NL | | P | P |
| Birds | *Stelgidopteryx serripennis* | N. Rough-winged Swallow | NL | | P | P |
| Birds | *Sterna forsteri* | Forster's Tern | SPC | | P | P |
| Birds | *Sterna hirundo* | Common Tern | THR | | P | P |
| Birds | *Sturnella magna* | Eastern Meadowlark | NL | | P | P |
| Birds | *Sturnella neglecta* | Western Meadowlark | NL | | P | |
| Birds | *Toxostoma rufum* | Brown Thrasher | **NL** | | P | P |
| Birds | *Tringa melanoleuca* | Greater Yellowlegs | NL | | P | P |
| Birds | *Troglodytes hiemalis* | Winter Wren | NL | | P | P |
| Birds | *Tympanuchus cupido* | Greater Prairie-chicken | SPC | | | |
| Birds | *Tympanuchus phasianellus* | Sharp-tailed Grouse | NL | | | |
| Birds | *Tyrannus verticalis* | Western Kingbird | NL | | P | |
| Birds | *Vermivora chrysoptera* | Golden-winged Warbler | **NL** | | P | P |
| Birds | *Vireo bellii* | Bell's Vireo | SPC | | | |
| Birds | *Vireo philadelphicus* | Philadelphia Vireo | NL | | P | P |
| Birds | *Xanthocephalus xanthocephalus* | Yellow-headed Blackbird | NL | | P | P |
| Caddisflies | *Agapetus tomus* | A species of caddisfly | SPC | | | |
| Caddisflies | *Anabolia ozburni* | A species of northern caddisfly | SPC | | P | |

| Taxa | Scientific Name | Common Name | State Status | Federal Status | Camp Ripley Record | Arden Hills Record |
|---|---|---|---|---|---|---|
| Caddisflies | *Chilostigma itascae* | Headwaters Chilostigman Caddisfly | THR | | | |
| Caddisflies | *Goera stylata* | A species of caddisfly | THR | | | |
| Caddisflies | *Hydroptila metoeca* | A species of purse casemaker caddisfly | SPC | | | |
| Caddisflies | *Hydroptila quinola* | A species of purse casemaker caddisfly | SPC | | | |
| Caddisflies | *Hydroptila rono* | A species of purse casemaker caddisfly | THR | | | |
| Caddisflies | *Hydroptila tortosa* | A species of purse casemaker caddisfly | SPC | | | |
| Caddisflies | *Hydroptila waskesia* | A species of purse casemaker caddisfly | END | | | |
| Caddisflies | *Ironoquia punctatissima* | A species of northern caddisfly | THR | | | |
| Caddisflies | *Lepidostoma libum* | A species of caddisfly | THR | | | |
| Caddisflies | *Limnephilus janus* | A species of northern caddisfly | END | | | |
| Caddisflies | *Limnephilus rossi* | A species of northern caddisfly | THR | | | |
| Caddisflies | *Limnephilus secludens* | A species of northern caddisfly | END | | | |
| Caddisflies | *Ochrotrichia spinosa* | A species of purse casemaker caddisfly | END | | | |
| Caddisflies | *Oecetis ditissa* | A species of long-horned caddisfly | THR | | | |
| Caddisflies | *Oxyethira ecornuta* | A species of purse casemaker caddisfly | THR | | | |
| Caddisflies | *Oxyethira itascae* | A species of purse casemaker caddisfly | SPC | | | |
| Caddisflies | *Parapsyche apicalis* | A species of netspinning caddisfly | THR | | | |
| Caddisflies | *Polycentropus glacialis* | A species of tube casemaker caddisfly | THR | | | |
| Caddisflies | *Polycentropus milaca* | A species of tube casemaker caddisfly | END | | | |
| Caddisflies | *Protoptila erotica* | A species of saddle casemaker caddisfly | SPC | | | |

