

# INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

Fort Riley, Kansas

June 2022



## Fort Riley Integrated Natural Resources Management Plan

I In accordance with; Title 16, U.S. Code, Section 670a; Public Law 86-797, as amended, and DoDI and DoDM4715.03, the Department of Defense, Department of Interior and the State of Kansas, through their duly designated representatives whose signatures appear below, approved the following Integrated Natural Resources Management Plant (INRMP) for the protection, development and management of natural resources on the Fort Riley Military Reservation, Kansas.

II. This INRMP will be in full forces and effective upon its adoption. Adoption will be indicated by the signatures below of duly authorized representatives of the three agencies named above; will remain in full force and effect as long as permitted by the cited authorities under which it is entered.

III. This INRMP updates the previous INRMP 2016, with annual interim updates through February 2020 by the duly authorized representatives of Fort Riley, The U.S. Fish and Wildlife Service and the Kansas Department of Wildlife and Parks. This INRMP may be amended or revised by agreement among all parties hereto. Any proposed amendment of this INRMP may originate with any of the participating agencies.



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2022 06 27

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# PART I: OVERVIEW OF THE FORT RILEY INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

## CHAPTER 1: INTRODUCTION

### SECTION 1.1: MILITARY VISION, POLICIES, AND GOALS

#### **Department of the Army Vision, Policies, and Goals**

**Vision:** Achieve an enduring Army enabled by sustainable operations, installations, systems, and communities.

**Policies:** The Army's strategy for natural resources management is based on the principle of sustainability. It reflects the Army's appreciation of the interdependence between the mission, the community, and the environment. This strategy applies a community, regional, and ecosystem approach to managing natural resources on the installation. This is a strategy for a homeland that is protected, an environment that is sustained, and waterways and ecological resources that are preserved as natural and economic assets.

The Army will sustain its testing and training lands' natural resource base in quantity, quality, and configuration to meet current and future requirements. The Army will manage range activities to maintain the resiliency and buffering needed to protect the environment and the surrounding communities from impacts of training and testing.

The Army will apply an ecosystem-based approach to manage natural resources and will collaborate with stakeholders to protect ecosystems. It will be a leader in sustainability; this is crucial to the success of the mission as the Army meets current and future challenges.

The Army will strengthen and build community partnerships to achieve sustained and sound environmental stewardship and a ready military force through communication, coordination, consultation, and collaboration. It will foster open relationships to increase understanding by all. It will communicate the Army's readiness requirements and environmental initiatives, while at the same time, listening to its neighbors' needs and concerns to build win-win situations together.

All requirements set forth in this INRMP requiring the expenditure of (installation) funds are expressly subject to the availability of appropriations and requirements of the Anti-Deficiency Act (31 USC section 1341). No obligation undertaken by (installation) under the terms of this INRMP will require or be interpreted to require a commitment to expend funds not obligated for a particular purpose.

**Goals:** The following goals have been adopted to achieve an enduring Army enabled by sustainable operations, installations, systems, and communities (Army 2004):

- Foster an ethic within the Army that goes beyond environmental compliance to sustainability.
- Strengthen Army operational capability by reducing its environmental footprint through more sustainable practices.
- Meet current and future training, testing, and other mission requirements by sustaining land, air, and water resources.
- Enhance the well-being of Soldiers, Civilians, Families, Neighbors and Communities through leadership in sustainability.

### **Fort Riley INRMP Vision, Policies and Goals**

**Vision:** Achieve a management strategy that dually supports Fort Riley's current and projected missions and complies with environmental regulations while sustaining the natural resources for future use.

**Policies:** Fort Riley's Integrated Natural Resources Management Plan (INRMP) will reflect and implement the Army strategy for natural resources management.

- Fort Riley will sustain its testing and training lands' natural resource base in quantity, quality, and configuration to meet current and future requirements.
- Fort Riley will manage range activities to maintain the resiliency and buffering needed to protect the environment and the surrounding communities from impacts of training.
- Fort Riley will apply an ecosystem-based approach to manage natural resources and will collaborate with stakeholders to protect ecosystems.
- Fort Riley will strengthen and build community partnerships to achieve sustained and sound environmental stewardship and a ready military force through communication, coordination, consultation, and collaboration. It will foster open relationships to increase understanding by all. It will communicate the Army's readiness requirements and environmental initiatives, while at the same time, listening to our neighbors' needs and concerns to build win-win situations together.
- Fort Riley will apply adaptive ecosystem management strategies when making natural resources management decisions. The ecosystem management strategy will strive to achieve the potential natural vegetation of the region. Adaptive ecosystem management on Fort Riley will take into account changes in military mission and associated training requirements, climate change, and the nature and extent of managed natural resources. Adaptive management will adjust management practices to enable accomplishment of military training requirements and to provide for ancillary uses of the installation's natural resources where and when such uses are compatible with the military training requirements.

**Goals:** Fort Riley embraces Army and AMC (Army Materiel Command) policy of sustainability regarding its natural resources management. A critical responsibility of the installation is to provide training lands upon which its Soldiers can develop their war-fighting skills. The following INRMP goals will be adapted to natural resources management in an effort to ensure the long-term sustainability of Fort Riley's training lands

- **Strengthen mission sustainability.**
  - Apply an adaptive ecosystem management approach to integrate planning of natural resources programs.
  - Practice adaptive ecosystem management to review and revise management practices.
  - Practice sustained yield in consumption of natural resources.
  - Coordinate natural resources management actions with other installation activities and resource management agencies.
  - Strive for no net loss in the capability of installation lands to support current and future military training at Fort Riley.
  - Monitor quality and status of training lands.
  - Mitigate effects of training on natural resources.
  - Rehabilitate training lands.
  - Implement strategies to mitigate the effects of climate change.
- **Support, maintain, and increase Soldier safety.**
  - Minimize impediments and safety hazards to training.
- **Reduce and manage effects of encroachment on the mission.**
  - Collaborate and partner with stakeholders to protect relevant ecosystems off of the installation.
  - Manage the Army Compatible Use Buffer (ACUB) Program.
- **Enhance the well-being and quality of life of our Soldiers, Civilians, Families, Neighbors and Communities.**
  - Involve community stakeholders in management planning and decision-making.
  - Provide opportunity for sustainable natural resource-based recreational activities.
  - Provide sustainable forest product use opportunities.
  - Provide sustainable agricultural production opportunities.
  - Provide professional conservation law enforcement.
- **Maintain compliance with laws and regulations.**
  - Maintain compliance with Federal and state laws and regulations.

- Maintain compliance with Executive Orders (EOs).
- Maintain compliance with and Department of Defense (DoD) and Army regulations. (A list of the federal laws and EOs governing natural resources management on military lands is in Appendix A).
- **Annually assess this INRMP.**
- Assess this INRMP at least annually to determine its effectiveness in sustaining land, air, and water resources, and thereby strengthening mission capabilities.
- Modify this INRMP, as required.

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## **SECTION 1.2: LOCATION, ACREAGE, AND HISTORY**

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### **Location**

Fort Riley is located in northeastern Kansas occupying portions of Geary, Riley, and Clay counties. The installation's southern boundary is at the confluence of the Smoky Hill and Republican rivers, which combine to form the Kansas River. Milford Lake, a 15,700 acre impoundment of the Republican River, is located at the installation's western boundary. Tuttle Creek Lake is approximately eight miles northeast of the installation. Portions of the installation are bounded by the city limits of Riley, Milford, Junction City, Keats and Ogden (Figure 1)**Error! Reference source not found.** The city of Manhattan's nearest city limit boundary is located approximately two miles east of the installation, although the Manhattan Regional Airport and Manhattan Corporate Technical Park are located adjacent to the installation boundary and city-like residential development associated with the city of Manhattan exists close-by the installation. Fort Riley is approximately 95 miles west of Kansas City and 90 miles northeast of Wichita.

### **Installation History**

Fort Riley was established in 1853 to protect westward moving pioneers on the Santa Fe Trail. Soldiers rode to campaigns such as Beecher's Island, Washita River Fight, and the Battle of Little Big Horn. At the end of the Indian Wars, this frontier post became the home of the Army's Cavalry and Light Artillery Schools in 1893. The Cavalry School was deactivated in 1946 when all horse units in the Army were replaced by mechanized Cavalry and Armor units. Fort Riley has served as a major training and mobilization site, deploying units to fight in the Spanish American War, both World Wars, the Korean Conflict, Vietnam, Desert Storm, and the Global War on Terrorism.

Fort Riley is the home station of the Army's First Infantry Division and has approximately 15,000 assigned active duty service members and more than 18,000 family members. The First Infantry Division units currently stationed at Fort Riley are the Division and Headquarters Battalion, 1<sup>st</sup> Armored Brigade Combat Team, 2<sup>nd</sup> Armored Brigade Combat Team, Division Artillery, 1<sup>st</sup> Sustainment Brigade and the Combat Aviation Brigade. More than 5,000 civilian employees who live in the region work on post.

### **Acreege and Acquisition**



Over the years, Fort Riley has expanded in size. Originally a 23,871 acre post, the first major expansion occurred in 1942 when 31,720 acres, located to the north and east of the installation, were purchased as part of the World War II mobilization effort. The second major expansion occurred in 1965 when 46,065 acres were purchased to accommodate the installation's mission as being the home base for an infantry division. After later acquisitions of smaller parcels and excessing of other small parcels cut off from the installation by changes in rivers' courses, the installation's present size stands at 100,733 acres.

### **Neighbors**

Manhattan is the largest city near Fort Riley (population 67,662), followed by Junction City, Ogden, Milford, Riley, and Wakefield (populations 23,102, 2,320, 1,463, 939, and 900, respectively; U.S. Census Bureau 2020 population estimates). Most land surrounding Fort Riley has traditionally been used for agricultural production, a use generally compatible with the installation's training mission. Recently, this agricultural land has increasingly been parceled, sold, and developed for residential use. Development of residences and residential areas near Fort Riley's boundaries create conditions for potential conflicts between landowners and the installation due to noise and smoke issues, and the potential for grassland fires leaving the installation and burning private property.

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## **SECTION 1.3: MILITARY MISSION**

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### **Overview**

Fort Riley is classified as a Tier 1 installation (installation with significant training value to the Major Commands and having high range and land capability) that has an Army-wide strategic and enduring training capability. Range and training facilities provide year-round support for live-fire exercises, maneuver training for mechanized/armored vehicles, attack helicopter gunnery, operation of rotary-winged aircraft, drone aircraft, small arms firing, mortar, artillery and tank firing exercises, engineer obstacle and demolition training and maneuver training. These training activities are expected to remain stable.

Fort Riley encompasses 100,733 acres. Of this, approximately 70,000 acres separated into 103 training areas are available for maneuver training (Figure 1). Every unit assigned to Fort Riley conducts rotational training. The most heavily used Maneuver Areas are occupied more than 200 days per year. Fort Riley aircraft have access to 432 square miles of airspace. Flight operations occur daily, with approximately 21,000 helicopter flight hours and 15,000 UAS hours annually logged.

The Artillery and Mortar Impact Area and its associated training live-fire ranges consist of 16,200 acres. Cantonment areas, which include the Marshall Army Airfield (MAAF), total approximately 11,000 acres. The roughly 2,000 acre Douthit Gunnery Complex houses the Digital Multi-Purpose Range Complex (DMPRC) and Digital Multipurpose Training Range (DMPTR). The Gunnery Complex has averaged more than 300 days of use per year. Live-fire exercises involving mortars, artillery, tanks and aircraft occur throughout

the year. These firing ranges for large caliber weapons

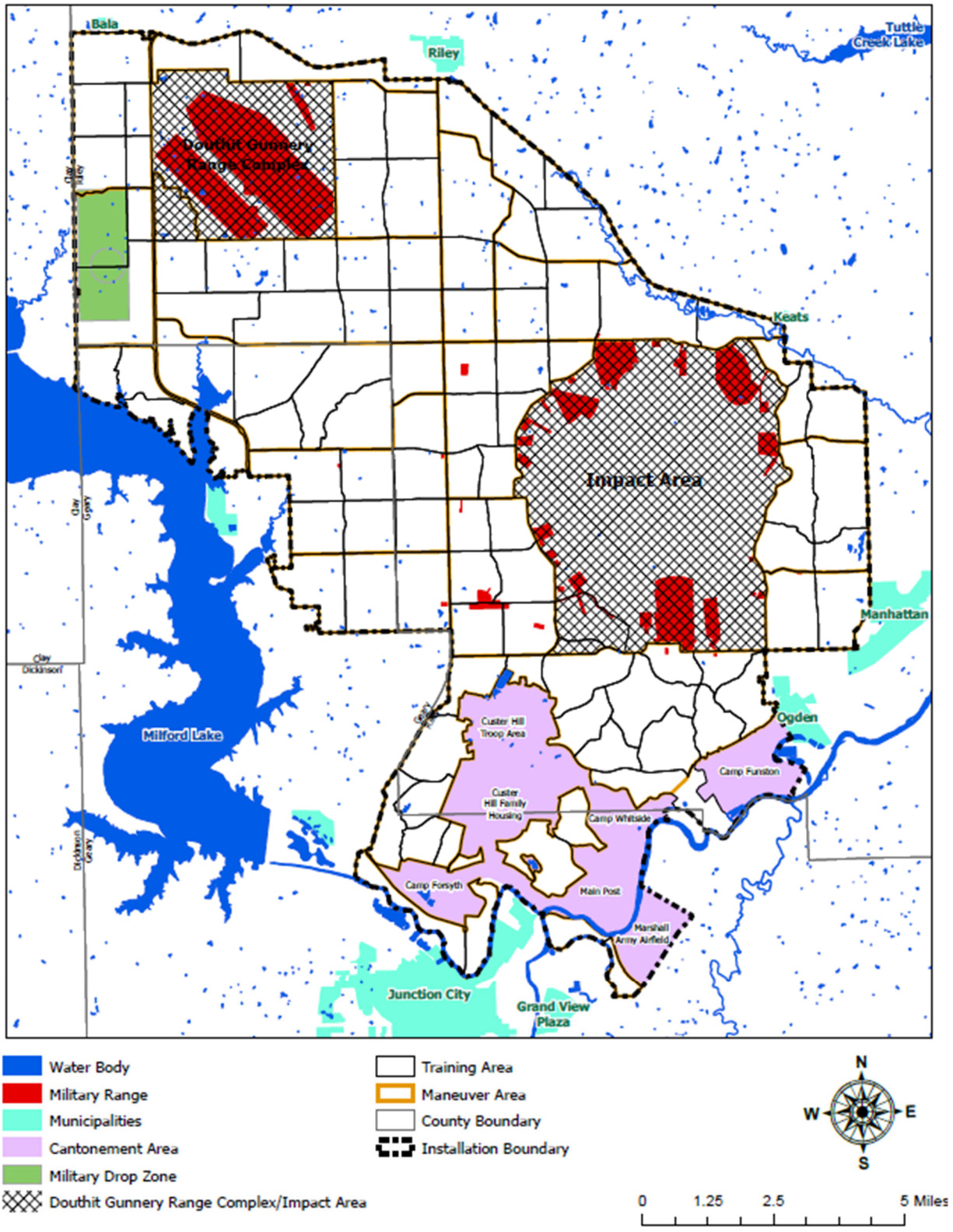


Figure 1. General location of the Fort Riley Military Installation and the surrounding communities.

and aircraft are used extensively by units assigned to Fort Riley, active Army units assigned to other installations, Army Reserve units, National Guard units, and U.S. Air Force units.

Use of the DMPTR and DMPCRC has increased the number of training exercises that can be supported at any one time and throughout a typical training year by approximately one-third. This has allowed more personnel and units to train simultaneously at the installation. While munitions fired at these facilities do not generate any louder noises; the additional range capacity allows for a higher throughput of training units, increasing the intensity of the noises generated when both ranges are active.

### **Mission and Vision Statements**

The 1<sup>st</sup> Infantry Division and Fort Riley build and maintain combat ready forces; on order deploys these forces to conduct Decisive Action to fight and win in complex environments as members of a Joint Inter-organizational, and Multi-national team. Fort Riley encompasses 101,733 acres with 91,597 dedicated to training areas that are key to Soldier readiness and serves a population of more than 67,000 including approximately 15,400 active duty members, 19,600 family members, 6,100 civilian employees as well as 26,000 retirees and veterans who live in the region and/or work at the post. In addition Fort Riley provides support and training for a significant number of National Guard and Reserve members from the region including Kansas, Oklahoma, Missouri, Nebraska and Iowa.

### **Ongoing Mission Activities**

Wide ranges of activities occur on a regular basis at Fort Riley to conduct and support the installation's assigned training mission. These activities are listed in Appendix B.

### **Effects of Natural Resources Management on the Mission**

Fort Riley's ecosystem is dominated by grassland interspersed with wooded areas of varying sizes and densities that provides a variety of terrain types that are useful for both mounted and dismounted training activities. This ecosystem generally facilitates Fort Riley's mission now and as it is projected to do so for the foreseeable future. However, as woody vegetation invades into grasslands, the continued capability of the land to support that training could be diminished. Therefore, the objective of this plan is to sustain a grassland-dominated ecosystem interspersed with woodlands in a pattern similar to what currently exists, but with the spatial extent of many of the individual woodlands and the number of isolated trees in grasslands reduced.

***Grassland Management:*** Fort Riley's gently-rolling, open topography lends itself to force-on-force maneuver training, an important component of the installation's mission. Maintaining open grassland to support maneuver or artillery firing training is an important management objective, particularly in Maneuver Areas A, D, E, H, K, L, O, and P, the Douthit Gunnery Complex box, and the Impact Area. Poor grassland management promotes woody plant invasion. As woody vegetation increases in grasslands, weapon

firing lines become obscured by tree growth, the ability of commanders to view troop field maneuvers and firing exercises is compromised, and areas with dense shrubs are no longer as suitable for dismounted training. Management actions that remove trees from grasslands, suppress and reverse woody encroachment, and maintain a grassy cover all work together to maintain open vistas that support the military mission.

**Woodland Management:** Woodlands associated with stream drainages and deep ravines provide ideal locations for dismounted military training that occurs on Fort Riley. The woodlands serve as visual barrier for dismounted units in the field, allowing for more efficient use of training lands, particularly in Training Areas 1-24, and Maneuver Areas C, F and I. The presence of large trees on slopes of ravines with steep rock outcrops enhances Soldier safety by serving as a visual deterrent and physical barrier to keep vehicles from falling or rolling down these embankments. Tree lines may be useful for tactical concealment during military training exercises. Around the installation's perimeter, tree lines serve as a visual barrier to on-post activities, can serve as a barrier to unauthorized access, and can reduce the amount of dust moving beyond installation boundaries.

Woodland management further sustains training lands through soil and water conservation. For example, trees have been planted to restore cover after soil mining projects were performed in support of the military and related construction projects. Timber harvest and timber stand improvement are used to expand and enhance access for military equipment. Areas for thinning and harvest also have been provided to Engineering units for chainsaw training. Trees have been provided at times for the construction of defensive positions.