| Taxa | Scientific Name | Common Name | State Status | Federal Status | Camp Ripley Record | Arden Hills Record |
|---|---|---|---|---|---|---|
| Caddisflies | *Triaenodes flavescens* | A species of long-horned caddisfly | SPC | | | |
| Caddisflies | *Ylodes frontalis* | A species of long-horned caddisfly | THR | | | |
| Fish | *Acipenser fulvescens* | Lake Sturgeon | SPC | | | |
| Fish | *Alosa chrysochloris* | Skipjack Herring | END | | | |
| Fish | *Ammocrypta clara* | Western Sand Darter | NL | | | |
| Fish | *Anguilla rostrata* | American Eel | SPC | | | |
| Fish | *Aphredoderus sayanus* | Pirate Perch | SPC | | | |
| Fish | *Catostomus catostomus* | Longnose Sucker | NL | | | |
| Fish | *Clinostomus elongatus* | Redside Dace | SPC | | | |
| Fish | *Coregonus kiyi* | Kiyi | SPC | | | |
| Fish | *Coregonus nipigon* | Nipigon Cisco | SPC | | | |
| Fish | *Coregonus zenithicus* | Shortjaw Cisco | SPC | | | |
| Fish | *Cottus ricei* | Spoonhead Sculpin | NL | | | |
| Fish | *Couesius plumbeus* | Lake Chub | SPC | | | |
| Fish | *Crystallaria asprella* | Crystal Darter | END | | | |
| Fish | *Cycleptus elongatus* | Blue Sucker | SPC | | | |
| Fish | *Erimystax x-punctata* | Gravel Chub | THR | | | |
| Fish | *Etheostoma chlorosoma* | Bluntnose Darter | SPC | | | |
| Fish | *Etheostoma microperca* | Least Darter | SPC | | | |
| Fish | *Fundulus sciadicus* | Plains Topminnow | THR | | | |
| Fish | *Hybognathus nuchalis* | Mississippi Silvery Minnow | SPC | | | |
| Fish | *Hybopsis amnis* | Pallid Shiner | END | | | |
| Fish | *Ichthyomyzon fossor* | Northern Brook Lamprey | SPC | | | |
| Fish | *Ichthyomyzon gagei* | Southern Brook Lamprey | SPC | | | |
| Fish | *Ictiobus niger* | Black Buffalo | THR | | | |
| Fish | *Lepomis gulosus* | Warmouth | SPC | | | |
| Fish | *Lepomis peltastes* | Northern Longear Sunfish | SPC | | | |
| Fish | *Lythrurus umbratilis* | Redfin Shiner | SPC | | | |
| Fish | *Morone mississippiensis* | Yellow Bass | SPC | | | |
| Fish | *Moxostoma duquesnei* | Black Redhorse | SPC | | | |
| Fish | *Myoxocephalus thompsoni* | Deepwater Sculpin | NL | | | |
| Fish | *Nocomis biguttatus* | Hornyhead Chub | NL | | | |

| Taxa | Scientific Name | Common Name | State Status | Federal Status | Camp Ripley Record | Arden Hills Record |
|---|---|---|---|---|---|---|
| Fish | *Notropis anogenus* | Pugnose Shiner | THR | | | |
| Fish | *Notropis nubilus* | Ozark Minnow | SPC | | | |
| Fish | *Notropis texanus* | Weed Shiner | NL | | | |
| Fish | *Notropis topeka* | Topeka Shiner | SPC | E | | |
| Fish | *Noturus exilis* | Slender Madtom | END | | | |
| Fish | *Opsopoeodus emiliae* | Pugnose Minnow | NL | | | |
| Fish | *Percina evides* | Gilt Darter | SPC | | | |
| Fish | *Phenacobius mirabilis* | Suckermouth Minnow | SPC | | | |
| Fish | *Platygobio gracilis* | Flathead Chub | SPC | | | |
| Fish | *Polyodon spathula* | Paddlefish | THR | | | |
| Fish | *Prosopium coulterii* | Pygmy Whitefish | SPC | | | |
| Fish | *Salvelinus fontinalis* | Coaster Brook Trout | NL | | | |
| Fish | *Salvelinus fontinalis* | Brook Trout SE MN Heritage Strain | NL | | | |
| Jumping spiders | *Habronattus calcaratus maddisoni* | A species of jumping spider | SPC | | | |
| Jumping spiders | *Habronattus texanus* | A species of jumping spider | SPC | | | |
| Jumping spiders | *Habronattus viridipes* | A species of jumping spider | SPC | | | P |
| Jumping spiders | *Marpissa formosa* | A species of jumping spider | SPC | | | |
| Jumping spiders | *Paradamoetas fontana* | A species of jumping spider | SPC | | P | |
| Jumping spiders | *Pelegrina arizonensis* | A species of jumping spider | SPC | | | |
| Jumping spiders | *Phidippus apacheanus* | A species of jumping spider | SPC | | | |
| Jumping spiders | *Phidippus pius* | A species of jumping spider | SPC | | | |
| Jumping spiders | *Sassacus papenhoei* | A species of jumping spider | SPC | | | |
| Jumping spiders | *Tutelina formicaria* | A species of jumping spider | THR | | | |
| Leafhoppers | *Aflexia rubranura* | Red-tailed Leafhopper | SPC | | | |
| Leafhoppers | *Attenuipyga vanduzeei* | Hill Prairie Shovelhead Leafhopper | SPC | | | |

| Taxa | Scientific Name | Common Name | State Status | Federal Status | Camp Ripley Record | Arden Hills Record |
|---|---|---|---|---|---|---|
| Leafhoppers | *Macrosteles clavatus* | Caped Leafhopper | SPC | | | |
| Butterflies and moths | Aspitates aberrata | | NL | | | |
| Butterflies and moths | *Atrytone arogos iowa* | Arogos Skipper | SPC | | | |
| Butterflies and moths | *Atrytonopsis hianna* | Dusted Skipper | NL | | P | |
| Butterflies and moths | *Boloria chariclea* | Arctic Fritillary | NL | | | |
| Butterflies and moths | *Carmenta anthracipennis* | Blazing Star Clearwing Moth | NL | | | |
| Butterflies and moths | *Catocala abbreviatella* | Abbreviated Underwing | SPC | | | |
| Butterflies and moths | *Catocala whitneyi* | Whitney's Underwing | SPC | | | |
| Butterflies and moths | *Danaus plexippus* | Monarch | NL | | P | P |
| Butterflies and moths | *Erebia mancinus* | Disa Alpine | SPC | | | |
| Butterflies and moths | *Erynnis martialis* | Mottled Dusky Wing | NL | | | |
| Butterflies and moths | *Erynnis persius persius* | Persius Duskywing | END | | | |
| Butterflies and moths | *Euchloe ausonides* | Large Marble | NL | | | |
| Butterflies and moths | *Euphyes binacula (bimacula?) illinois* | Two-spotted Skipper | NL | | P | |
| Butterflies and moths | *Hesperia assiniboia* | Assiniboia Skipper | END | | | |
| Butterflies and moths | *Hesperia dacotae* | Dakota Skipper | END | T | | |
| Butterflies and moths | *Hesperia leonardus* | Leonard's Skipper | SPC | | P | |
| Butterflies and moths | *Hesperia ottoe* | Ottoe Skipper | END | | | |
| Butterflies and moths | *Hesperia uncas* | Uncas Skipper | END | | | |
| Butterflies and moths | Lasionycta secedens | | NL | | | |