**Agricultural Lease Management:** The installation's perimeter lands are leased to farmers for crop production. These leased croplands provide a system of firebreaks, with the primary function of impeding fires that start on the installation from moving off of the installation. This protects private property adjacent to the installation from wildfire, and protects the installation from the liability that would result from destroying private property by fire. A secondary function of the firebreak fields is to provide a distinct demarcation between Fort Riley and privately owned lands so that troops do not stray onto private property. Both functions contribute to the capability of Soldiers to train on the installation up to its boundaries, without land being lost to no-training buffers.

Approximately 30,000 acres are leased for hay production. Soldiers and equipment are often stationed in grasslands in such a manner as to be susceptible to wildfire. Reducing the accumulation of standing, dead vegetation through hay harvest lessens the potential danger of wildfires to Soldiers and equipment in the field. Hay harvest also seasonally provides areas of short vegetation, which are desired for establishing bivouac sites during training exercises.

**T&E Species, Migratory Bird and Wetland Management:** Maintaining compliance with endangered species, migratory bird, eagle and wetlands laws, regulations and Executive Orders is of paramount importance in sustaining the military mission on Fort Riley and

protecting Army personnel from civil and criminal prosecution. The overall strategies are to prevent conflicts between mission requirements and mandated protection through coordinated, long-term planning with the Kansas Department of Wildlife and Parks (KDWP) and the U.S. Fish & Wildlife Service (USFWS), and to develop partnerships that manage and maintain sensitive habitats off of the installation to preclude future listings of additional species as threatened or endangered and thereby abate encroachment<sup>1</sup>.

Fort Riley has prepared management plans that describe necessary actions to conserve and protect each federally-listed candidate, threatened or endangered species known to occur on the installation, as well as bald eagles and Fort Riley Species at Risk (Appendix C). These management plans were prepared with and approved by the USFWS and the KDWP. They represent Fort Riley's means to minimize or prevent conflicts between listed species and the military mission.

One of the objectives of Fort Riley's Army Compatible Use Buffer (ACUB) program is to ease environmental encroachment issues that might otherwise arise due to loss of tallgrass prairie tracts off of the installation. Similarly, Fort Riley participates in regional conservation planning and partners with private landowners and organizations that manage habitats off of the installation in an effort to retain a functional and regionally significant tallgrass prairie ecosystem around the installation.

Mission restrictions due to federally-listed threatened and endangered species are minimal due to the limited interface between the species and the mission. One of the three listed species known to have been recently present on the installation is a bird that uses riverine habitat along the Kansas and Republican rivers. One is a rare migratory bird that has been documented for a brief period during its migration. The third listed species is a minnow that has been found - though not since 2011 - in a limited number of streams. Stream and riverine habitats do not lend themselves well to mechanized training; thus impact by, and to, military training is limited. Threatened and endangered species are more thoroughly addressed in Section 7.10 and Appendix C.

Wetlands are a minor landform of Fort Riley, generally small and dispersed. Except for crossing streams, Soldiers generally avoid wetlands during maneuver activities because wetlands don't lend themselves to vehicle movements.

***ITAM (Integrated Training Area Management):*** ITAM is a core component of the Sustainable Range Program (SRP) and is responsible for maintaining training land to help the Army meet its training requirements. To accomplish this mission, ITAM relies on its five components: Land Rehabilitation & Maintenance (LRAM), Range & Training Land Assessment (RTLA), Sustainable Range Awareness (SRA), Training Requirements & Integration (TRI), and SRP Geographic Information System (GIS). The purposes of the ITAM program components are to integrate mission requirements with environmental

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<sup>1</sup> Encroachment refers to external factors that impact military training operations and training lands, with the potential to limit the installation's capability to accomplish its training mission and maintain ready forces

management practices and establish the policies and procedures to achieve sustainable use of training and testing lands. (Appendix F)

- **LRAM (Land Rehabilitation and Maintenance):** LRAM is the primary program for repair and rehabilitation of training lands within ITAM. LRAM uses land management practices and support from RTLA to enhance safety and training value of the land by minimizing adverse impacts through rehabilitation and maintenance of training lands. LRAM averages 10 projects a year that improve training land sustainability. Over the past 5 years, treated sites ranged from 0.25-15 acres.
- **RTLA (Range and Training Land Assessment):** RTLA acquires data and assesses information to track the capability and sustainability of the land to support mission activities. RTLA data is used to identify LRAM projects, ensure that biological considerations are part of the LRAM project prioritization process, determine the effectiveness of LRAM projects, and recommend training load distribution for land so that the sustainability of the training land can be maintained.
- **SRA (Sustainable Range Awareness):** SRA provides a proactive means to develop and distribute educational materials that relate procedures to reduce the potential for inflicting avoidable impacts on range and training land during military training.
- **TRI (Training Requirements Integration):** TRI facilitates achieving mission goals through decision support and coordinating training needs with other installation plans to provide information and analysis that assist with range and training land planning, scheduling, maintenance and modernization. Information is obtained from SRP GIS, RTLA, LRAM, and appropriate installation offices, and the analysis considers environmental compliance requirements, range facilities requirements, and landscape condition requirements in the development of range and training land management decisions. This includes the integration of Range Complex Master Plan (RCMP) mission goals and objectives into the INRMP and its subordinate plans. TRI is a continual collaboration with the installation range office, natural resources and environmental staff, and state and federal agencies.
- **SRP Geographical Information System (SRP GIS):** The SRP GIS Mission is to *create, analyze, manage, and distribute* authoritative standardized spatial information, products, and services for the execution of training strategies and missions on U.S. Army ranges and training lands. Through information excellence, one of the three tenets upon which the SRP was founded, the SRP GIS Program strives to provide the SRP Community, Trainers, and Soldiers with the ability to leverage the most accurate and complete datasets through easily accessible and user-friendly products and applications. SRP GIS provides geospatial data and analysis to support land management decisions and Training Mission geospatial products.

**Quality of Life Management:** Recreational opportunities to harvest fish and wildlife game species are important morale-building activities for Soldiers and their families. While the military mission requirements take precedence over recreation, every effort is

made to allow hunting and fishing to safely coexist with military training exercises. Hunter munition restrictions, hunter orange requirements and minimum distance buffers from Soldiers are outlined in the installation's hunting, fishing, and trapping regulation, FR 210-15 and enforced by the installation's Directorate of Emergency Services (DES) Conservation Law Enforcement Officer Section. Hunting and fishing are prohibited in areas when those activities will not safely coexist with planned military training events.

### **Effects of the Military Mission on Natural Resources**

Military training involves three major activities: construction of facilities, maneuver activities, and weapons systems firing. Construction actions generally occur within cantonment areas and seldom impact high quality native habitats. However, construction actions to update ranges or provide improved training realism do occur outside of cantonment areas. Potential effects of such construction actions are evaluated on a case-by-case basis during the NEPA process, and will not be addressed further in this document.

Maneuver activities' impacts primarily occur on and parallel to tank trails (CERL 1991). The highest frequency of such disturbance occurs along trails leading to the Douthitt Gunnery Complex. Low to moderate levels of disturbance may increase the abundance of indiagrass on the installation as well as other grasses, such as tall dropseed, tall witchgrass, and foxtail (CERL 1991). Higher levels of disturbance may result in the increases in abundance of forbs, particularly annual forbs, and in some instances woody vegetation (CERL 1991). Impacts to natural resources from weapons systems firing and explosives detonations are generally restricted to the Impact Area, but may also occur throughout the installation. Noise and dust impacts from training can occur on the installation and in the immediate vicinity during routine training exercises. Those impacts vary by training duration and intensity, weather and seasonal climate.

**Soil:** Soil impacts primarily result from tactical digging, off-road tactical vehicle movements (both cross-country and on minimally maintained trails), explosive ordnance detonations, and borrow actions. These impacts include soil disturbance, erosion and compaction. The areas affected by soil erosion and compaction occur throughout the Maneuver and Training Areas, as well as the Impact Area.

Tactical digging refers to any process or activity involving the disturbance of soil, regardless of size, depth or purpose. This includes creating individual fighting positions, trenches, bunkers, berms, defilades, tank traps, or mine plowing.

The off-road movements of both tracked and wheeled vehicles can compact lower soil horizons, loosen upper soil layers, disrupt root mats, create ruts, and remove vegetative cover. These impacts intensify as the soil's moisture level and numbers of vehicles increase. As vehicles repeatedly pass on non-hardened trails, the original corridors become less passable, and the damage can be spread laterally as vehicles attempt to by-pass the disturbed sites. To combat this trail widening, frequently driven trails are hardened with gravel or recycled asphalt pavement, or leveled by road graders.

The repeated crossing of drainage channels at the same non-hardened location creates areas with gully erosion along sloped approaches, destabilized streambanks, and deeply cut stream channels. As the original crossing becomes less passable, the damage can be spread laterally as vehicles attempt to by-pass the disturbed sites. To combat channel damage, crossings are hardened in strategic locations, and unauthorized crossing sites are closed by placement of obstructions across access points.

Soils are affected in the Impact Areas' detonation zones by both non-explosive and explosive rounds. Erosion may be high at the locations of ordnance impact because fires are frequently generated by the impact. Further, the explosive force of live ordnance disturbs and exposes the soil surface as well as destroys protective vegetation cover and root mats. However, the danger posed by unexploded ordnance in the Impact Area prevents actions from being taken to monitor or control soil erosion there.

**Water:** The primary effects to water from military training result from soil erosion entering surface water in runoff from Training Areas and the Impact Area. Sources of erosion are described in Section 4.5.1. Increased rates of soil erosion at disturbed sites may increase turbidity and sedimentation of some surface waters on the installation. Portions of streams, rivers, and lakes located off-post also may be affected by increased turbidity.

**Vegetation:** Off-road vehicle maneuvering causes the most notable training impact to vegetation within the Training Areas of Fort Riley. High levels of disturbance in grasslands can lead to:

- replacement of perennial grasses (e.g., big bluestem, indiangrass, little bluestem, and grama grasses) by early successional grasses and forbs (e.g., curly dock, common mullein, tansy mustard, black medic, field bindweed, and various species of goldenrods and sunflowers);
- mechanical disruption and breaking of root mats, which allow the invasion of woody plants such as eastern redcedar, buckbrush, dogwood, American elm, and hackberry;
- compaction of soil, which hinders seed germination;
- damage to roots of established trees and shrubs;
- soil compaction;
- increase seedling mortality (Goran et al., 1983); and
- dispersal of noxious weed seed via wheeled and tracked vehicles, particularly in muddy conditions.

Other activities affecting vegetation on Firing Ranges are wildfires, herbicide application and the periodic mowing and cutting of areas of vegetation to maintain lines-of-sight to targets. Soil sterilant is used on specific small spots around the perimeter of each target mechanism on most Firing Ranges. The average area of soil sterilized around target mechanisms is 0.01 acre. The aggregate area of soil sterilant application is approximately 16 acres. Broad-leafed plant herbicides are applied aerially to



approximately 480 acres at Ranges 17, 18, and 19 within the Impact Area and approximately 2,140 acres within the Douthit Range Complex.

***Fish and Wildlife:*** The military mission affects Fort Riley fish and wildlife populations directly and indirectly, primarily through habitat disturbance such as wildland fire and mechanical manipulation of the soil and vegetation. Disturbance regimes are important components of ecological systems, and may control succession and community function (Collins et al. 1998, Sousa 1984). Causes of natural disturbance may be abiotic factors such as fire, floods, drought, and wind; or biotic factors such as predation or grazing (Sousa 1984). Impacts from disturbance vary and depend on: spatial distribution, frequency of occurrence, area covered, and intensity (Rykiel 1985, Turner 1989, White and Pickett 1985).

It is well documented that military training with combat vehicles directly impacts soil and vegetation communities (Diersing et al. 1988; Leis et al. 2005; Van Horne and Sharpe 1998). This disturbance subsequently creates indirect effects on vertebrate communities (Leis et al. 2007; Li et al. 2006). Training with military combat vehicles, such as the M1A2 tank (57,000 kg), results in disturbances such as removal of vegetation, soil compaction (Johnson 1982; Li et al. 2006; Milchunas et al. 2000; Prosser et al. 2000; York et al. 1997), and the creation of large areas of bare ground (Althoff et al. 2006). These disturbance-induced changes to the landscape create a spatial and temporal mosaic of habitat conditions available for use by wildlife (Lindenmayer et al. 2016). As a result, military disturbances may generate shifts in wildlife communities, such as altering the ratio of species abundances in small mammals (Keating et al 1994, Moon 2011) or affecting native fish populations by increasing headwater siltation (Quist 1999).

It is well understood that the timing and frequency of disturbance plays a key role in species composition. While the effects of military training on individual wildlife species remains poorly documented, disturbances that are similar to military training activities are well-examined. Native grassland bird species are influenced by changes in the composition and structure of the floral community, such as haying (Perlut et al. 2006), fire (Cully and Michaels 2000; Walk and Warner 2000; Rahmig et al. 2009), and grazing (Walk and Warner 2000; Rahmig et al. 2009). Additionally, invertebrate species such as beetles (Louzada et al. 2010), butterflies (Poyry et al. 2004), and grasshoppers (Joern 2005) have been documented to alter their habitat use due to disturbance induced changes of vegetation structure or composition. Overall, the effects of military training on Fort Riley produce a temporal and spatial mosaic of habitat types that are mostly favorable to native fish and wildlife species.

### **Future Military Mission Impacts on Natural Resources**

Future mission impacts on natural resources are assumed to remain similar to those occurring today. While it is not known what mission changes will occur at Fort Riley during the next five years, it is expected that all future missions will be compatible with land forms existing at Fort Riley.

Any significant change in mission, including fielding of new equipment, will be analyzed under the NEPA process, where applicable, and will be communicated during the INRMP annual reviews. Army guidance is for installations to annually review activities conducted under its INRMP to determine that the plan has been effectively implemented while maintaining the installation's mission.

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## **SECTION 1.4: FACILITIES**

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### **Transportation System**

**Roadways:** Fort Riley has approximately 241 miles of paved roads and 124 miles of graveled tank trails. In addition, the installation's training areas are threaded with a vast network of dirt roads and trails. Fort Riley is served by an extensive, well-maintained, off-post, roadway system. Seven principal roadways access the installation: Grant Avenue (from Junction City, at West Huebner); K18 Highway (at 12th Street, Camp Funston and via Riley Avenue, Ogden, at East Huebner); I-70, Exit 301 (Henry Drive at Marshall Army Airfield); Washington Street (from Junction City at Trooper Drive); and old US77 Highway (Parker Road, into Custer Hill).

**Railways:** Fort Riley has 12 miles of track located in three areas: Camp Funston, Camp Whitside, and Main Post. The Army owns the track on the installation, with the exception of the main line, which is owned by the Union Pacific Railroad. Camp Funston is the primary location for rail loading activities. This area contains adequate open land for staging, new dock facilities, good rail access, and night lighting for 24-hour operations. The Camp Funston area has a capacity of 340 rail cars.

**Airfields:** Marshall Army Airfield (MAAF) is Fort Riley's on-post airfield. It consists of a 4,503-foot long runway (100 feet wide with 25 feet paved shoulders), 50-foot wide taxiways (with 25 feet paved shoulders), and 148,000 square yards of parking aprons. It is primarily designed to accommodate rotary-winged aircraft but does also serve fixed-winged platforms. The MAAF Wildlife Aircraft Strike Hazzard Plan 2018 provides procedures and defines responsibilities for wildlife management in and around the the airfield. The WASH Plan minimizes risk of wildlife strikes to fixed and rotary winged aircraft as well as potential for human health hazards posed by populations. The WASH plan has been in effect since December 2018

### **Water Supply**

Groundwater is the water source for domestic and industrial use at Fort Riley. The groundwater for most of Fort Riley is withdrawn from aquifers recharged by the Republican and Kansas rivers. Individual well capacities range from 400 to 1,300 gallons per minute (gpm). The total pumping capacity from these wells is 1,400 gpm or 10.8 million gallons per day (mgd). The water used at the Douthit Gunnery Complex is withdrawn from an upland aquifer with well capacity of 80 gpm.

### **Wastewater**

Ft. Riley is served by an advanced wastewater treatment plant (AWWTP) constructed in 2011. The AWWTP influent is primarily domestic wastewater with a design flow of 3

million gallons a day. The treatment process units consist of pumping and preliminary, biological processes, post treatment processes and solids treatment and handling.

Domestic wastewater is collected and conveyed through the gravity collection system (consisting of approximately 85 miles of pipeline) to a series of pump stations that pump the wastewater to the AWWTP. AWWTP biosolids are held in three covered bays for further drying and storage prior to being hauled from the installation and applied to land in the local area.

Most industrial wastewater is generated in the tactical equipment shops and vehicle washracks on Custer Hill. Wastewater from these operations undergoes oil/water separation and sediment settling in sedimentation basins on Custer Hill. After passing through the sedimentation basins, the water drains into the Central Vehicle Wash Facility lagoon system for further treatment, where it is eventually recycled for exterior vehicle cleaning at the facility.

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## SECTION 1.5: LAND USES

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The training/range land use category is the dominant one on Fort Riley. Cantonment areas that provide housing, community/recreation, and industrial and transportation operations are mostly in the southern portion of the installation (Figure 1).

### **Training/Range Land Use Areas**

**Training Areas:** One hundred three designated training areas, 76 of which are combined into 17 larger maneuver areas, comprise approximately 70,000 acres.

**Impact Area:** The main impact area and the surrounding live-fire training ranges in the eastern portion cover approximately 16,200 acres. These areas are off-limits to maneuver training, public use, and most management activities.

**Douthit Gunnery Complex:** The Douthit Gunnery Complex in the northwestern portion includes approximately 2,000 acres. Training and maneuvers that usually occur within the Douthit Gunnery Complex Temporary Impact Area (aka. Safety Fan) cease when either the DMPRC or DMPTR is active. The Douthit Gunnery Complex Temporary Impact Area covers approximately 30,500 acres and includes Training Areas 57-62, 66-74, 77, 78, 83, 84, 88, 93 and 96.

**Cantonment Land Use Areas:** Cantonment (or developed) areas total approximately 12,000 acres and are Main Post, Camp Forsyth, Camp Funston, Camp Whitside, Custer Hill, and Marshall Army Airfield.

**Improved Grounds:** Improved grounds include improved and semi-improved areas. Improved grounds contain many native and non-native trees, shrubs, and groundcovers on approximately 5,600 acres. Improved areas are maintained as mowed turf and planted with ornamental and native trees and shrubs. Semi-improved areas are grassy fields and larger groves of trees that receive periodic mowing and maintenance.

**Outdoor Recreational Facilities:** Three parks/picnic areas totaling approximately 60 acres are maintained in a semi-natural condition; they are Moon Lake and McCormick and Wyman parks.

**Borrow Areas:** Soil borrow is used for two major purposes on Fort Riley; as fill material and as topsoil, and is generally associated with construction and demolition projects. Borrow sites on Fort Riley are controlled under a National Pollutant Discharge Elimination Program (NPDES) permit authorized under the Clean Water Act. Active soil borrow sites are depicted in Appendix N.

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## **SECTION 1.6: LISTS OF RESPONSIBLE AND INTERESTED PARTIES**

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### **Primary Army Installation Personnel and Organizations**

- **Senior Commander:** Fort Riley's Senior Commander, the Commanding General (CG) of the 1<sup>st</sup> Infantry Division, is directly responsible for overall mission accomplishment at Fort Riley.
- **Garrison Commander:** The Garrison Commander (GC) is responsible for land and facilities. This responsibility includes overseeing the implementation of this INRMP. The GC advises the CG on natural resources issues, with guidance from the Directorate of Public Works', Environmental Division.

### **Directorate of Public Works**

- **Environmental Division:** The Directorate of Public Works' (DPW), Environmental Division is responsible to develop, execute, and administer environmental programs and projects. The Chief of the Environmental Division advises the GC and CG on environmental issues, including implementation of this INRMP.
- **Conservation Branch:** This Branch, within the Environmental Division, is responsible for the management of natural and cultural resources on Fort Riley. Accordingly, programs are developed and implemented to ensure that natural and cultural resources are conserved and enhanced for future generations. One of the central functions of natural resources management is the implementation of this INRMP pursuant to Army guidance and the Sikes Act Improvement Act of 1997. The Conservation Branch is the installation liaison with state and Federal agencies concerning natural resources to meet the INRMP goals and objectives.
- **Pollution Prevention Branch:** This Branch, which is also within the Environmental Division, oversees and guides the installation's compliance with the full spectrum of Kansas and Federal environment protection regulations aside from those promulgated specifically for the protection of fish and wildlife or for pesticides and pesticide applications control. It conducts maintenance facilities compliance inspections that help prevent releases of contaminants into the environment and conducts environmental training classes, which may include information pertinent to the INRMP. The Branch also disposes of hazardous waste, investigates and

cleans up chemical spills, conducts air and water quality sampling and reporting, and supports municipal solid waste management.

- Other DPW Divisions: The DPW is the primary organization responsible for maintaining lands and facilities. DPW provides logistical, manpower, and equipment support to construct wildlife habitat projects. Examples of DPW support are the construction of gravel trails to fishing ponds, excavation and surveying of wetland construction projects, and range road construction and maintenance.

### **Directorate of Emergency Services**

- ***Fire and Emergency Services Division:*** The Directorate of Emergency Services (DES), Fire and Emergency Services Division, is responsible for controlling wildland fires. The Conservation Branch provides assistance for wildfire response. The Fire and Emergency Services Division collaborates with the Conservation Branch in developing and implementing the annual prescribed burning plan, along with the Range Support Branch, DPTMS. Personnel in the Fire and Emergency Services Division and Conservation Branch implement the plans jointly.
- ***Provost Marshal:*** The Provost Marshal's Office (PMO) is responsible for enforcing cultural and natural resources laws and regulations on Fort Riley, including fish and game laws of the State of Kansas and the U.S. Government.

### **Directorate of Plans, Training, Mobilization and Security**

- The Directorate of Plans, Training, Mobilization and Security (DPTMS) is a vital coordination and approval point in implementing this INRMP. DPTMS provides review during the decision-making process for implementing management plans, developing Environmental Assessments, conducting field work and establishing firearms deer season dates. This activity provides information about planned military training missions for review relative to compliance with the Endangered Species Act, NEPA and permits for tactical digging. DPTMS, through its ***Range Support Branch***, implements the ITAM program.
- The ***Range Support Branch*** collaborates with the Conservation Branch and Fire and Emergency Services Division in developing annual prescribed burning plans. The Range Support Office: coordinates with the Conservation Branch concerning availability of areas and times for natural resources management activities; assists contractors and lessees concerning access to training and maneuver areas; and provides Conservation Branch with information concerning access times and locations for outdoor recreationalists and fuelwood cutters.

### **Staff Judge Advocate**

The Staff Judge Advocate (SJA) interprets and enforces natural and cultural resources laws and regulations. SJA provides legal opinions and guidance in interpreting and complying with Federal and State laws and Federal, State, Army, and Fort Riley regulations. SJA reviews and approves Fort Riley regulations that are promulgated to protect natural resources. SJA also reviews contracts and pertinent documents or actions requiring Command Decision or

Approval/Signature. SJA assists with prosecuting violators of installation, Kansas, and Federal statutes and regulations concerning natural and cultural resources protection.

### **Garrison Public Affairs Office:**

The Garrison Public Affairs Office (PAO) helps disseminate information to soldiers, their families, and the general public about natural resources management and recreational opportunities on Fort Riley. PAO publishes a weekly article written by Conservation Branch staff on natural resources topics in the installation newspaper, as well as other articles as requested. PAO coordinates media requests for interviews, including television and radio, and issues news releases to the civilian media regarding various natural resources management activities on Fort Riley.

### **Medical Department Activity:**

One of the Medical Department Activity functions is to prevent and control communicable diseases of wildlife on Fort Riley. Preventive Medicine conducts annual tick collections, seasonal mosquito surveys, stored-product pest surveillance in warehouses and commissary locations, cockroach control surveys in mess halls, screening for Lyme disease and human ehrlichiosis, and evaluations of other disease transmission sources. Veterinary Services supports collection of blood and tissue samples from various wildlife species to monitor parasite and disease occurrence. Veterinary Services also provides technical advice to Conservation Branch personnel regarding the epidemiology of diseases and their control. Occupational Health provides medical fitness testing for prescribed burning crews, prophylactic rabies vaccines for staff who may handle wild animals, and prescription safety glasses.

### **Military Units:**

Military units infrequently provide manpower, equipment, and logistical support for a wide range of natural resources-related activities. For example, engineer support has been used to clear shrubby areas for planting wildlife food. Also, aircraft support has been provided for aerial wildlife surveys.

### **Higher Military Headquarters**

- **Installation Management Command (IMCOM):** The IMCOM mission is to provide the Army the installation capabilities and services to support expeditionary operations in a time of persistent conflict, and to provide a quality of life for Soldiers and Families commensurate with their service.
- **U. S. Army Forces Command (FORSCOM):** FORSCOM is the Army's Force Provider to joint combatant commanders worldwide. FORSCOM combines the contributions of more than 750,000 Army National Guard, Army Reserve, and active component Soldiers with those of more than 2,400 Army civilians to form a seamless, winning force that operates as a team across services, components and units. FORSCOM trains, mobilizes, deploys, sustains and reconstitutes combat

ready Army forces capable of responding rapidly to crises worldwide. FORSCOM tailors the resources and training of its units to meet the specific and ever-changing requirements of combatant commanders and, when directed, those of U.S. civil authorities.

- **Army Environmental Command (AEC):** AEC, a field-operating activity of the Army, is the central point of coordination of Army environmental programs, including conservation and ACUB programs. AEC oversees, manages, and executes programs and projects. AEC also provides technical advice regarding pest management, endangered species, ITAM, and other related compliance areas.
- **Central Region Environmental and Government Affairs Office:** The Central Region Environmental and Government Affairs Office focuses on working cooperatively with state rule-writers and legislators to help maintain realistic training environments. Its proactive approach provides solutions that help ensure military readiness.

### Army Corps of Engineers

- **Kansas City District:** The Corps of Engineers, Kansas City District (KCD) assists Fort Riley by developing, executing, and administering contracts. The KCD is responsible for administering leases for the Agricultural Outleasing program. It is also responsible for issuing permits to conduct activities such as road building that potentially may affect wetlands in accordance with Section 404 of the Clean Water Act.
- **Waterways Experiment Station:** The Corps of Engineers, Waterways Experiment Station (WES) provides general weed control information on request. An expert management software system (*Plant Management Information System*) was provided in 1996 for weed management decisions. WES has assisted Fort Riley through the Conservation Assistance Program, providing designs and specifications of a water control inlet structure for wetlands, and a biologist in training personnel to mist-net and identify bats.
- **Construction Engineering Research Laboratories:** The Corps of Engineers Construction Engineering Research Laboratories (CERL) helped develop the ITAM program on Fort Riley. CERL continues to execute research and management programs through the ITAM program.

### United States Department of Agriculture

- **U.S. Forest Service:** The U. S. Forest Service (USFS) cooperates with DoD in the Forest Pest Suppression (FPS) program. Through that program, USFS entomologists and plant pathologists consult with installation personnel about potential damage from, and control efforts for, serious outbreaks of insects and disease in the Installation's woodlands and forests. The installation assists the USFS, North Central Research Station to complete 10-year State Forest Inventories. The Conservation Branch coordinates access to inventory plots on

the installation by the Station's personnel. The results of the most recent inventory of Fort Riley plots were published in *An Analysis of the Forest Resources of Kansas, 1999, NC-334*.

- **Natural Resources Conservation Service:** As part of efforts to address urban encroachment concerns, DoD has created programs to work with partners to promote "compatible use buffers" and conservation planning around military bases. Such buffers also provide wildlife habitat and conserve the land. This partnership enables NRCS and the Department of Defense to gain greater efficiency by sharing technical information and services necessary to continued conservation efforts. In cases where priority conservation objectives overlap, NRCS easement programs will add to DoD efforts.
- **Animal-Plant Health Inspection Service (APHIS):** The Plant Protection and Quarantine Division (PPQ) of APHIS provides research, inspection, and funding to control and eradicate noxious and invasive weeds. Fort Riley serves as a member of the Kansas Biological Control Steering Committee. This committee advises PPQ on priorities for biological control research and recommends funding for projects that will assist landowners throughout Kansas, including the Army. APHIS also provides interstate and Federal property quarantine designations for alien invasive insects determined to be significantly detrimental. Fort Riley is under an Inter-Agency Agreement with APHIS-Wildlife Services to provide nuisance wildlife control including the funding of one full time biologist to address nuisance wildlife related issues on the installation.

### **United States Department of the Interior**

- **U.S. Fish and Wildlife Service (USFWS):** The USFWS is given the trust responsibility for management of migratory birds and threatened and endangered species. Through this oversight, USFWS provides Fort Riley guidance and recommendations to further manage species that fall under these categories. Fort Riley consults and confers with the USFWS Field Office in Manhattan, Kansas, whenever projects arise that may impact threatened and endangered species or their habitat, eagles or their habitat, or that may significantly affect the population of any migratory bird species. USFWS shares jurisdiction with Kansas Department of Wildlife and Parks pertaining to game and fish law enforcement. USFWS Special law enforcement agents have been involved with investigations of poaching on-installation. They also have provided informal training to personnel of the DES. This shared jurisdiction will continue through the foreseeable future. The USFWS Partners for Wildlife Program has helped to arrange grassland conservation practices on a prairie land parcel adjacent to the installation. The USFWS, in accordance with the Sikes Act Improvement Act of 1997, is a signatory cooperator in implementation of this INRMP.
- **U.S. Geological Survey:** The Biological Resources Division, U.S. Geological Survey, operates a Cooperative Fish and Wildlife Research Unit at Kansas State University. This Unit has partnered with Fort Riley's ITAM program to help manage



and implement its RTLA component, as well as conducted research in support of Fort Riley's Conservation Branch.

### **State Agencies**

- **Kansas Forest Service (KFS):** The KFS is currently the lead agency in Kansas for coordinating forest surveys on Federal lands. Fort Riley signed a Memorandum of Understanding (MOU) with the KFS in 2006 concerning training of personnel in wildland firefighting. Under this MOU, KFS personnel provide S130 wildland firefighting training to Fort Riley personnel; oversee mandatory endurance testing required for Fort Riley firefighters to maintain their red card eligibility; and coordinate documentation to attain red cards for qualified staff. It is anticipated that NWCG qualification standards and record keeping for the DoD will soon fall under the Bureau of Land Management. The KFS will remain a mutual aid and training partner when that transition takes place. The KFS provides seedlings for forest and wildlife habitat plantings at a nominal cost to the installation. Insect and disease updates and general forest management information is given by the agency to assist in maintaining the installation's woodlands and urban forest (cantonment areas). The KFS surveys for invasive and exotic forest insect outbreaks in cooperation with APHIS, PPQ and Fort Riley.
- **Kansas Department of Agriculture (KDA):** The Federal Noxious Weed Law requires that Federal agencies comply with all state laws governing the control of noxious weeds. The Plant Protection and Weed Control Division of the KDA is responsible for implementing the state's noxious weed protection laws throughout Kansas, including Fort Riley. The State Noxious Weed Coordinator and local county noxious weed officers conduct periodic checks and inspections for noxious weeds and their control. The installation provides an annual report to the state on control efforts and surveys. An annual meeting each fall addresses efforts and plans for future control. Fort Riley has entered into two MOUs that define compliance and the relationship between the two agencies.
- **Kansas Department of Wildlife and Parks (KDWP):** KDWP is given the responsibility for management of fish and wildlife species in Kansas. Fort Riley confers with the KDWP whenever projects arise that may impact state-listed threatened and endangered species or their habitat and when establishing deer and elk hunting seasons. Under an agreement with KDWP, that agency provides various sport fish at no cost to stock Fort Riley lakes and ponds. In return, Fort Riley charges no fee to anglers to fish on the installation. KDWP shares conservation law enforcement jurisdiction on-post with the USFWS and PMO. KDWP frequently supports law enforcement during peak hunting seasons, particularly during firearms deer season. KDWP has investigated incidents of poaching on-post and off-post involving Soldiers. The KDWP, in accordance with the Sikes Act Improvement Act of 1997, is a signatory cooperator in implementation of this INRMP
- **Kansas State Historical Society:** Adverse impacts from natural resources management activities on cultural resources are minimized to the maximum extent

practicable through adherence to a Programmatic Agreement negotiated with the State Historical Preservation Officer (SHPO). Fort Riley's Cultural Resources Manager is the primary contact between the installation and the SHPO.

### **Other Interested Parties**

- **County Governments:** The Geary and Riley County Weed Departments inspect installation lands occasionally for noxious weeds. The Conservation Branch is contacted by County Weed Supervisors to notify the installation of locations of noxious weeds for control. The Riley County Conservation District is a government subdivision of the state of Kansas, and is a public body corporate and politic. The District receives funding from Riley County, the State of Kansas, grants and fund-raising activities. Its mission is to work with all county land-owners and residents toward the wise use of the natural resources by providing conservation planning, financial assistance, education and representation in conservation policies and programs. Fort Riley partners with the Riley County Conservation District to implement conservation practices within the Wildcat Creek watershed.
- **Contractors:** Contractors provide services and supplies for the Conservation Branch natural resources management efforts. Contractors range from citizen farmers planting wildlife food plots to local companies spraying weeds and state universities conducting research and planning level surveys. When procuring services and supplies, Fort Riley personnel use local suppliers whenever possible.
- **Partners in Flight (PIF):** The National Fish and Wildlife Foundation initiated PIF in 1990. Its purpose is to galvanize International, Federal, State, and non-governmental organizations in the conservation and management of migratory birds. DoD joined the PIF initiative in 1991. Fort Riley is located in the PIF Midwest Region. A biologist of the Conservation Branch is a DoD-PIF Midwest representative.
- **Kansas Land Trust (KLT):** The Army has signed a Cooperative Agreement with the KLT to serve as Fort Riley's partner to implement the Army Compatible Use Buffer (ACUB) program. The KLT procures funding from other sources to match with Army funds. Jointly, Environmental Division and KLT staffs develop annual work plans. The KLT then implements those plans, negotiating conservation easements with identified landowners, and is the holder and overseer of those easements.
- **Rocky Mountain Elk Foundation:** The Rocky Mountain Elk Foundation has provided funding that has been used to defray the expenses of habitat management projects, such as food plot planting. Funding from the Foundation also has been used to rent commercial aircraft for elk surveys, and to fund research studying movement of the elk herd. All funding has been used for "on-the-ground" expenses, and not used to pay administrative overhead.
- **Ducks Unlimited:** Ducks Unlimited has funded wetland construction on Fort Riley.
- **Pheasants Forever:** Fort Riley has assisted with the development of a Pheasants Forever Habitat Team. This assistance has included equipment, training, funding

for startup costs. Pheasants Forever also has provided seed used in installation food plots.

- **Fort Riley Outdoorsmen Group (FROG):** The FROG is dedicated to creating and sustaining strong interest in Fort Riley’s environment, wildlife, and recreational opportunities by educating the public, sponsoring conservation and recreational projects, and promoting outdoor recreation. FROG works especially with the youth and new hunters and anglers to teach safety, ethics, and stewardship. It sponsors conservation and recreational projects that enhance skills and interest in outdoor recreation.
- **National Wild Turkey Federation:** The National Wild Turkey Federation has provided funding that has been used to defray the expenses of habitat management equipment, such as tree shears and prescribed burn equipment. All funding has been used for “on-the-ground” equipment, and not used to pay administrative overhead.

### **Customers**

- **Soldiers and Families:** Fort Riley’s asserts that the installation’s key customers are military units, Soldiers, and Soldiers’ Families. Taking care of these customers is a primary mission of the Conservation Branch. The quality of life of the Soldiers and their families is enhanced by providing natural resources-based recreation such as hunting, angling, fuelwood cutting, and bird watching. Also, quality of life is improved by providing comfortable and pleasant living areas through control of nuisance and pest wildlife and plants.
- **Local Community Residents:** The surrounding cities and towns are home to a population associated with Fort Riley. Many military personnel retire to the Fort Riley area specifically for the opportunity to utilize the natural resources available on and around the installation. Local civilians and military retirees are permitted to utilize Fort Riley’s natural resources through hunting, fishing, fuelwood cutting, hay harvesting, and many other consumptive and non-consumptive activities. These customers are also directly or indirectly affected by management activities that may have influences off the installation, such as prescribed burning, pond construction, and erosion control.
- **Non-residents:** Many persons travel to Fort Riley from across the country to hunt on installation lands.

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## **SECTION 1.7: NEPA**

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### **NATIONAL ENVIRONMENTAL POLICY ACT**

The National Environmental Policy Act (NEPA) of 1969, as amended, was created to identify environmental effects from Federally-funded projects and activities, and then provide a decision mechanism as to whether the project or activity should proceed. Any Federally-funded action that could have an impact on human health, any natural system (air, water, soil, plant, animal, or other resources) or any social or economic system (to

include Environmental Justice), must have some level of environmental analysis to determine its effects.

### **NEPA and Natural Resources Management**

Natural resources activities, including implementation of this INRMP, must be properly planned, coordinated, and documented using NEPA. All natural resources management activities are considered and implemented according to the requirements of NEPA. Appropriate NEPA documentation for this plan will be completed following its approval by the USFWS, KDWP, and Fort Riley's Garrison Commander prior to implementation of the INRMP.