| Taxa | Scientific Name | Common Name | State Status | Federal Status | Camp Ripley Record | Arden Hills Record |
|---|---|---|---|---|---|---|
| Butterflies and moths | Lasionycta taigata | | NL | | | |
| Butterflies and moths | *Plebejus idas nabokovi* | Nabokov's Blue | SPC | | | |
| Butterflies and moths | *Plebejus melissa samuelis* | Karner Blue | END | E | | |
| Butterflies and moths | *Oarisma garita* | Garita Skipper | THR | | | |
| Butterflies and moths | *Oarisma poweshiek* | Poweshiek Skipper | END | E | | |
| Butterflies and moths | *Oeneis uhleri varuna* | Uhler's Arctic | END | | | |
| Butterflies and moths | *Polygonia gracilis* | Hoary Comma | NL | | | |
| Butterflies and moths | *Proserpina (Proserpinus) juanita* | Juanita Sphinx Moth | NL | | | |
| Butterflies and moths | *Pyrgus centaureae freija* | Grizzled Skipper | SPC | | | |
| Butterflies and moths | *Schinia indiana* | Phlox Moth | SPC | | | |
| Butterflies and moths | *Schinia lucens* | Leadplant Flower Moth | SPC | | | |
| Butterflies and moths | *Schinia sanguinea* | Blazing Star Flower Moth | NL | | | |
| Butterflies and moths | *Speyeria idalia* | Regal Fritillary | SPC | | | |
| Butterflies and moths | *Xestia mixta* | | NL | | | |
| Mammals | *Alces americanus* | Moose | SPC | | P | |
| Mammals | *Cervus canadensis* | Elk | SPC | | | |
| Mammals | *Cryptotis parva* | North American Least Shrew | SPC | | | |
| Mammals | *Eptesicus fuscus* | Big Brown Bat | SPC | | P | P |
| Mammals | *Lasionycteris noctivagans* | Silver-haired Bat | NL | | P | P |
| Mammals | *Lasiurus borealis* | Red Bat | NL | | P | P |
| Mammals | *Lasiurus cinereus* | Hoary Bat | NL | | P | P |
| Mammals | *Lynx canadensis* | Canada Lynx | SPC | T | P | |
| Mammals | *Microtus ochrogaster* | Prairie Vole | SPC | | P | |
| Mammals | *Microtus pinetorum* | Woodland Vole | SPC | | P | |

| Taxa | Scientific Name | Common Name | State Status | Federal Status | Camp Ripley Record | Arden Hills Record |
|---|---|---|---|---|---|---|
| Mammals | *Mustela nivalis* | Least Weasel | SPC | | | |
| Mammals | *Myotis lucifugus* | Little Brown Myotis | SPC | | P | P |
| Mammals | *Myotis septentrionalis* | Northern long-eared bat | SPC | T | P | P |
| Mammals | *Onychomys leucogaster* | Northern Grasshopper Mouse | SPC | | | |
| Mammals | *Perimyotis subflavus* | Tri-colored bat | SPC | | P | P |
| Mammals | *Perognathus flavescens* | Plains Pocket Mouse | SPC | | | P |
| Mammals | *Phenacomys ungava* | Eastern Heather Vole | SPC | | | |
| Mammals | *Poliocitellus franklinii (Spermophilus)* | Franklin's Ground Squirrel | NL | | P | |
| Mammals | *Puma concolor* | Mountain Lion | SPC | | P | |
| Mammals | *Reithrodontomys megalotis* | Western Harvest Mouse | SPC | | | |
| Mammals | *Sorex fumeus* | Smoky Shrew | SPC | | | |
| Mammals | *Spilogale putorius* | Eastern Spotted Skunk | THR | | | |
| Mammals | *Synaptomys borealis* | Northern Bog Lemming | SPC | | | |
| Mammals | *Taxidea taxus* | American Badger | NL | | P | |
| Mammals | *Thomomys talpoides* | Northern Pocket Gopher | THR | | | |
| Mammals | *Urocitellus richardsonii* | Richardson's Ground Squirrel | SPC | | | |
| Mammals | *Lepus townsendii* | White-tailed Jackrabbit | NL | | P | |
| Mussels | *Actinonaias ligamentina* | Mucket | THR | | | |
| Mussels | *Alasmidonta marginata* | Elktoe | THR | | | |
| Mussels | *Anodonta suborbiculata* | Flat Floater | SPC | | | |
| Mussels | *Arcidens confragosus* | Rock Pocketbook | END | | | |
| Mussels | *Cumberlandia monodonta* | Spectaclecase | END | E | | |
| Mussels | *Cyclonaias tuberculata* | Purple Wartyback | END | | | |
| Mussels | *Ellipsaria lineolata* | Butterfly | THR | | | |
| Mussels | *Elliptio complanata* | Eastern Elliptio | SPC | | | |
| Mussels | *Elliptio crassidens* | Elephant-ear | END | | | |
| Mussels | *Elliptio dilatata* | Spike | THR | | | |
| Mussels | *Epioblasma triquetra* | Snuffbox | END | E | | |
| Mussels | *Fusconaia ebena* | Ebonyshell | END | | | |
| Mussels | *Lampsilis higginsii* | Higgins Eye | END | E | | |
| Mussels | *Lampsilis teres* | Yellow Sandshell | END | | | |
| Mussels | *Lasmigona compressa* | Creek Heelsplitter | SPC | | P | |