## **CHAPTER 2: OVERVIEW OF NATURAL RESOURCES AND CLIMATE**

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### **SECTION 2.1: SETTING AND BACKGROUND**

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Fort Riley lies in the Flint Hills ecoregion. This is a region of limestone and shale open hills with relatively narrow, steep valleys. Most of the Flint Hills is pastureland grazed by beef cattle, in contrast to surrounding ecological regions that are mostly in cropland. Potential natural vegetation in the region is tallgrass prairie. The Nature Conservancy lists the tallgrass prairie as the most altered ecological community in North America. Of the 142 million acres of tallgrass prairie that once covered the American heartland, less than 4% remains. The Flint Hills area of Kansas and Oklahoma is by far the largest tallgrass prairie landscape on the continent, with more acres remaining there than in all the other prairie states and provinces combined. However, invasive plants, urban sprawl, urban-to-rural migration, woody encroachment, and continued prairie and ranch fragmentation have degraded a sizable portion of the Flint Hills.

### **Cultural Resources**

A range of cultural resources are present within the boundaries of Fort Riley. These include a National Register of Historic Places listed district and two that are eligible for listing; cultural landscapes, structures and objects; prehistoric and historic (including military) archaeological sites; and Native American sacred sites. Fort Riley's mission and mission support activities, including natural resources management activities, have varying degrees of impact on these cultural resources.

Cultural Resources Management occurs in compliance with all pertinent Federal laws, regulations, and executive orders, and in accordance with Army regulations and policy. Cultural Resource Program staff perform reviews of Fort Riley's activities to determine the level of impact to cultural resources and resolve effects, in accordance with the National Historic Preservation Act of 1966, as amended. The review process and resolution of effects has been streamlined via alternative procedures as outlined in an operations and maintenance Programmatic Agreement with the Kansas State Historic Preservation Officer (SHPO) and Advisory Council on Historic Preservation (see Appendix G. Additional agreements that may impact natural resources or be impacted

by Natural Resources Management activities include two Programmatic Agreements addressing privatized Army lodging and family housing, in addition to two Comprehensive Agreements with the Kaw Nation of Oklahoma and the Pawnee Nation of Oklahoma, addressing obligations in accordance with the Native American Graves Protection and Repatriation Act. Lastly, the Cultural Resources Program staff have been delegated the responsibility to act as liaisons with the ACHP, Kansas SHPO and all 12 federally-recognized tribes/Nations with expressed interest in prehistoric cultural resources at Fort Riley.

Collaboration between the natural and cultural resources programs occurs frequently, including wildland fire planning, mitigation of the effects of ground disturbance and historic building/wildlife issues. Staff meet regularly and in an individual setting or upon discovery of potential issues that may affect either program.

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## SECTION 2.2: ABIOTIC DESCRIPTION

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### **Topography, Geology, and Soils**

**Topography:** Elevations on Fort Riley vary from 1,025 to 1,365 feet above mean sea level. Terrain varies from alluvial bottomlands along the Republican and Kansas rivers on the southern portion of the installation, through the hilly to steep lands in the central and east portions, to the high uplands in the north and west portions.

**Geology:** Fort Riley is composed of three types of geological-physiographic areas: 1) high upland prairies; 2) alluvial bottomland flood plains; and 3) broken and hilly transition zones. The high upland prairies consist of layers of nearly level to gently dipping limestone and shale of the Permian, with the various shale layers covering the escarpment-forming limestones. The cutting action of the streams on the thick shale units has sculpted much of the area into a rolling plateau. Two types of alluvial bottomlands exist at Fort Riley: wide meandering floodplains of major rivers, with associated terraces; and areas created by smaller creeks and streams that cut the uplands. The transitional areas, extending from the uplands down to the valley floors are broken, sloping to steep country composed of alternating limestones and shales. Fort Riley is located within a Zone II seismic area, which includes the entire Flint Hills area from Oklahoma to Nebraska. A small fault located northeast of Fort Riley near Tuttle Creek Lake appears to be inactive. Nevertheless, earthquakes producing moderate structural damage are possible within the Fort Riley area. No other identified geologic hazards exist in the Fort Riley area.

**Soils:** The primary soil association encountered on Fort Riley is the Wymore-Irwin. It is a deep, nearly level group of silty, clay loams found in the upland. The Smolan-Geary and the Clime-Sogn are also prevalent (Jantz et. al, 1975). Smolan soils are composed of deep, gently sloping to sloping materials and are typically formed in loess. These tend to be moderately well to well-drained soils with slow permeability. Geary soils consist of deep, gently sloping and sloping deposits that are well drained and have moderate permeability. Clime soils consist of moderately deep, sloping to moderately steep deposits that are calcareous in nature as a result of being formed from the weathered

residuum of calcareous clayey shales. These soils have moderately well to well-drained characteristics with moderately slow permeability. Sogn soils are shallow, sloping underlain by limestone and were formed in residual material weathered from shale and limestone. They have moderate permeability and can be excessively drained. The Eudora-Haynie-Sarpy Eudora association is found on floodplains & terraces. The soils tend to be deep, nearly level silt loams, very fine sandy loams, and loamy fine sands with well-drained characteristics and are moderately permeable.

### **Climate**

Fort Riley has a temperate continental climate characterized by hot summers, cold, dry winters, moderate winds, low to moderate humidity, and a pronounced peak in rainfall late in the spring and in the first half of summer. Prevailing winds are from the south to southwest during most of the year, except during February and March when the prevailing winds are from the north. Average yearly precipitation is 32 inches and most of the precipitation (75%) falls within the six month period from April through September. The three highest rainfall months (May, June, and July) each average more than 4 inches per month. Much of this precipitation occurs during thunderstorms, when 2 inches or more of rain may fall in one storm. December, January, and February are the driest months with each averaging less than 1.56 inches of liquid-equivalent precipitation. An average of about 15 inches of snowfall occurs annually.

Insufficient precipitation is the major limiting factor to plant growth at Fort Riley. Normally, spring rains are adequate to recharge soil moisture before the summer months when evapotranspiration rates normally exceed precipitation rates, especially in the latter half of the summer. In years of below average rainfall, soil moisture in the upper soil levels is depleted, which stresses shallow rooted plants.

### **Water Features**

***Wetlands:*** Wetland areas on Fort Riley include springs, seeps, streams, rivers, ponds, lakes, vernal pools and emergent marshes (Figure 2). Approximately 1,536 acres of wetlands are present on the installation according to a National Wetlands Inventory completed in 1991 by the U.S. Fish and Wildlife Service. Of this total, 972 acres are considered permanently inundated. The majority of all wetlands are riverine; riverine habitat comprises 144.8 miles and encompasses 748 acres. Lacustrine and palustrine wetlands cover 431 and 270 acres of the installation, respectively.

***Rivers and Streams:*** Three rivers are on Fort Riley (Figured 2), flowing for a combined 13.6 miles. All rivers have surface flow throughout the year. The Republican River and the Smoky Hill River come together at the southern boundary of Fort Riley to form the Kansas River. Fifteen other streams are present, flowing for a combined 131.2 miles. Onemile, Dry, Dry Branch, Farnum and Rush creeks generally have surface flow only during runoff from storm events. Surface flow in Forsyth Creek is maintained by effluent from the WWTP. The flow in the other streams results from runoff, seeps and springs. Honey, Little Arkansas, Wind, and Fourmile creeks are intermittent. Wildcat, Sevenmile, Timber, Threemile and Madison creeks generally have surface flow year round, although during droughts these will become intermittent as well.

Streams in the southern and central portions of Fort Riley drain to the south into the Republican or Kansas rivers. Streams in the western portion of Fort Riley drain toward

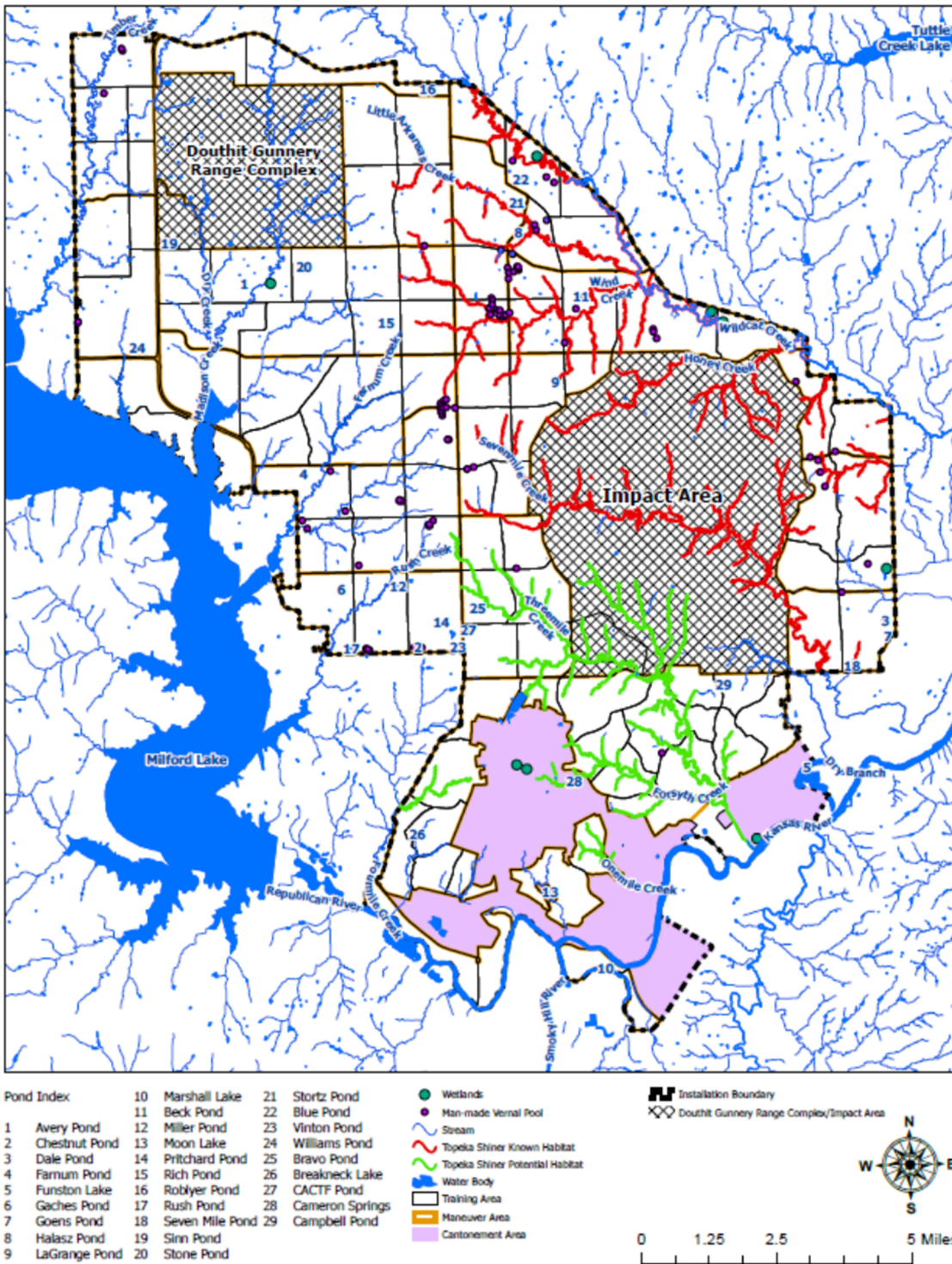


Figure 2 – Fort Riley water features.

the southwest into Milford Lake. Streams in the northeastern portion of Fort Riley drain to the northeast into Wildcat Creek, a tributary of the Kansas River.

**Ponds and Lakes:** Milford Lake was formed by the damming of the Republican River to the northwest of the installation. Presently, 29 other ponds and lakes on Fort Riley are actively managed for sport fishing and game fish (Figure 2).

**Vernal Pools and Emergent Marshes:** Vernal pools occur mostly in low areas behind terraces of abandoned crop-fields, and have been constructed in other locations that receive light military use. Emergent marshes exist as man-made wetlands, pools behind beaver dams, or occur along the periphery of water bodies, such as those within the Madison Creek outlet into Milford Lake (Figure 2).

**Surface Water Quality:** The Kansas Department of Health and the Environment (KDHE) has designated surface water use categories for the Republican and Kansas rivers; Fourmile, and Threemile creeks (KDHE 2013). Designated uses are defined in Kansas Water Quality Standards. The KDHE has determined these surface water bodies are suitable for, and should be protected for, contact recreation, expected or special aquatic life, food procurement, domestic water supply, irrigation, livestock watering, industrial water supply, and groundwater recharge.

The ITAM program conducted a water quality study comparing hardened stream crossing sites to unimproved earthen fords at six streams on Fort Riley (Sample 1996). Data were collected on turbidity, total solids, total dissolved solids, total suspended solids, settleable solids, pH, total hardness, calcium hardness, and total alkalinity at stream crossings prior to and after traffic. Water quality associated with hardened stream crossings was determined to be better than that associated with earthen fords.

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### SECTION 2.3: BIOTIC DESCRIPTION- FLORA

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Under natural conditions, this region consisted of tall- and mixed-grass prairies dominated by big bluestem, indiagrass, and switchgrass (Kuchler, 1974). The pre-settlement prairie was maintained through frequent wildfires and grazing by herbivores. Fort Riley's prairie is manipulated by man-made influences and by natural factors. Fort Riley grasslands are interspersed by linear communities of woodlands, highly variable in width, that are associated with streams, other woodland plantings, and man-made water impoundments. Woodlands tend to increase in width the closer the tributary streams are to the river. The flora and fauna in some locations are further influenced by their proximity to Milford Lake. Past and current land management practices, such as the suppression of fire, the introduction of agriculture, and the expansion of urban facilities have degraded the grasslands, allowed for invasive woody vegetation, and resulted in the establishment of several non-native vegetation classes.

In 2003, the Kansas Biological Survey (KBS) completed a project examining the vegetation of Fort Riley that assessed the current condition of vegetation on the installation, located tracts of native prairie, and determined the locations and severity of noxious weed species infestations. In 2011/2012, these surveys were repeated. The



KBS developed a new vegetation classification for the installation, identifying eight primary habitat types; floodplain forest, ravine woodland, Flint Hills tallgrass prairie, sand prairie, limestone butte vegetation, altered grassland vegetation, woodland-brushy, and planted/cultivated vegetation (Figure 3); see Appendix H for detailed descriptions of classification). During their surveys, KBS recorded nearly 520 species of vascular plants (Freeman and Delisle 2004; Appendix I, Table 1).

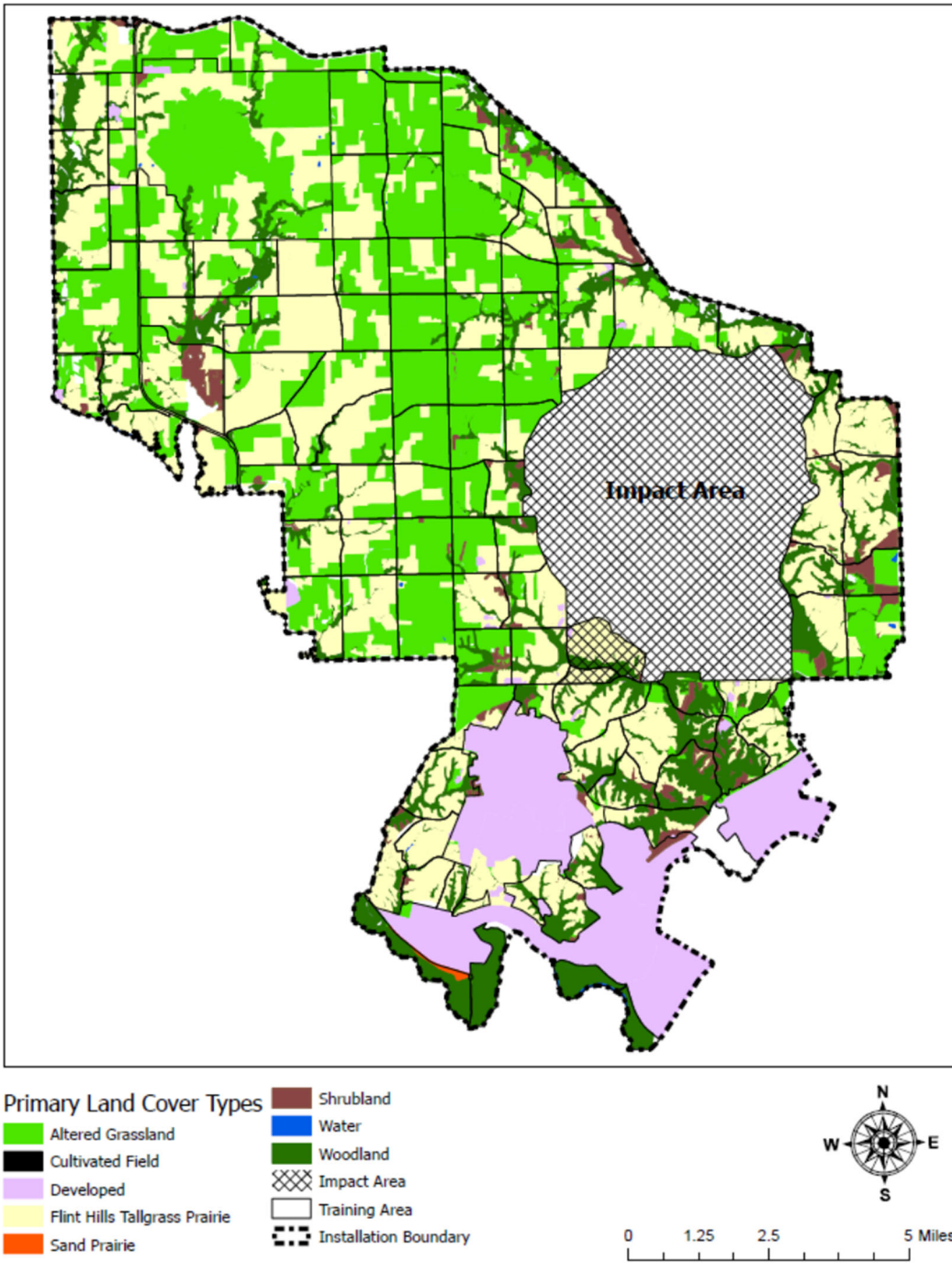
### **Grasslands**

Freeman and Delisle (2004) considered grasslands to be vegetative communities with grass and forb coverage greater than 25% canopy cover and woody cover less than 25%. Grasslands on Fort Riley consist of two basic types: native grasslands and "altered" areas. Grasslands comprise approximately 67% of the installation, as shown on Figure 3. Hay leases are let on approximately 36,000 acres of warm and cool season grasslands for the most recent contracting period in 2021. In 2014, aerial photography was captured soon after the warm season haying period had ended, allowing for the capture of actual acres hayed. Approximately 12,000 acres were hayed out of approximately 30,000 acres leased, indicating that less than half of the leased acres are actually cut on an annual basis.