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|---|---|---|---|---|---|---|
| Mussels | *Lasmigona costata* | Fluted-shell | THR | | | |
| Mussels | *Ligumia recta* | Black Sandshell | SPC | | P | |
| Mussels | *Ligumia subrostrata* | Pondmussel | THR | | | |
| Mussels | *Megalonaias nervosa* | Washboard | END | | | |
| Mussels | *Obovaria olivaria* | Hickorynut | NL | | | |
| Mussels | *Plethobasus cyphyus* | Sheepnose | END | E | | |
| Mussels | *Pleurobema sintoxia* | Round Pigtoe | SPC | | | |
| Mussels | *Potamilus capax* | Fat Pocketbook | NL | | | |
| Mussels | *Quadrula fragosa* | Winged Mapleleaf | END | E | | |
| Mussels | *Quadrula metanevra* | Monkeyface | THR | | | |
| Mussels | *Quadrula nodulata* | Wartyback | THR | | | |
| Mussels | *Simpsonaias ambigua* | Salamander Mussel | END | | | |
| Mussels | *Tritogonia verrucosa* | Pistolgrip | END | | | |
| Mussels | *Truncilla donaciformis* | Fawnsfoot | THR | | | |
| Mussels | *Venustaconcha ellipsiformis* | Ellipse | THR | | | |
| Dragonflies and damselflies | *Aeshna sitchensis* | Zigzag Darner | SPC | | | |
| Dragonflies and damselflies | *Aeshna subarctica* | Subarctic Darner | SPC | | | |
| Dragonflies and damselflies | *Amphiagrion abbreviatum* | Western Red Damsel | NL | | | |
| Dragonflies and damselflies | *Argia plana* | Springwater Dancer | NL | | | |
| Dragonflies and damselflies | *Boyeria grafiana* | Ocellated Darner | SPC | | | |
| Dragonflies and damselflies | *Coenagrion angulatum* | Prairie Bluet | NL | | | |
| Dragonflies and damselflies | *Coenagrion interrogatum* | Subartic Bluet | NL | | | |

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|---|---|---|---|---|---|---|
| Dragonflies and damselflies | *Cordulegaster obliqua* | Arrowhead Spiketail | NL | | | |
| Dragonflies and damselflies | *Gomphus adelphus* | Mustached Clubtail | NL | | | |
| Dragonflies and damselflies | *Gomphus lineatifrons* | Splendid Clubtail | NL | | | |
| Dragonflies and damselflies | *Gomphus quadricolor* | Rapids Clubtail | NL | | | |
| Dragonflies and damselflies | *Gomphus ventricosus* | Skillet Clubtail | NL | | | |
| Dragonflies and damselflies | *Gomphus viridifrons* | Green-faced Clubtail | NL | | | |
| Dragonflies and damselflies | *Ischnura posita* | Fragile Forktail | NL | | | |
| Dragonflies and damselflies | *Leucorrhinia glacialis* | Crimson-ringed Whiteface | NL | | P | |
| Dragonflies and damselflies | *Nannothemis bella* | Elfin Skimmer | NL | | | |
| Dragonflies and damselflies | *Neurocordulia molesta* | Smoky Shadowdragon | NL | | | |
| Dragonflies and damselflies | *Ophiogomphus anomalus* | Extra-striped snaketail | SPC | | | |
| Dragonflies and damselflies | *Ophiogomphus carolus* | Riffle Snaketail | NL | | | |
| Dragonflies and damselflies | *Ophiogomphus colubrinus* | Boreal Snaketail | NL | | | |

| Taxa | Scientific Name | Common Name | State Status | Federal Status | Camp Ripley Record | Arden Hills Record |
|---|---|---|---|---|---|---|
| Dragonflies and damselflies | *Ophiogomphus howei* | Pygmy Snaketail | SPC | | | |
| Dragonflies and damselflies | *Ophiogomphus smithi* | Sioux Snaketail | NL | | | |
| Dragonflies and damselflies | *Ophiogomphus susbehcha* | Saint Croix Snaketail | THR | | | |
| Dragonflies and damselflies | *Rhionaeschna multicolor* | Blue-eyed Darner | NL | | | |
| Dragonflies and damselflies | *Rhionaeschna mutata* | Spatterdock Darner | NL | | | |
| Dragonflies and damselflies | *Somatochlora brevicincta* | Quebec Emerald | SPC | | | |
| Dragonflies and damselflies | *Somatochlora cingulata* | Lake Emerald | NL | | | |
| Dragonflies and damselflies | *Somatochlora elongata* | Ski-tipped Emerald | NL | | | |
| Dragonflies and damselflies | *Somatochlora ensigera* | Plains Emerald | NL | | | |
| Dragonflies and damselflies | *Somatochlora forcipata* | Forcipate Emerald | SPC | | | |
| Dragonflies and damselflies | *Somatochlora franklini* | Delicate Emerald | NL | | | |
| Dragonflies and damselflies | *Somatochlora kennedyi* | Kennedy's Emerald | NL | | | |
| Dragonflies and damselflies | *Somatochlora minor* | Ocellated Emerald | NL | | | |

| Taxa | Scientific Name | Common Name | State Status | Federal Status | Camp Ripley Record | Arden Hills Record |
|---|---|---|---|---|---|---|
| Dragonflies and damselflies | *Somatochlora walshii* | Brush-tipped Emerald | NL | | | |
| Dragonflies and damselflies | *Stylogomphus albistylus* | Eastern Least Clubtail | NL | | | |
| Dragonflies and damselflies | *Stylurus amnicola* | Riverine Clubtail | NL | | P | |
| Dragonflies and damselflies | *Stylurus plagiatus* | Russet-tipped Clubtail | NL | | | |
| Dragonflies and damselflies | *Stylurus scudderi* | Zebra Clubtail | NL | | | |
| Dragonflies and damselflies | *Sympetrum madidum* | Red-veined Meadowhawk | NL | | | |
| Dragonflies and damselflies | *Williamsonia fletcheri* | Ebony Boghunter | NL | | | |
| Reptiles | *Apalone mutica* | Smooth Softshell | SPC | | | |
| Reptiles | *Aspidoscelis sexlineata (Cnemidophorus)* | Six-lined Racerunner | NL | | | |
| Reptiles | *Coluber constrictor* | North American Racer | SPC | | | |
| Reptiles | *Crotalus horridus* | Timber Rattlesnake | THR | | | |
| Reptiles | *Diadophis punctatus edwardsii (northern subspecies)* | Northern Ring-necked Snake | NL | | | |
| Reptiles | *Emydoidea blandingii* | Blanding's Turtle | THR | | P | P |
| Reptiles | *Glyptemys insculpta (Clemmys)* | Wood Turtle | THR | | | |
| Reptiles | *Heterodon nasicus* | Plains Hog-nosed Snake | SPC | | P | |
| Reptiles | *Heterodon platirhinos* | Eastern Hog-nosed Snake | NL | | P | |
| Reptiles | *Opheodrys vernalis (Liochlorophis)* | Smooth Greensnake | NL | | P | P |
| Reptiles | *Pantherophis obsoletus* | Western Ratsnake | THR | | | |
| Reptiles | *Pituophis catenifer* | Gophersnake | SPC | | | |