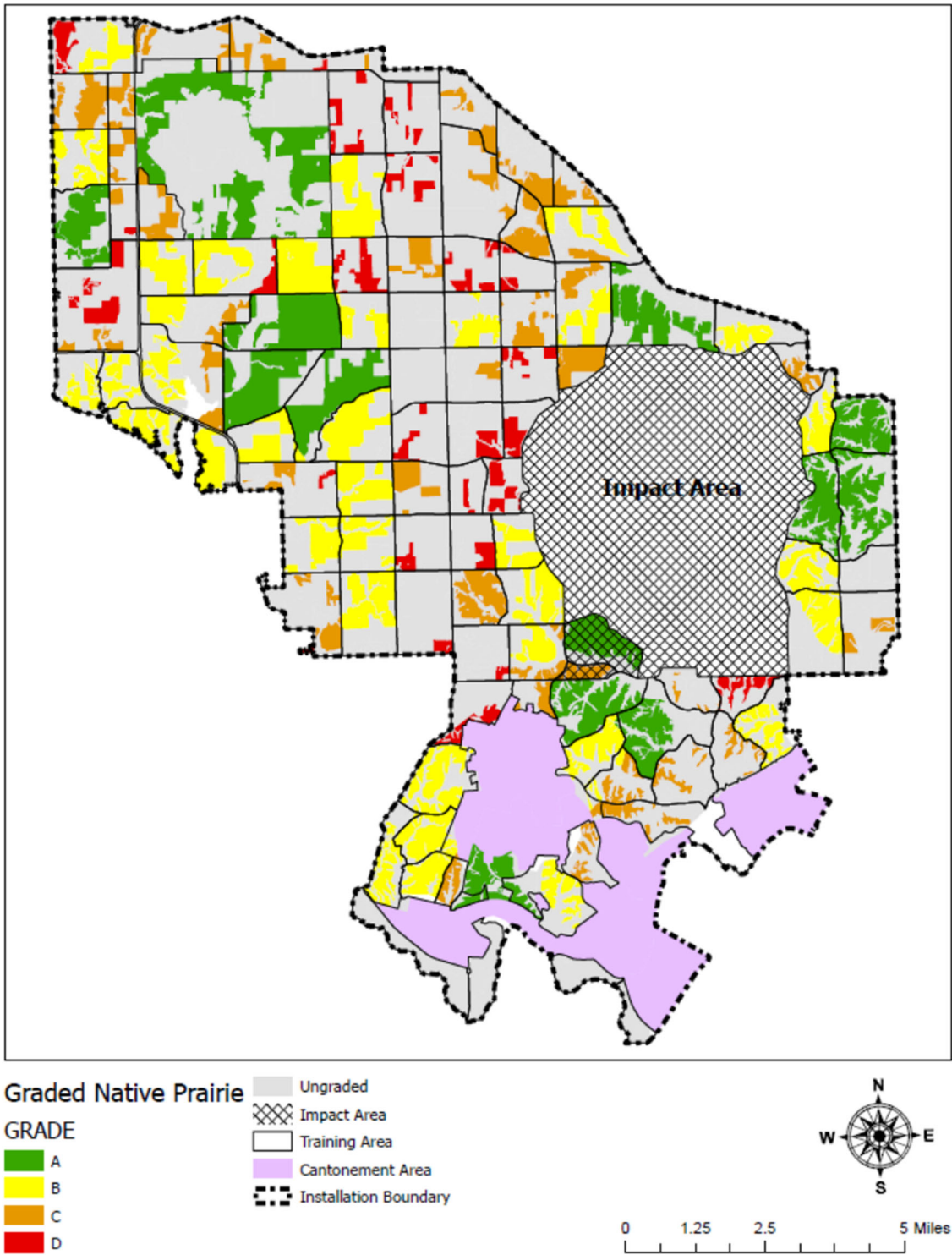
***Native Grasslands:*** The native grasslands of Fort Riley consist primarily of tallgrass prairie. Some elements of the mixed-grass prairie exist because Fort Riley is located near the transition zone between the tallgrass prairie and the mixed-grass prairie to the west (Kuchler, 1974). The native grasslands on Fort Riley generally do not exhibit classic tallgrass prairie composition, which would be big bluestem, indiagrass, switchgrass, or the mid-grass prairie, such as little bluestem and sideoats grama. Past land use activities, minimal management, lack of large herbivore grazing, and military training exercises have produced native grasslands that exhibit a less than pristine species composition, and that have been invaded by woody species. The grasslands with the least disturbance contain the highest percentages of native warm-season grasses and associated forbs.

Delisle et al. (2013) located, evaluated, and mapped locations of native prairie fields on Fort Riley (Figure 4). They identified 120 Flint Hills Tallgrass Prairies ranging in size from 12-2,172 acres, 78% of which were considered to be A-grade or B-grade, indicating low to moderate impact by humans. This was a significant increase from the 33.6% that were identified in the 2002/2003 surveys (Freeman and Delisle 2004). The largest prairies generally graded the highest, and were concentrated in the south, east, and northwest parts of the installation. The remaining prairie fields were C-grade or D-grade. Most of these prairies were small, isolated, and moderately to severely impacted by past or ongoing human activities. Prairies are most abundant in those areas with the greatest topographic relief. Areas with comparatively lower relief have experienced a much higher incidence of past cultivation, as in the central part of the installation.

Three kinds of native grassland were delineated; Flint Hills Tallgrass Prairie, Sand Prairie, and Limestone Butte Sparse Vegetation. Flint Hills Tallgrass Prairie is the dominant natural community type on the installation. Stands occur primarily on uplands and slopes



**Figure 3 - The eight primary habitat types of Fort Riley, identified by the Kansas Biological Survey during surveys conducted in 2002 and repeated in 2011-2012.**



**Figure 4 - Locations and grades of native prairie fields identified by the Kansas Biological Survey on Fort Riley during its Planning Level Survey conducted in 2012.**

but may occur infrequently in well-drained sites on floodplains. This community is dominated by a dense cover of tall grasses with a moderate to high richness of forbs. Dominant grasses are big bluestem, indiagrass, and little bluestem. Sideoats grama, switchgrass, and tall dropseed are common but less abundant. Typical forbs include asters, sunflowers, roundhead lespedeza, scurfpeas, goldenrods, and violets. Shrubs, such as leadplant, and trees usually are infrequent but can be common near watercourses or where fires have been suppressed.

Sand Prairie is restricted to the floodplain of the Republican and Kansas rivers, usually immediately adjacent to the rivers. The best remnants occur in Training Areas 18 and 19. This community is dominated by moderately to widely-spaced mid- to tall-grasses. The dominant species are sand bluestem and prairie sandreed. Other characteristic grasses include blue grama, hairy grama, sandbur, sand lovegrass, prairie junegrass, and little bluestem. Characteristic forbs are sand milkweed, desert goosefoot, winged pigfoot, sunflowers, blazing star, cutleaf evening primrose, groundcherry, and wooly plantain. Representative shrubs and vines are rough-leaved dogwood, sandhill plum, fragrant sumac, and poison ivy.

Limestone Butte Sparse Vegetation is dominated by drought-tolerant herbaceous species. This community is widely distributed on the installation, primarily on the upper slopes along bluffs of the Republican and Kansas rivers, and along their tributaries in association with outcrops of the Fort Riley limestone. Representative species include prairie spurge, Missouri pincushion, greenviolet, lomatium, Missouri evening primrose, fine-leaf gerardia, and yuccas. Stands on Fort Riley are in small patches and were mapped to be included in the Flint Hills Tallgrass Prairie GIS layer.

**“Go-Back” Grasslands (Abandoned Cropland/Brome Field):** “Go-back” grassland refers to grassland communities that have been moderately to highly altered by human activities, usually due to past cultivation. Some of the “go-back” areas on Fort Riley ceased to be cultivated prior to their acquisition by the Army. Most ceased to be cultivated after acquisition. The “go-back” lands are in various stages of ecological succession. Early seral stages consisting of annual grasses (prairie threeawn, green bristlegrass, smooth brome) and forbs (Missouri goldenrod, daisy fleabane, snow-on-the-mountain, western ragweed) are present in areas that continue to have frequent vehicular traffic (e.g., parts of Maneuver Areas A, B, D, and E). Most examples are dominated by herbaceous species, but shrubs or trees often are present, and in some cases they dominate.

Other “go-back” grassland areas not as frequently or intensively impacted by military vehicles are in further developed seral stages, and at times are exceedingly difficult to distinguish from prairie in the field. Dominant species in these areas are those typically occurring in the installation’s native grasslands (indiagrass and switchgrass) or are mosaics of native tallgrass prairie species and perennial cool season “tame” grasses. Delisle et al. (2013) located, evaluated, and mapped locations of “go-back” grasslands on Fort Riley (Figure 4).

### **Shrublands**

Extensive areas of shrubland are not a natural feature of the prairie environment. The reduction in wildfires, lack of management, past cultivation and ground disturbances from military training activities have contributed to shrubby encroachment. This includes the overgrown condition of windbreaks, the encroachment of woody shrubs into the grasslands, the establishment of single, large trees in the grasslands, and the maturation of large trees in small, shrubby drainage fingers. Shrublands remain a minor, but increasing component of the installation's landscape, covering less than 2 percent of the installation.

Woody encroachment is occurring in all types of grasslands. Shrubs are located along the edges of woodlands, in isolated patches along the smaller intermittent drainages and ravines, and scattered throughout many grassland fields (Figure 5).

The shrub encroachment generally is dominated by a moderate to dense cover of shrubs, frequently intermixed with a variety of immature trees. Buckbrush is the most common understory shrub, usually associated with American or sandhill plum, rough-leaved dogwood and smooth sumac. Eastern redcedar, eastern cottonwood and elms are the primary tree species invading grasslands, although honey locust, green ash and Osage-orange also occur. The herbaceous understory is highly variable from site to site.

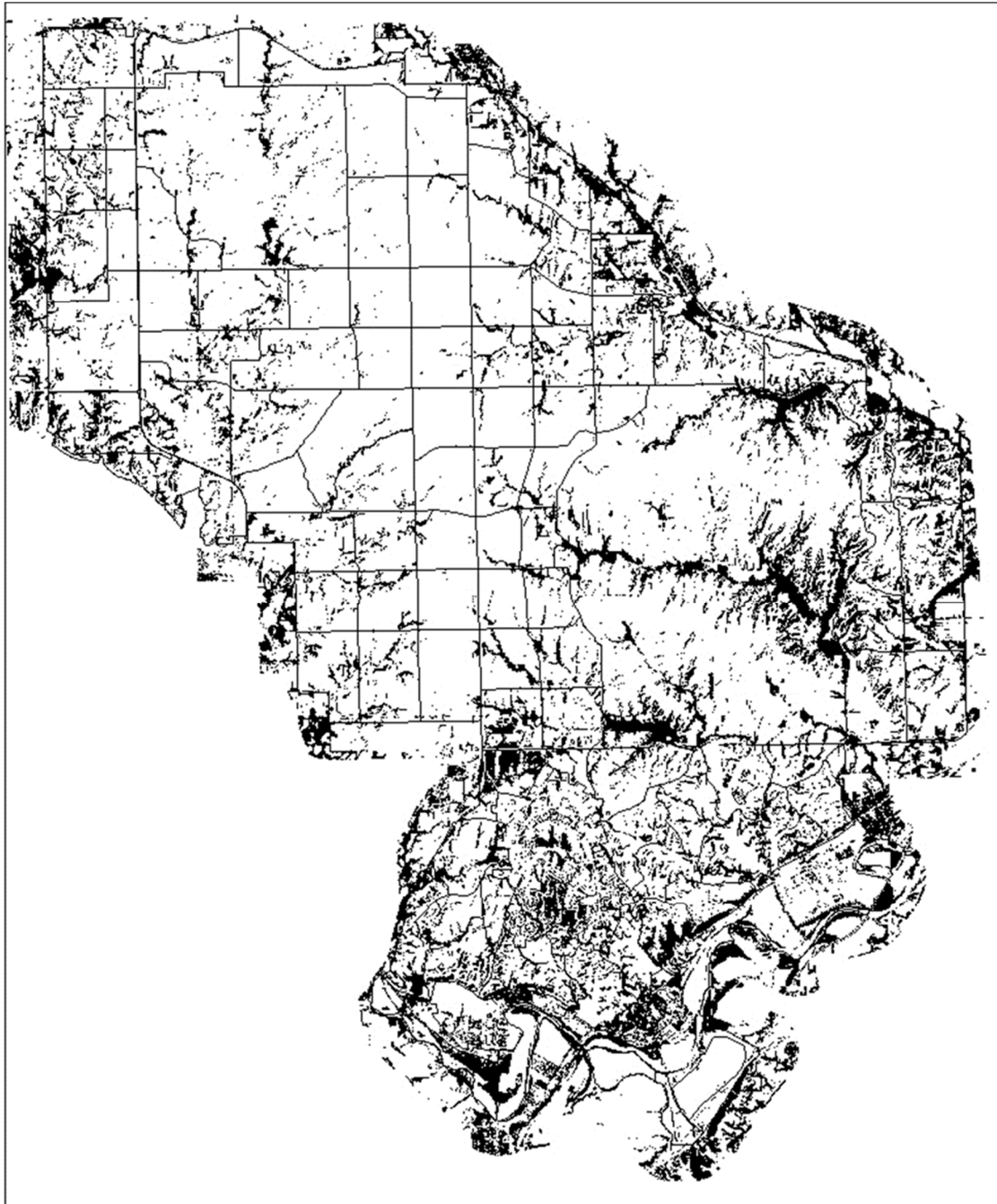
An exotic invasive is the black locust tree. Native to the Southern Appalachians and the Southeastern United States, this tree is naturalized throughout America. Once introduced to an area, black locust expands into areas where its shade reduces competition from other sun-loving plants. The tree poses a threat to native vegetation in prairies, oak savannas and upland forest edges outside of its historic range. While present on the installation, it does not appear to be significantly spreading (Delisle et al. 2013)

### **Forestlands**

Forestlands comprise approximately 16,400 acres of Fort Riley (Figure 3). Most of this acreage is associated with the bottomland forests along the Republican and Kansas Rivers and the woodlands within the drainages of Threemile, Sevenmile and Wildcat creeks. However, upland forests occur along the mainstems of most streams on the installation.

Freeman and Delisle (2004) identified three forest communities (Eastern cottonwood-Willow Forest, Eastern cottonwood-Sycamore Forest, and Green ash-Elm-Hackberry Forest) and one woodland community (Chinquapin oak-Bur oak Ravine Woodland) on Fort Riley. Forest Communities generally had 61–100% tree canopy cover, three distinct canopy layers (overstory trees, understory shrubs, herbaceous layer), and trees >5 m tall. Woodland communities usually had 26–60% canopy cover and trees <5 m tall.

***Riverine Floodplain Forest:*** Fort Riley riverine floodplain forests types include the eastern cottonwood-willow forest and the riparian upland woodland.



**Figure 5 - Locations of shrubs located along the edges of woodlands, in isolated patches along the smaller intermittent drainages, and scattered throughout many grassland fields on Fort Riley.**

The Eastern cottonwood-Willow Forest stands occur on floodplains adjacent to rivers in sites that frequently are flooded. Establishment and maintenance of the community is tied closely to flooding events. This riparian forest community has a closed or nearly closed tree canopy with eastern cottonwood and black willow as the dominant trees. Boxelder, silver maple, green ash, sycamore, and American elm are common associates, but tree diversity is limited due to the dynamics of flooding, scouring, and sediment deposition. The subcanopy usually is dominated by black willow. The shrub layer may be conspicuously absent, and herbaceous growth may be lush but often is patchy, again due to flooding.

The Eastern cottonwood-Sycamore Forest stands occur in floodplains of rivers, and along large streams as they empty into rivers. This riparian forest community has an open to closed tree canopy with eastern cottonwood and sycamore as the dominant tree species. Boxelder, hackberry, and black willow are common associates. The shrub layer may be poorly developed to well developed, depending on flood frequency and duration. Tartarian honeysuckle has become a dense understory component of many stands of this community. Delisle and Freeman (2004) combined the Eastern cottonwood-Black willow Forest and Eastern cottonwood-Sycamore Forest as riverine floodplain forest when mapping habitat types of Fort Riley (Figure 3).

***Riparian Upland Woodland:*** Fort Riley riparian upland woodland types include the green ash-elm-hackberry forest and the chinquapin oak-bur oak ravine woodland.

The Green ash-Elm-Hackberry Forest stands occur along the upper floodplain terraces of rivers and streams, and in upland river bottoms. This riparian forest community has an open to closed tree canopy with green ash, hackberry, and American elm as the dominant tree species. Silver maple, black walnut, eastern cottonwood, and basswood are common associates. Red elm may be part of the subcanopy. The well-developed shrub layer includes rough-leaved dogwood, wild gooseberry, wolfberry, and prickly ash, as well as woody vines, such as woodbine, greenbrier, poison ivy, and riverbank grape. The herbaceous layer in the western part of the range includes Virginia wildrye, nodding fescue, and wood nettle.

The Chinquapin oak-Bur oak Ravine Woodland stands occur on moderate to steep south-facing and west-facing slopes of ravines and river valleys. This open-canopy, upland community is dominated by chinquapin oak in the driest stands, with bur oak as a subdominant. Bur oak becomes more important in sites where conditions are more mesic until, eventually, the community grades into a forest with relatively little chinquapin oak. Elm species and redbud can be abundant. Shrub cover varies inversely with tree canopy cover. Common shrubs are rough-leaved dogwood and buckbrush. Hackberry and elm species often are in the shrub layer, especially on sites that have not been burned recently. Herbaceous dominants include little bluestem and switchgrass. The surface is not saturated or flooded by groundwater at any time during the year, and drought is relatively common. Drought and fire were common natural disturbances in this community type. Species composition is, however, generally shifting from an oak composition to nearly pure stands of hackberry. The primary factor for the species change is lack of

disturbance in forest stands, allowing the shade tolerant hackberry to rise from understory to dominance. Freeman and Delisle (2004) combined the Green ash-Elm-Hackberry Forest and Chinquapin oak-Bur oak Ravine Woodland when mapping habitat types of Fort Riley (Figure 3).

### **Invasive Plants**

Approximately one percent of the understory vegetation in woodland plots is the noxious weed sericea lespedeza. Woodlands are also experiencing invasion by the exotic Tartarian honeysuckle; in some tracts this invasive is achieving nearly 90% dominance of the understory vegetation in some areas, particularly in the southern part of the installation. The woodlands experiencing the greatest Tartarian honeysuckle invasion are in the southern portion of the installation, and generally along the Kansas and Republican rivers. A pocket of kudzu infesting less than one acre was located along One-Mile Creek within the Main Post District. The infestation was initially treated and plant population was reduced by over 99%. A very small infestation remains on the cut-bank of One-Mile Creek. The infestation is monitored and treated yearly to prevent any additional spread. The kudzu will be considered eradicated when no live plants are observed for five consecutive years.