| Taxa | Scientific Name | Common Name | State Status | Federal Status | Camp Ripley Record | Arden Hills Record |
|---|---|---|---|---|---|---|
| Reptiles | *Plestiodon fasciatus* | Common Five-lined Skink | SPC | | | |
| Reptiles | *Sistrurus catenatus* | Massasauga | END | C | | |
| Reptiles | *Tropidoclonion lineatum* | Lined Snake | SPC | | | |
| Snails | *Gastrocopta rogersensis* | Rogers' Snaggletooth Snail | SPC | | | |
| Snails | *Planogyra asteriscus* | Eastern Flat-whorl Snail | SPC | | | |
| Snails | *Striatura ferrea* | Black Striate Snail | SPC | | | |
| Snails | *Vertigo meramecensis* | Bluff Vertigo | THR | | | |
| Snails | *Zonitoides limatulus* | Dull Gloss | SPC | | | |
| Tiger Beetles | *Cicindela cursitans* | Ant-like Tiger Beetle | NL | | | |
| Tiger Beetles | *Cicindela denikei* | Laurentian Tiger Beetle | SPC | | | |
| Tiger Beetles | *Cicindela fulgida fulgida* | Crimson Salflat Tiger Beetle, *fulgida ssp.* | END | | | |
| Tiger Beetles | *Cicindela fulgida westbournei* | Crimson Salflat Tiger Beetle, *westb. ssp.* | THR | | | |
| Tiger Beetles | *Cicindela hirticollis hirticollis ssp.* | Hairy-necked Tiger Beetle | NL | | | |
| Tiger Beetles | *Cicindela hirticollis rhodensis ssp.* | Hairy-necked Tiger Beetle | END | | | |
| Tiger Beetles | *Cicindela lepida* | Ghost Tiger Beetle | THR | | P | P |
| Tiger Beetles | *Cicindela limbata nympha* | Sandy Tiger Beetle | END | | | |
| Tiger Beetles | *Cicindela macra macra* | Sandy Stream Tiger Beetle | SPC | | | |
| Tiger Beetles | *Cicindela patruela patruela* | Northern Barrens Tiger Beetle | SPC | | P | P |
| Tiger Beetles | *Cicindela splendida cyanocephalata* | Splendid Tiger Beetle | SPC | | | |
| | | | | | | |
| | **Federal Endangered=** | | | | 0 | 0 |
| | **Federal Threatened (excludes gray wolf)=** | | | | 2 | 1 |
| | **Federal Candidate=** | | | | 0 | 0 |
| | **State Endangered=** | | | | 2 | 1 |
| | **State Threatened=** | | | | 4 | 4 |
| | **State Special Concern=** | | | | 28 | 13 |
| | **Species in Greatest Conservation Need=** | | | | 101 | 57 |

(MNDNR 2018b).