**Noxious Weeds:** There are five species of noxious weeds that require control by Kansas laws that are known to occur on Fort Riley. These are musk thistle, kudzu, field bindweed, Johnsongrass and sericea lespedeza. Both native and “go-back” grasslands, as well as the other vegetative communities present on the fort, are experiencing varying amounts of noxious weed infestations.

Populations of muskthistle and Johnsongrass on the installation are mostly small and isolated (Figure 6), with 77 and 218 acres infested, respectively (Freeman & Delisle 2004). Field bindweed is principally a problem on routinely disturbed range sites and areas that are mowed to a height less than four inches. It also is a problem in firebreak and wildlife food plot crop fields.

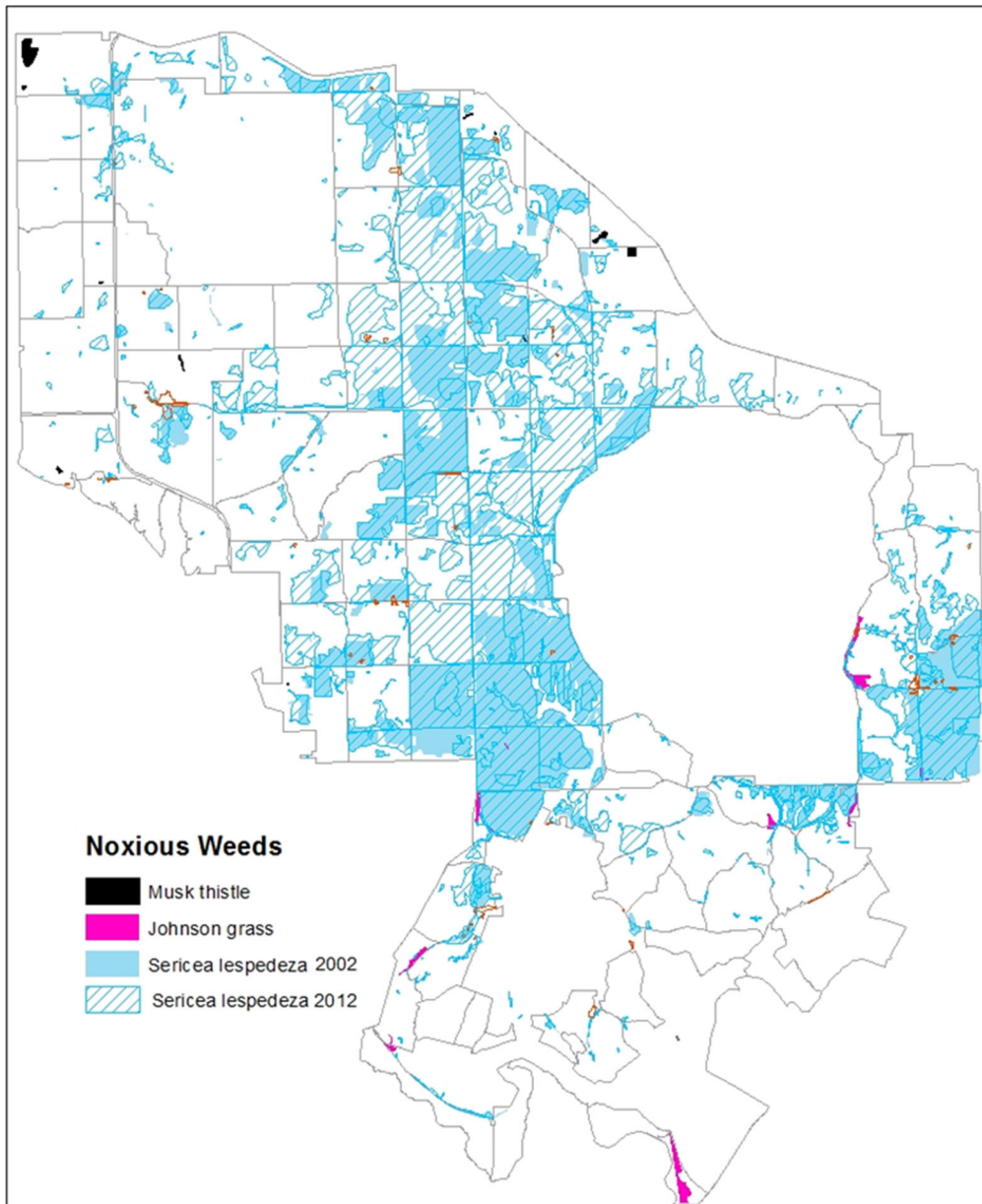
Sericea lespedeza is the most widespread noxious weed; Freeman & Delisle (2004) found it in 94 training areas and infesting an estimated 13,000 acres. Only localized populations were found on prairies; the most extensive sericea lespedeza populations occurred on go-back grasslands in the central and eastern parts of the installation (Figure 5). Ten years later KBS estimated 21,600 acres were infested with sericea lespedeza (Delisle 2013), with intrusion into grasslands increasing. Conservation Branch surveys have identified approximately 30,000 acres of sericea lespedeza on post. This includes areas that currently have actively growing plants as well as areas that have had infestations in the past and are believed to still contain a significant seed bank in the soil.

### **Savannas**

The upper regions of some of the Chinquapin oak-Bur oak Ravine Woodland stands produce savanna type habitats. Savannas are defined in this plan as areas that have tree canopy coverage from 5-15% and are one acre or more in size. Fort Riley’s savannas have an average of 25 trees per acre. The most common trees are oaks, hackberry, American elm and green ash. The most common understory plants are smooth brome,



big bluestem, smooth brome, and little bluestem. Noxious weeds are rare on the savanna sites. A planning level survey to document locations of savanna habitats was last



**Figure 6 - Locations of noxious weed infestations identified by the Kansas Biological Survey during its Planning Level Survey conducted in 2002, along with the extent of the spread of sericea lespedeza observed from 2012 surveys.**

performed in 1999. Due to the dynamic nature of vegetation resulting from aggressive prairie management actions, savannas on Fort Riley tend to be somewhat transitory. Surveys to determine current locations of savannas have not been performed since 1999 because of a low priority placed on management of this habitat type by the installation and the small quantity of this habitat on Fort Riley.

### **Hay Fields**

Many grassland fields on Fort Riley are leased for hay harvest (Figure 7). Hay fields are designated as either warm season or cool season, based upon the dominant grass species present. Most hay is harvested from areas dominated by native, warm-season grasses.

### **Croplands**

A firebreak system has been established around the installation's perimeter to delineate installation boundaries and minimize wildfire spread off the installation onto adjacent privately-owned lands. Nearly 1,300 acres along approximately 44 miles of the boundary are leased for crop production. Leased firebreak fields are maintained as agricultural croplands where soil conditions allow (Figure 8 **Error! Reference source not found.**). In areas where the soil is not arable because of severe slopes or rocky conditions, a crawler tractor-pulled disc is usually used to accomplish that tillage although occasionally a crawler tractor's dozer blade is used instead. The firebreak varies in width from approximately 100 feet to in excess of 300 feet.

Wildlife food plots consist of approximately 700 acres in plots of approximately 1 to 30 acres (Figure 8). These fields are located throughout the installation. The majority of the food plots have now been planted to alfalfa to reduce long-term costs and provide increased pollinator food sources, and some of those may be rotated or converted to clovers for the same objectives. Soybean, winter wheat and corn food plots are planted in areas often frequented by elk in an effort to reduce migration off post. Sunflower food plots are planted for mourning doves and passerine birds. Grain sorghum (milo) food plots are occasionally planted for crop rotation purposes. Korean lespedeza will continue to be used as an additive to some food plots and is broadcast in disturbed areas to quickly establish a ground cover and provide an additional source of food for upland birds.

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## **SECTION 2.4: BIOTIC DESCRIPTION- FAUNA**

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Fort Riley habitat supports at least 44 species of mammals, 270 species of birds, 47 species of turtles, reptiles and amphibians, and 61 species of fish.

### **Game Animals and Furbearers**

Fort Riley supports viable populations of all the typical game species found in this region of Kansas. Upland game birds are northern bobwhite, ring-necked pheasant and greater prairie-chicken. Migratory game birds include various duck and goose species, mourning dove, Wilson's snipe, crow and American woodcock. Small game animals in abundance include fox squirrel and cottontail rabbit. Jackrabbits have not been documented for many years and may be extirpated from Fort Riley. Hunting jackrabbits is prohibited on the installation by Fort Riley Regulation 210-15. Big game species include white-tailed deer, elk, and wild turkeys. Furbearer species include badger, bobcat, mink, muskrat,

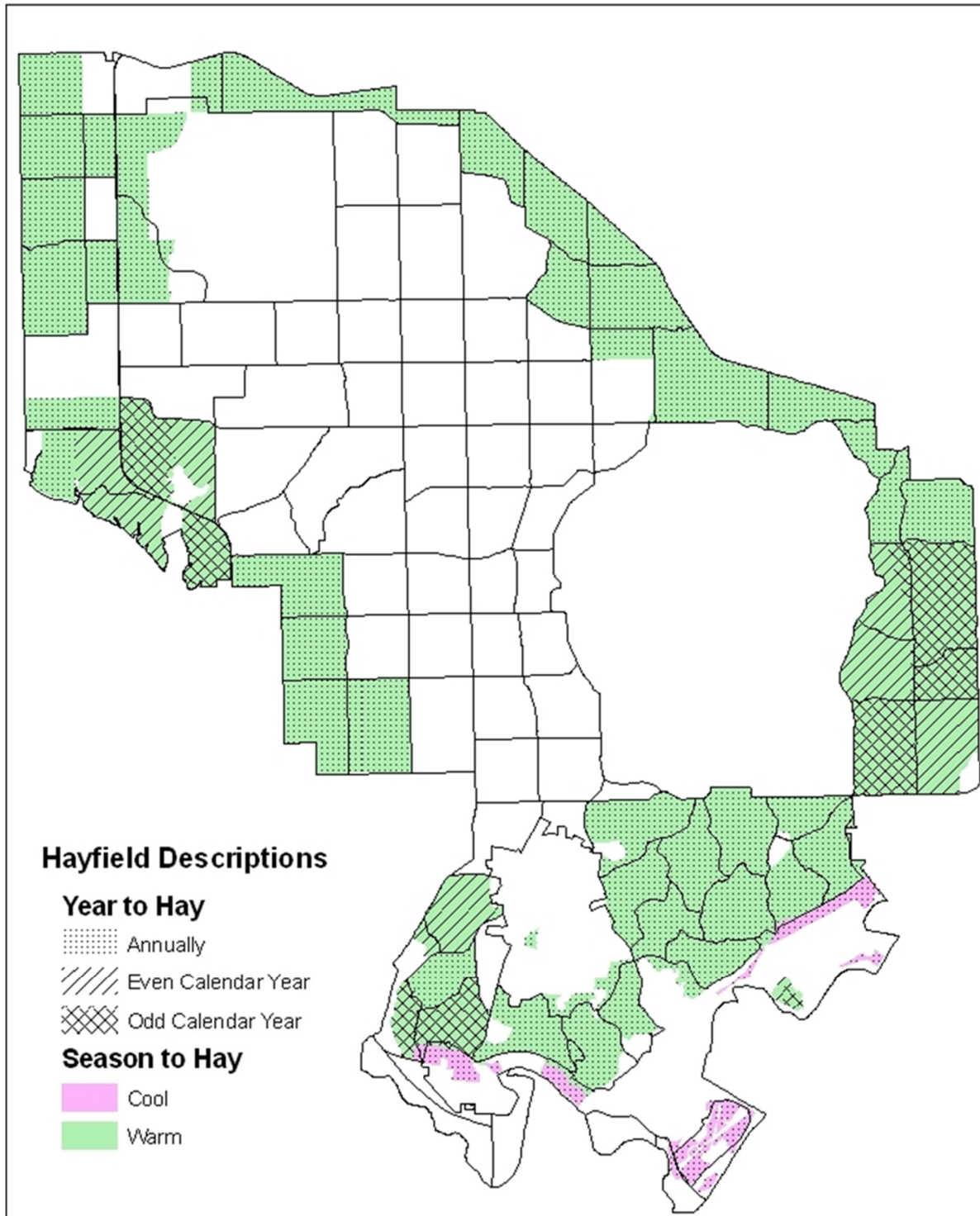
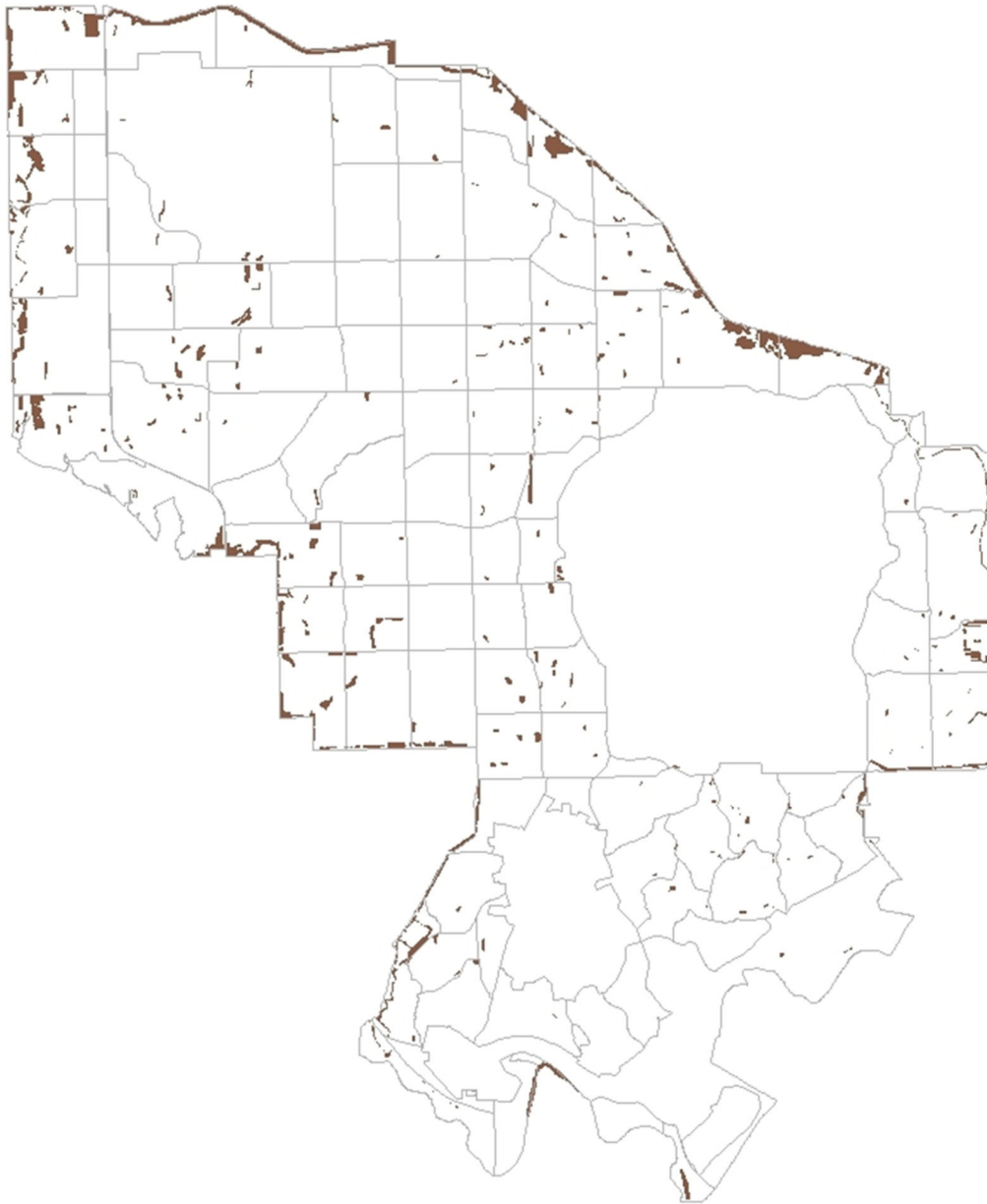


Figure 7 - Locations of hay field leases on Fort Riley.



**Figure 8 - Locations of agricultural firebreaks and food plots on Fort Riley.**

opossum, raccoon, red fox, gray fox, striped skunk, coyote and beaver. A description of the distribution and abundance of game animals and furbearers on Fort Riley is in Appendix J.

### **Non-Game Animals**

***Mammals:*** Thirty two species of non-game mammals have been reported on Fort Riley. Four of those species (hoary bat, little brown bat, gray squirrel and eastern spotted skunk) are documented only by Pitts et al. (1987). It is unclear whether the author actually observed these species, or included these as species that should be present based on a

literature review of the range for these species. Non-game mammalian species considered abundant on Fort Riley are Elliot's short-tailed shrew, eastern mole, big brown bat, eastern red bat, plains pocket gopher, western harvest mouse, deer mouse, white-footed mouse, cotton rat, eastern woodrat, prairie vole, and house mouse. The southern bog lemming, a Kansas-listed Species in Need of Conservation, has been documented. The complete list of mammals is at Appendix I, Table 2.

**Birds:** The avifauna of Fort Riley is rich and diverse, with 270 bird species documented on the installation (Appendix I, Table 3). As is typical for Kansas, most of these species are migrant, non-game passerines. The birds occupy a wide range of habitat types on the installation, from riverine sandbars to interior woodlands.

Numerous inventories of birds have been conducted on Fort Riley, and are described in Appendix K. Surveys have documented 134 bird species on Fort Riley during “breeding safe dates”, i.e., periods when migrants of that species are expected to be absent from Kansas (Appendix I, Table 4). Of these, 110 are confirmed or probable breeders. The most abundant breeding birds are brown-headed cowbird, dickcissel, grasshopper sparrow, eastern meadowlark, northern bobwhite, and mourning dove. Notable grassland breeding species include the Henslow's sparrow and loggerhead shrike. Common woodland species include blue jay, red-bellied woodpecker, black-capped chickadee and northern cardinal. Notable woodland breeding species include the ovenbird, wood thrush and prothonotary warbler. Common shrubby edge species include brown thrasher, Bell's vireo and field sparrow.

Common raptors are red-tailed hawk, northern harrier, great horned owl, barred owl, bald eagle, eastern screech-owl and American kestrel. Common shorebirds are killdeer, greater yellowlegs, lesser yellowlegs, least sandpiper, and spotted sandpiper. Common wading birds are great blue heron, great egret and green heron. Common winter birds are Harris's sparrow, American tree sparrow and dark-eyed junco.