# Appendix B: Brief Descriptions of Endemic Vector-Borne Diseases in Minnesota.

*Tick Borne*

- Anaplasmosis – the second most common tick borne disease in Minnesota. It is a bacterial illness caused by *Anaplasma phagocytophilum* and transmitted by the bite of an infected blacklegged (deer) tick. It was formerly known as human granulocytic ehrlichiosis and was first recognized in Minnesota in the mid-1990s. Symptoms usually occur within 1 – 2 weeks of a tick bite and may include a sudden onset of fever, headache and muscle aches.
- Babesiosis – the third most common tick borne disease in Minnesota. It is caused by a blood parasite, *Babesia microti*, and transmitted by the bite of an infected blacklegged (deer) tick. Many people infected with babesiosis have no symptoms or only mild symptoms. Symptoms such as fever, headache, muscle aches and fatigue may appear within several weeks of a tick bite.
- Ehrlichiosis – a rarely reported form of ehrlichiosis *(Ehrlichia muris eauclairensis*) has been found to be transmitted by the bite of infected blacklegged (deer) ticks in Minnesota and Wisconsin. It was first discovered in 2009 and is similar to anaplasmosis involving symptoms such as fever, headache and muscle/joint aches.
- Hard Tick Relapsing Fever – a recently identified illness caused by the bacteria, *Borrelia miyamotoi*. It was first identified as a cause of human illness in 2011 and is likely transmitted by the bite of an infected blacklegged (deer) tick. To date, low numbers of human disease have been reported from the Northeastern and Upper Midwestern regions of the United States. The most common symptoms have included fever, chills, headache, muscle/joint pain and fatigue.
- Lyme Disease – the most common tick borne disease in Minnesota and in the United States. It is a bacterial illness caused by *Borrelia burgdorferi* and transmitted by the bite of an infected blacklegged (deer) tick. It was discovered in Lyme, Conneticut in 1975 and has since been found increasingly throughout several parts of the Northeastern and Upper Midwestern regions of the United States. Early symptoms typically appear within 30 days of a tick bite and may include rash, fever, headache, fatigue and muscle/joint pain. Other symptoms (e.g., multiple rashes, paralysis on one side of the face, or swelling in one or more joints) may occur weeks to months later if a person is not treated early in the course of illness. A closely related organism, *Borrelia mayonii*, was recently identified in 2013 to cause an illness similar to Lyme disease. To date, this organism has only rarely been found in patients with exposures to blacklegged (deer) ticks in Minnesota and Wisconsin.
- Rocky Mountain Spotted Fever – a very rare bacterial illness, caused by *Rickettsia rickettsii*, that is transmitted by the bite of an infected American dog (wood) tick. It is more commonly reported in south-central and southeastern states although rare cases have been reported in Minnesota. Symptoms may include an abrupt onset of fever, headache, muscle aches, nausea, vomiting and spotted rash. The illness can cause organ failure and death so prompt treatment is recommended in suspect cases

- Tularemia – a very rare bacterial illness caused by *Francisella tularensis* and transmitted by several different routes. For instance, bites from an infected deer fly or American dog (wood) tick may transmit the disease while contact with infected rabbits may also spread the disease. Symptoms vary depending on the route of exposure and may include fever, enlarged lymph nodes, ulcerated skin wound, respiratory or gastrointestinal signs. The illness can cause serious complications and death so prompt treatment is recommended in suspect cases.

*Mosquito Borne*

- Eastern Equine Encephalitis (EEE) - a rare illness in humans that is maintained in nature through a transmission cycle involving *Culiseta melanura* and birds. Humans may become infected after a bite through an infected bridge vector such as *Coquillettidia perturbans.* Many people infected with EEE virus show no symptoms but some (primarily children) have severe illness. Symptoms may include a sudden onset of headache, fever and vomiting that may progress to disorientation, seizures, coma and death. Although cases have been reported in horses, no human cases have been identified in Minnesota.
- Jamestown Canyon Virus Disease – a rarely reported cause of illness in humans that may be transmitted by several different types of mosquitoes throughout Minnesota, particularly the snowmelt *Aedes* species. The virus is closely related to La Crosse virus although any age group may be affected and cases may occur anytime during the warmer months of the year, most commonly between May and September. Similar to other mosquito borne illnesses, symptoms may include fever, headache, meningitis or encephalitis (inflammation of the central nervous system, including the brain).
- La Crosse Encephalitis – this rare illness is caused by La Crosse virus and transmitted to humans primarily by *Aedes triseriatus* (tree hole mosquito) in Minnesota. Cases have been primarily reported from the southeastern region of Minnesota but the Minnesota Department of Health has had recent case reports from central Minnesota in Stearns County. Most people infected with this virus will have either no symptoms or a mild flu-like illness. Symptoms usually show up suddenly within 1 – 2 weeks of being bitten by an infected mosquito. A small percentage of people (especially children) may develop encephalitis (inflammation of the brain).
- West Nile Virus Disease - West Nile virus (WNV) is transmitted to people through the bite of an infected mosquito. In Minnesota, *Culex tarsalis*, a common mosquito in agricultural regions of western and central Minnesota, is the most important vector in transmitting the virus to humans. Most people infected with West Nile virus will have no symptoms or a mild illness with fever. A small percentage of people (<1%), especially elderly patients, may develop meningitis or encephalitis (inflammation of the central nervous system, including the brain). Approximately 10% of these encephalitis cases are fatal.