**Reptiles and Amphibians:** Fort Riley supports the species of snakes, turtles, lizards, frogs, and toads commonly found in the tallgrass prairie region (Busby et al, 1994). Forty-seven species of reptiles and amphibians (21 species of snakes, 9 lizards, 7 turtles, and 10 amphibians) have been captured or observed on Fort Riley (Appendix I, Table 5). The most common species are ringneck snake and western chorus frog. No listed threatened or endangered species are known to occur.

The venomous copperhead is common in woodlands on Fort Riley. In 2005, there was a report of a massasauga observed in Maneuver Area N. However, the snake was not captured, no picture was taken to confirm the identification, and the observer was not certain of the identification. Thus, the species is not included. A photo of a timber rattlesnake reportedly taken from Fort Riley in Training Area 33 on March 31, 2010 has been received by the Conservation Branch. The species is considered rare on Fort Riley.

**Fish:** Fish habitat on Fort Riley comprises perennial and intermittent streams, rivers, and man-made and natural impoundments. Sixty-one species of fish have been documented in Fort Riley's streams, lakes, and ponds (Appendix I, Table 6).

Surveys of Fort Riley streams other than the adjacent three rivers have documented 47 fish species (Appendix I, Table 7) and produced a general portrait of fish assemblages. Species assemblages in streams that drain into Milford Lake show a lake effect, and are dominated by centrarchids (sunfish family). Largemouth bass, green sunfish, and bluegill are the major representatives. Streams on the eastern side of the installation are dominated by cyprinids (minnow family), such as redfin shiners, bluntnose minnows, fathead minnows, and central stonerollers. The endangered Topeka shiner has historically occurred in some of these eastern streams.

Surveys have documented 40 species in the three rivers on Fort Riley (Appendix I, Table 6). These include the shovelnose sturgeon, suckermouth minnow, red shiner, sand shiner, emerald shiner and river carpsucker.

Fish in ponds and lakes are largely represented by species managed for recreational fishing. Sport fish species introduced or supplemented by periodic stocking consist of channel catfish, rainbow trout, largemouth bass, flathead catfish, redear sunfish, and hybrid bluegill. Other unstocked game fish species inhabiting some ponds include white bass, yellow bullhead, black bullhead, green sunfish and white crappie. Appendix I, Table 8, lists the species found in each of the 29 managed lakes and ponds.

**Invertebrates:** Generally, invertebrate data is lacking for Fort Riley. KDWP surveys found 19 orders/families of aquatic insects in Timber Creek and 14 orders/families of aquatic insects in Fourmile Creek. Conservation Branch surveys documented 17 mussel species that have resided on Ft. Riley, of which seven species were found extant (Appendix I, Table 9). The other 10 species are apparently extirpated from the installation. One of the ten (hickorynut) is apparently extirpated from the entire state. The most common species collected alive were the pondhorn, fragile papershell, pink papershell, and mapleleaf.

Terrestrial invertebrate surveys have occurred looking specifically for listed species, or ancillary to other field activities. Specific surveys have located prairie mole crickets and various burying beetles (but not American burying beetle). Prior to 2013, location sightings for regal fritillary were recorded as ancillary information collected during other wildlife surveys.

In 2013, Fort Riley funded a two-year research project to 1) provide spatially explicit estimates of the distribution and abundance of the regal fritillary and its host plant, prairie violet; 2) provide models that identify habitat features and management practices that influence the density of regal fritillary adults; and 3) produce information on the effectiveness of management strategies for the regal fritillary populations on Fort Riley.

In 2015, Fort Riley further funded the above project to provide baseline population estimates of adult monarch and population trend estimates of adult regal fritillary. The study also identified environmental attributes such as hay removal and fire land management practices that influence those species, including an analysis of land management implications. Current monitoring efforts for butterfly species are outlined in the regal fritillary management plan in appendix C.

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## **SECTION 2.5: THREATENED, ENDANGERED, AND RARE SPECIES**

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The presence of three federally-listed, and five Kansas-listed threatened and endangered species, along with ninety-one rare species have been documented on Fort Riley. Fifteen additional listed or rare species lack documentation but could possibly occur on Fort Riley (Appendix I, Table 10).

### **Federal Threatened or Endangered Species**

Federally-listed species documented on Fort Riley include the Topeka shiner (endangered), eastern black rail (threatened), and the piping plover (threatened). The bald eagle, delisted in 2007, is a year-around resident, and the least tern, which was delisted in January 2021, is a seasonal migrant that may breed along the Republican and Kansas River corridors.

The Topeka shiner has been found in Wildcat, Sevenmile, Wind, Honey, Silver and Little Arkansas creeks though not since 2011. It is believed that Topeka shiners potentially may immigrate into Fourmile, Threemile, and Forsyth creeks. The piping plover is an uncommon, primarily transient migrant, but is also a potential breeder along the Republican and Kansas rivers' sandbars where it has been observed. The eastern black rail is an occasional migrant that occurs sporadically on Fort Riley primarily during fall migration.

The primary migratory path for a fourth species, the endangered whooping crane, occurs within 100 miles of Fort Riley, and it has been observed at Milford and Tuttle Creek lakes. The Conservation Branch has received a report of a group of 3 whooping cranes observed flying at low altitude over Maneuver Area O during November 2021 during a period when the species is confirmed to have been present in Kansas. However the observed birds were not photographed and the observer's identification of the species is not considered certain.

Bald eagles, while no longer listed under the ESA as threatened, still receives federal protection under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c), enacted in 1940. At least 19 locations with eagle nests occur on and around Fort Riley. Bald eagles roost along the Kansas and Smoky Hill rivers, and are frequently observed perched along the Republican River, Kansas River, and Milford Lake shorelines. Additionally, Fort Riley has documented sightings of golden eagles, also protected by the Bald and Golden Eagle protection Act, in Maneuver Areas A, G, and H.

### **Kansas Threatened or Endangered Species**

The Kansas-listed species documented on Fort Riley are the plains minnow, piping plover, snowy plover, sturgeon chub, Topeka shiner, and eastern spotted skunk<sup>2</sup> (threatened). Kansas lists Fort Riley as being within the historic range of six additional species; the American burying beetle, silver chub, shoal chub, eastern spotted skunk, and whooping crane. The American burying beetle, and whooping crane also are federally-listed as endangered.

### **Rare Species**

Scientific names, designations and status of the rare species that are documented on Fort Riley are provided in Appendix I, Table 10. Rare species' habitats, abundances and distributions are described in Appendix I, Table 11.

### **Species at Risk (SAR)**

Fort Riley maintains a SAR list to identify imperiled species that would have a significant impact on military missions if federally-listed as threatened or endangered. The objective of creating the SAR list is to proactively conserve these species now and thereby preclude the need for a future listing. Army resources were budgeted for SAR management. Fort Riley SARs that occur on the installation are the Henslow's sparrow, regal fritillary, rusty blackbird and Texas horned lizard.

### **Birds of Conservation Concern**

The 1988 amendment to the Fish and Wildlife Conservation Act (Public Law 100-653, Title VIII) requires the Secretary of the Interior, through the USFWS, to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973." *Birds of Conservation Concern 2008* (BCC 2008), the most recent effort by the USFWS to carry out this proactive conservation mandate, identifies migratory and non-migratory birds that are of conservation concern due to population declines, naturally small ranges or population sizes, threats to habitat, or other factors. Birds on the BCC 2008 list that have been documented on Fort Riley are the Acadian flycatcher, American bittern, bald eagle, Bell's vireo, Bewick's wren, black-billed cuckoo, black-crowned night-heron, black rail, black tern, buff-breasted sandpiper, dickcissel, field sparrow, grasshopper sparrow, Henslow's sparrow, horned grebe, Hudsonian godwit, Kentucky warbler, loggerhead shrike, marbled godwit, northern flicker, peregrine falcon, pied-billed grebe, prothonotary warbler, red-headed woodpecker, rusty blackbird, short-eared owl, solitary sandpiper, upland sandpiper, whimbrel, whip-poor-will, and wood thrush.

### **Species in Need of Conservation (SINC)**

SINC is a Kansas designation given to any nongame species in the state deemed to require conservation measures in an attempt to keep the species from becoming a threatened or endangered species. SINC species do not have the level of statutory

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<sup>2</sup> The eastern spotted skunk is documented only by Pitts et al. (1987). It is unclear whether the author actually observed this species, or included it as a species that should be present based on a literature review of the range for the species.



protection as those species listed as threatened or endangered in Kansas. Species on the SINC list that have been documented on Fort Riley are the prairie mole cricket, blue sucker, common shiner, Johnny darter, southern redbelly dace, timber rattlesnake, western hognose snake, black rail, black tern, bobolink, ferruginous hawk, golden eagle, Henslow's sparrow, short-eared owl, whip-poor-will, and southern bog lemming.

### **Species of Greatest Conservation Need**

Species of Greatest Conservation Need is a Kansas-generated list of species revised during development of the Kansas State Wildlife Action Plan. The Plan is based upon guidance provided by Congress, the USFWS, and the International Association of Fish and Wildlife Agencies. All species of fish and wildlife in Kansas were evaluated using eight selection criteria, resulting in the identification of 285 species of greatest conservation need. The species of greatest conservation need were prioritized into two categories. Tier 1 includes species listed as endangered or threatened, or with global conservation status rank of G1 or G2; all remaining species are assigned into Tier 2. Tier 1 species that have been documented on Fort Riley are snowy plover, least tern, piping plover, sturgeon chub, Topeka shiner and plains minnow. Fort Riley has documented 83 Tier 2 species (Appendix I, Table 10 and 11).

### **Listed Habitats**

There is no Critical Habitat designated on Fort Riley. The Army is required to implement effective conservation and management programs for federally listed species to help preclude the need for Critical Habitat (CH) designation. To preclude CH designation, INRMPs for installations with federally listed species must provide adequate protection and a benefit to the species. The Army participates in the CH rule-making process when the installation is within an area proposed for CH designation for an ESA-listed species. The National Defense Authorization Act for Fiscal Year 2004 codified this policy by amending the Endangered Species Act. Specifically, section 4(a)(3)(B)(i) of the Act (16 U.S.C. 1533(a)(3)(B)(i)) now provides: "The Secretary shall not designate as critical habitat any lands or other geographical areas owned or controlled by the Department of Defense, or designated for its use, that are subject to an integrated natural resources management plan prepared under section 101 of the Sikes Act (16 U.S.C. 670a), if the Secretary determines in writing that such plan provides a benefit to the species for which critical habitat is proposed for designation."

## **CHAPTER 3: GRASSLAND MANAGEMENT**

The overall goal of the natural resources management program is to integrate prescribed burning, hayfield cutting, mechanical control, herbicide application and land rehabilitation actions to sustain the training mission; enhance Soldier safety; maintain, enhance or reclaim native prairie; reverse or control undesirable invasive plants; and provide suitable habitat for the potential natural fauna typically associated with tallgrass prairie.

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### **SECTION 3.1: GRASSLAND MANAGEMENT STRATEGY**

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### **Native Grassland**

The tallgrass prairie is the most altered ecological community in North America, with less than 4% left. Not coincidentally, grassland animal species have experienced a more consistent, steeper, and widespread decline than any other group in North America (Samson and Knopf 1994, Knopf 1994, Johnson 1995). Factors involved in these declines include habitat loss, habitat fragmentation, and woody vegetation encroachment. Many of the species experiencing the greatest declines, such as the greater prairie-chicken and Henslow's sparrow, are area sensitive (i.e., there is a minimum area size below which the species will not occur). The habitats needed by grassland species vary from short or recently burned grass to dense grass that have remained unburned for 3-4 years.

The overall strategy is to protect, propagate, and conserve the native tallgrass prairie where it occurs on and off of the installation, and the faunal species associated with it. Native prairie evolved under the influences of fire and grazing, and these or similar disturbances are required to maintain the grasslands. Fire is especially effective in retarding the spread of woody vegetation into the prairie. However, burning entire landscapes can be detrimental to a number of species. For example, greater prairie-chickens prefer to nest in unburned fields located within ½ mile of the lek (Horak 1985). Management actions will focus on smaller parcels of land, juxtaposing vegetative conditions in varying stages of time since last disturbance treatment to create more heterogeneous habitat conditions.

### **Go-Back Grassland**

The "go-back" grasslands are mosaics of native tallgrass prairie plant species, annual grasses and perennial "tame" grasses. The strategy is to encourage and facilitate the return of native grass and forb species into these areas using the same tactics as previously described in the native grassland section.

### **Sericea lespedeza**

Until eradicated or controlled, large sericea lespedeza infestations in the central and eastern parts of the installation will continue to serve as seed reservoirs that will allow the species to spread into other parts of the installation, and to surrounding private lands. The dual strategy for sericea lespedeza control is to minimize its spread into native prairie areas while controlling or eradicating it in other parts of the installation. Integrated Pest Management (IPM) principles will be used, to include education, cultural control, mechanical control, and the judicious use of low-toxicity pesticides. Aggressive control measures involving chemical spraying are warranted to stem the spread of this noxious weed. Generally, aerial spraying to control sericea lespedeza will be restricted to those fields identified as "go-back" or "brome" by Freeman and Delisle (2004). Spot and patch or direct, ground-spraying by truck, ATV, or backpack equipment will generally occur in fields identified as native prairie. Recently, Fort Riley has increased the frequency and acreage of late summer/early fall burning in areas containing sericea lespedeza. The goal is to reduce or eliminate seed production during the year of the burn and decrease vigor of the plant over time.

### **Woody Encroachment**

Significant woody invasion and maturation has occurred on Fort Riley rangelands over the past 50 years. Reducing this invasive woody component will be an integral component to maintaining and restoring the tallgrass prairie and increasing the occurrence and production of grassland nesting birds.

Some grassland fauna, such as the northern bobwhite, Bell's vireo and orchard oriole, benefit by increases in woody vegetation,. However, these species do not appear to be area sensitive (Fitzgerald 1997). There is no belief or desire that execution of this plan will result in the eradication of the shrubby component from Fort Riley grasslands, especially in the smaller grassland tracts. Thus, sufficient areas of suitable shrub habitat will remain for the grassland/shrub ecotone suite of species installation-wide. The shrub habitat will not, however, be distributed uniformly across the installation. So some areas will be deficient in this habitat as compared to prime habitat for grassland/shrub species. When evaluating habitats for these species, a patchwork pattern of shrubs scattered throughout a grassland will be generally considered preferable to shelterbelts and windbreaks. Shelterbelts and windbreaks fragment grasslands, preclude certain grassland species from an area, provide perches for raptors and cowbirds, and are travel lanes for mammalian predators (Fitzgerald 1997, Johnson 1995).

The overall strategy for woody encroachment into grasslands will be to remove or thin brush in many locations. Figure 9**Error! Reference source not found.** depicts a series of iso-lines indicating a range of predicted shrub densities based on the percentage of land area covered by shrubs, as calculated by Environmental Sensitivities Research Institute's GeoStatistical Analyst toolbox applied to Light Detection and Ranging (LIDAR) data. The iso-lines represent areas of high and low concentrations of shrub densities based on the percentage of land area covered by shrubs on individual 160 acre plots. Appendix L provides additional details of how this map was generated and verified. Generally, in grasslands with a landscape level shrubby component  $\leq 0.4\%$ , prescribed burning will be the only management tool used for shrub control. In grasslands with a landscape level shrubby component between 0.41 and 0.82%, prescribed burning, rotary mowing and chemical treatment will be used to reduce the woody encroachment. In grasslands with a landscape level shrubby component exceeding 0.82%, prescribed burning, various mechanical controls, and chemical control will be used to combat woody encroachment.

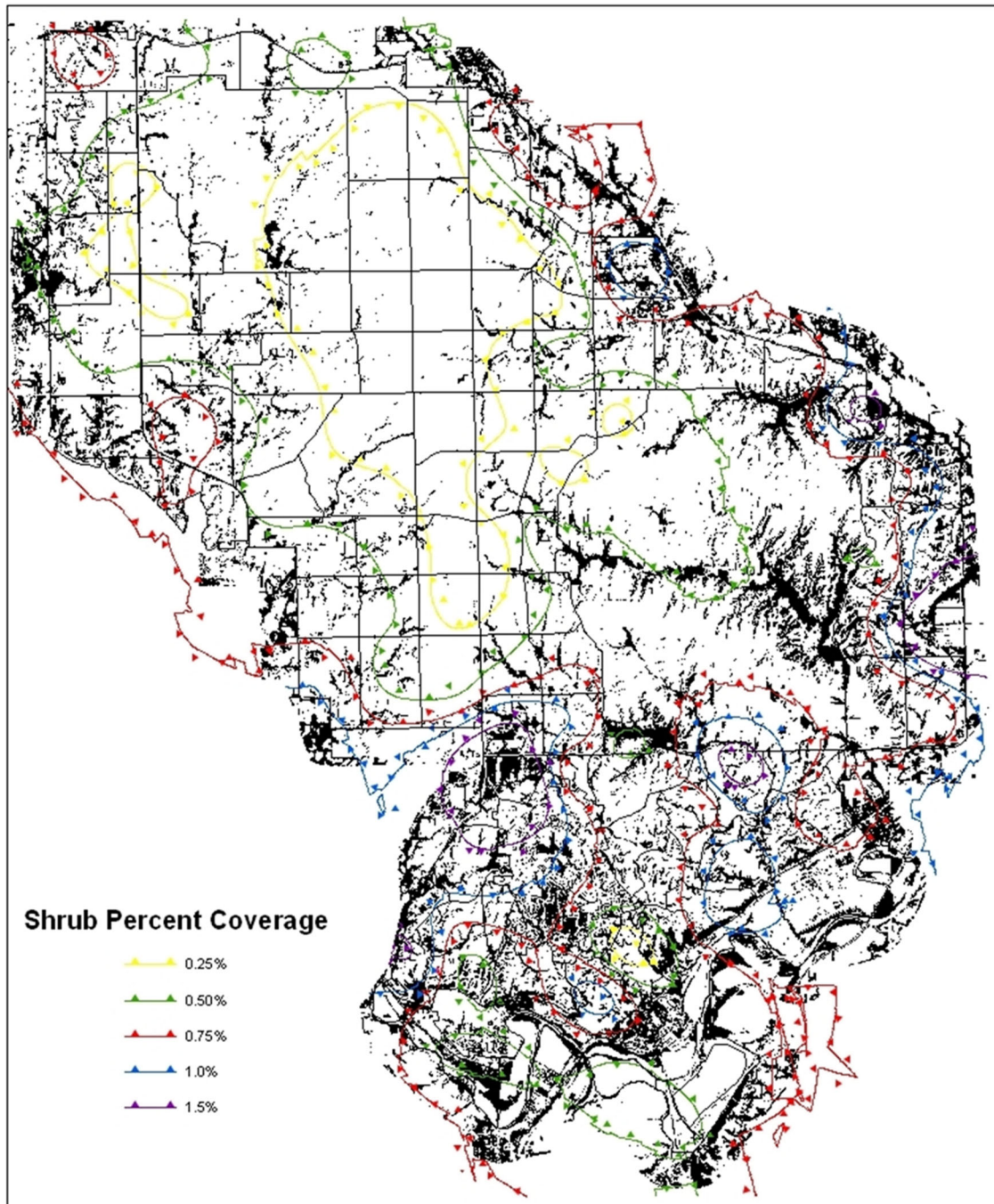
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## **SECTION 3.2: GRASSLAND MANAGEMENT TOOLS**

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### **Prescribed Burning**

The time during which a prescribed burn occurs determines which species are benefited and which are harmed. For example, conducting prescribed burns during the March through early-May timeframe promotes the growth of warm season grasses and their associated forb community at the expense of the annual cool-season grasses. However, burns at this time of the year generally do not harm shrubby vegetation nor control sericea lespedeza seed production to the degree that burns occurring in late-August through early-October do.



**Figure 9 - Contour iso-lines representing the % density of woody encroachment on a landscape scale.**

The goals of prescribed burning include maintenance of open space for military training, reduction of wildfire potential, reduction and suppression of woody plant encroachment onto the prairie, maintenance of wildlife resting and breeding cover, and sericea lespedeza control. To achieve these goals, prescribed burns will usually be conducted from approximately August 15 through April 30 annually, avoiding the natal period of most

wildlife species, with the objective that every grassland area not managed for Henslow's sparrows will burn at least every other year. Henslow's sparrow habitat areas will be managed for three year old grassland stands.

The most common exception for conducting prescribed burns from May 1 through mid-August will be to directly support the military mission. Examples include to support construction activities or scheduled weapons firing, or to compartmentalize grasslands to reduce wildfire dangers. Such burns may compete and conflict with natural resources objectives but will be completed, as necessary. Other exceptional burns may be performed to damage woody vegetation in an area determined to be badly over-run by shrubs. Exceptional burns will be limited to as small an area as can be practically burned considering manpower and equipment constraints and objectives of the burn.

Prescribed burns accomplished from late-August to mid-winter also will be limited to as small an area as can be practically burned considering manpower and equipment constraints and objectives of the burn. Particular consideration will be given to the provision of fall and winter habitat needs of small nongame and game wildlife and the erosion potential of locations burned.

Prescribed burns of individual areas accomplished during late-winter through early spring will be of portions or entire Training Areas and throughout the installation. Little consideration will be given to provision of residual wildlife habitat and erosion potential of burned areas.

Prescribed burning and wildland firefighting have the potential to affect cultural resources. Thus, these actions will be reviewed prior to execution in accordance with the procedures described in Appendix G.

***Prescribed Burning Management Actions:***

- Annually update the Prescribed Burn Strategic Plan, incorporating invasive plant control, identifying areas for spring, fall and winter burns, and areas left unburned. The Annual Wildland Fire Management Plan shall focus on mottled burning and small patch size (generally less than 640 acres), juxtaposition and timeliness of burns.
- Annually, retain 10,000 acres as no-burn areas within identified Henslow's sparrow habitats. These areas will not intentionally be burned, and efforts to fight wildfires in them will be aggressive. The No Burn areas will be incorporated into the Annual Wildland Fire Management Plan.
- Prescribed burning will generally not occur in areas likely to contain nesting greater prairie-chickens between mid-April and mid-August.
- Maintain firebreaks to better implement the focus on smaller patch size and managing training areas in smaller parcels.
- Seasonally, update Annual Wildland Fire Management Plan to account for unforeseen circumstances, special requests, ensure that sufficient breeding habitat for Henslow's sparrow will exist, and to redevelop the plan's third year.

- The Conservation Branch will collaborate with the DES, Fire Department and DPTMS, Range Support Branch to draft the Prescribed Burn Strategic Plan.
- The Annual Wildland Fire Management Plan, including any firebreak/fuelbreak maintenance and installation, shall be reviewed by and coordinated with the Cultural Resources manager.
- DPTMS staff will review firebreak operations conducted by Conservation Branch staff to identify potential erosion concerns.
- A safety bulletin and newspaper articles regarding Soldier safety during the prescribed burning season will be published each spring.
- All personnel who conduct prescribed burning, wildland firefighting, or both will receive training and certification/licensing in accordance with Fort Riley's Integrated Wildland Fire Management Plan.
- Approximately 30,000-35,000 acres outside of the installation's permanent Impact Area will be burned annually.

### **Haying**

See Section 5.1

### **Integrated Pest Management (IPM)**

The Pest Management Program at Fort Riley is designed to employ IPM principles to achieve effective control with minimal adverse environmental effects. IPM uses the best mix of available non-chemical and chemical control methods to achieve the most effective, economic, and environmentally safe pest management possible. Non-chemical control is the preferred method of control and will be used to the maximum extent practical. The non-chemical control methods used in grassland are prescribed burning and mechanical cutting. Chemicals are used when necessary and in combination with prescribed burning and mechanical control. Chemical applications are made in an effective and specific manner. Non-chemical and chemical treatments are combined to provide the greatest overall benefits. Chemical control methods include aerial, ATV, truck, backpack and tractor spraying, and wicking.

Mechanical control includes mowing and hand-cutting to remove unwanted invasive vegetation. While mechanical control by itself will not generally kill vegetation, it can be a useful stop-gap measure to control invasive vegetation and interrupt the development of viable noxious weed seed when other management tools are not available.

Fort Riley's Integrated Pest Management Plan<sup>3</sup> (IPMP) provides guidance for operating and maintaining an effective pest management program. The principles of IPM serve as

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<sup>3</sup> The IPMP is consistent with current military standards and criteria and is designed to be consistent with the mission of the installation. Compliance with the plan will ensure that proper regulatory procedures have been followed. The plan prescribes the roles and responsibilities of the various departments, organizations, and personnel actively involved in the application, storage, and use of pesticides at Fort Riley. It also identifies the existing pests at Fort Riley and characterizes their destructive abilities, so appropriate decisions can be made to satisfy any particular level of control.

the foundation for all activities described within the IPMP. The IPMP is incorporated by reference into this plan. It is revised each year as required by Army Regulation.

Prescribed burning and mechanical removal of vegetation have the potential to affect cultural resources. Thus, these activities will be reviewed prior to execution in accordance with the procedures described in Appendix G.

***IPM Actions:***

- Scattered trees will be removed from grassland areas as part of the prairie restoration program. Areas chosen for tree removal are in greater prairie-chicken or Henslow's sparrow habitats. Activities will consist of the mechanical removal of trees using chainsaws and machine-mounted clippers, grinders and saws. Herbicides may be applied to cut stumps of trees. Tree stumps generally will be cut to 8 inches or less in height. Those cut taller will be conspicuously marked soon after cutting if they present a foreseeable potential for vehicular damage through collision with them. All trees not associated with a riparian area, tree plantation or hedgerow targeted for renovation in these areas are candidates to be cut. Tree and brush cutting will typically be avoided during the primary migratory bird nesting season.
- Implement, evaluate and amend Shrub Reduction Strategic Plan to combat shrub encroachment into grassland. The Plan integrates GIS technology with prescribed burning, rotary mowing, mechanical clipping, grinding of trees and brush, and chemical use to achieve the most effective and economic control. The plan will prioritize treating areas where the woody invasion impacts Soldier use of the landscape for dismounted training, Henslow's sparrow habitat, or regal fritillary prairie.
- Any amendments to the Shrub Reduction Strategic Plan, including any mechanical removal of woody vegetation that has the potential to cause ground disturbance, shall be reviewed by and coordinated with the Cultural Resources manager.
- Rotary mowing and chemical control of 300 acres of shrub infested grasslands will be completed annually.
- Ground spraying of 150 acres of shrub infested grasslands will be completed annually.
- Large trees in shrubby areas of forest edge/upland shrub habitat will be cut to improve early successional habitat conditions for species such as the northern bobwhite, painted bunting, and spotted towhee.
- Update GIS data layers of tree clipping activities annually.
  - Hedgerows rated to be ten years or less from a commercial size are to be retained for contractual sales. The remaining hedgerows are to be evaluated jointly by Conservation Branch and DPTMS for possible renovation cutting or removal.

- Tactical Concealment Island plantings that were established in or adjacent to grasslands are to be evaluated jointly by Conservation Branch and DPTMS for possible removal to increase the value of those areas to grassland-dependent fauna.
- Aerial and ground spraying of herbicides, mechanical removal and prescribed burning are used to control noxious weeds. Plans and methods of control are discussed in IPMP.
- Prepare pesticide report annually.
- All personnel who apply pesticides will receive training sufficient to be certified for such actions.

### **Partnerships**

Many organizations have interest in conserving and preserving prairie habitats on public and private lands surrounding Fort Riley. These include government agencies such as the USFWS, KDWP and U.S. Department of Agriculture (USDA)-Natural Resources Conservation Service (NRCS), and non-government organizations such as the Kansas Land Trust, Rocky Mountain Elk Foundation, National Wild Turkey Federation and Pheasants/Quail Forever. Cooperating, collaborating and sharing resources with these organizations to enhance grassland management on lands surrounding Fort Riley will help retain healthy populations of wildlife, and may preclude future listings of grassland species as threatened or endangered, thereby helping to maintain and sustain Fort Riley's mission.

### ***Partnerships Management Actions:***

- Implement Fort Riley's ACUB program. The Army has signed a Cooperative Agreement with the KLT to serve as Fort Riley's partner to implement the Army Compatible Use Buffer (ACUB) program. The KLT procures funding from other sources to match with Army funds. Jointly, Environmental Division and KLT staffs develop annual work plans. The KLT then implements those plans, negotiating conservation easements with identified landowners, and is the holder and overseer of those easements. The primary benefit to Fort Riley is the effective management of development adjacent to and near the installation, thereby reducing the likelihood of training restrictions caused by noise, smoke dust or other issues. Currently there is 16,881 acres protected by KLT easements.
- Participate in regional conservation management workshops, planning meetings, and business meetings that are conducted by government and non-government organizations.
- Assist with management programs that perform on-the-ground habitat enhancement actions on public and private lands around Fort Riley.



## **Soil Management**

Soil resources management is the foundation upon which land sustainability depends. Soil management is integrated through ITAM among the DPW and DPTMS. The overall soil conservation strategy is to repair and improve training lands by planning and applying preventative and corrective land management practices that address erosion and damage caused by military training. ITAM Management Objectives and Goals are summarized in Appendix M.

Soil management practices include filling, grading, and seeding abandoned defilades and hardened assembly areas; controlling road ditch erosion by seeding, constructing earthen gradient diversions that divert storm water to established stands of grass, or by placing riprap in ditches.

LRAM activities such as grading abandoned defilades and hardened assembly areas, controlling road ditch erosion by constructing earthen gradient diversions and maintaining and establishing hardened, low-water fords have the potential to affect cultural resources. Thus, these activities will be reviewed prior to execution in accordance with the procedures described in Appendix G.

As a component of its NPDES permit, Fort Riley is required to develop and annually update a Borrow Area Management Plan. The purpose of the plan is to provide instructions so that borrow-related actions occur in a manner that ensures availability of materials, maintains sustainability of resources, meets environmental compliance, and minimizes conflicts with military day-to-day training operations. The Borrow Area Management Plan is at Appendix N.

### ***Soil Management Actions:***

- Repair gully erosion to include construction of check dams, as necessary.
- Excavate rock for erosion control structures, ford maintenance, road and parking lot base material, and other LRAM and DPW projects.
- Close off unauthorized stream crossings and repair sites, as needed.
- Repair lands damaged by maneuver training, which may include grading, shaping, seeding and mulching.
- Harden drainage ditches at locations that repeatedly are damaged during training events.
- Monitor soil erosion and soil compaction as part of the ITAM program.
- Continue constructing hardened stream fords, as needed, following approved protocol (see 9.3.2.1, Topeka shiner).
- Maintain fords following approved protocol (see 9.3.2.1, Topeka shiner).
- Implement plan for establishing, operating, closing and reutilizing borrow areas to increase troop safety, increase available training space, improve wildlife habitat, and improve the appearance of the installation.

- Coordinate LRAM projects with the Cultural Resources manager through the GIS database and by coordinated planning meetings.
- Manage digging permit program, whereby military units must coordinate with the DPW prior to conducting any tactical excavation or other ground disturbing activity during training exercises.
- Conduct soil and rock borrow actions in accordance with the Borrow Area Management Plan.

### **Native Grass Plantings/Restoration**

Planting of native grass is mainly conducted by ITAM personnel to replace cover lost during construction activities or to repair maneuver damage of specific sites. ITAM uses NRCS standards for mulching, fertilizing, and reseeding. Native plant species are preferred in any revegetation plans. ITAM staff generally use native grass species when planting to repair maneuver damage. Conservation Branch personnel will also plant native grass to meet specific wildlife management objectives, such as to restore riparian buffer strips. However, planting native plants in large scale prairie renovation or reclamation projects will not be performed.

## **CHAPTER 4: FOREST MANAGEMENT**

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### **SECTION 4.1: FOREST MANAGEMENT STRATEGY**

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#### **Riverine Floodplain Forest**

Most riverine floodplain forests in Kansas have been lost. Historically, riverine forests were linear and provided a different type of habitat than upland forests. Riverine forests were large stands of mature woodlands with tall trees and high canopy closure. The fact that linear, floodplain forests were interspersed with sloughs, oxbows, and marshes did not seem to negatively affect the presence of species normally associated with large, unfragmented woodlands. This resulted in different faunal species assemblages when compared to uplands. Species such as the pileated woodpecker, prothonotary warbler and red-shouldered hawk occurred in riverine forests. On Fort Riley, these species have been found only in floodplain forests.

Eastern cottonwood, sycamore and bur oak trees are preferred eagle perch trees. While trees of these species comprise a significant proportion of the overstory canopy, little regeneration of these species is occurring due to infrequent flooding and a closed canopy. The majority of sapling and pole-sized trees in these woodlands are shade-tolerant hackberry, boxelder and American elm. This, coupled with the Tartarian honeysuckle infestation, has created a closed sub-canopy condition. The overall usefulness of these areas to eagles may begin to decline when the large eastern cottonwood and sycamore trees senesce and fall over, and preferred trees do not replace them.

The overall strategy for riverine forests is to increase the width of forested floodplain corridors, promote large, mature to overmature stands, and maintain large, downed

woody material<sup>4</sup>. These stands will have high canopy closure and an open to intermediate sub-canopy to favor species typically occurring in floodplain forests (Evans and Fischer 1997, Schroeder 1982, Crocoll 1994, Stauffer 1994, Moldenhauer and Regelski 1996). Additional strategies for stands within the riverine floodplain forest are to investigate and address Tartarian honeysuckle infestations, maintain or enhance the abundance and distribution of trees suitable for bald eagles, and manage established tree plantations.

### **Riparian Upland Woodlands/ Oak Woodlands**

The forest condition typical for the Flint Hills ecoregion is for relatively open forest stands having low basal areas. However, many of the installation's forests have transitioned to a more closed condition with higher stem and understory densities. This successional change to a higher climax stage is due in large part to reduced fire pressure on the forestlands from that of the pre-settlement period and the concurrent aging of the stands.

The overall strategy is to develop, maintain, and enhance open oak woodland in areas of the installation with site conditions appropriate for burning, and creating a ground cover with forbs, grasses, and oak sprouts. The prairie and woodland ecotone will be maintained through the use of periodic prescribed fire, encouraging oaks and other shade intolerant species.

### **Riparian, Mixed Hardwood Woodlands**

The strategy in forest stands where use of fire is problematic is to develop the stands into a late successional woodland habitat featuring leaf litter, forbs, shrubs, and shade tolerant species in the understory. A gradual shift toward dominance by hackberry can be expected in these woodlands over the next century. Large stands of deciduous woodland, especially those with a core habitat area greater than 10 ha, will be managed for area-sensitive woodland species. These woodlands will be managed to maintain a minimum canopy height of 16 m, and greater than 54% canopy closure. Where possible, these stands will be connected with other hardwood stands.

### **Savannas**

Implementing the strategy described for oak woodlands in section 9.2.1.2.1 will effectively maintain and promote savannas on Fort Riley. The strategy to combat woody encroachment into prairie described in section 9.1.1.4 will not impact areas defined as savannas. Savannas typically have oaks, American elm and green ash trees, 5-15% canopy coverage and average 25 trees/acre. Areas targeted for woody encroachment management actions generally have Siberian elm, eastern cottonwood, locusts and Osage-orange trees, 0.1-5% canopy coverage, and average less than 20 trees/acre.

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<sup>4</sup> Maintaining large, downed woody material within riverine forests is done to provide foraging locations for pileated woodpeckers.

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## SECTION 4.2: FOREST MANAGEMENT TOOLS

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The overall goal is to integrate prescribed burning, timber stand improvement (TSI), IPM and commercial harvest actions to sustain the training mission, promote Soldier safety, provide improved forest stand health, and achieve the desired end-state forest conditions.

### **Prescribed Burning**

The goals of prescribed burning of woodlands are to promote oaks regeneration within woodlands, maintain the grassland/prairie ecotone, and to suppress woodland expansion into the grasslands. Damaging woody plants in tree plantations and woody wildlife plantings will be avoided unless a specific prescription for removal of any such area is developed and approved as part of a training area-specific management plan.

#### ***Prescribed Burning Management Actions:***

- See section 3.2
- Prescribed burns of woodlands will occur in such a manner as to avoid damaging the pole-sized and larger trees that are within the woodlands.
- Fires will be suppressed in riverine, floodplain forest stands to maintain large, downed woody material.
- Prescribed burns will be conducted within oak woodlands to favor oaks regeneration and discourage competition from shade tolerant species.
- Wildfires and prescribed prairie burns may be excluded from some riparian mixed hardwood stands.

### **Timber Stand Improvement**

Timber stand improvement actions are undertaken to develop, maintain, and enhance woodlands in a perpetually productive state. Trees determined inferior due to their health status, form, and/or species are removed from woodlands through TSI practices. Such practices may include mechanical thinning by felling or girdling trees, and chemical or mechanical treatments to control understory vegetation. Thinnings may be used to improve the diffuse light environment near the forest floor, or to release dominant and co-dominant trees as the woodland approaches conditions that are overstocked. Trees selected for removal generally will not be immediately adjacent to stream channels.

#### ***TSI Management Actions:***

- A 50-year Forest Stands Management Plan will prescribe specific management actions for each of the installation's forest stands. Actions will consist of near-term management activities, predicted condition of each forest stand throughout the 50-year period, and forecasted long-term management activities within each stand. Plans will be implemented as they are completed.
- Thinning oak woodlands from below will target non-oaks in the understory and mid-story to favor oaks.

- A minimum of 40 square feet of basal area/acre and approximately 20-pole size trees/acre will be retained throughout the regime of prescribed burns and/or thinnings conducted on oak woodland stands.
- Crown cover of at least 50% will be maintained throughout the regime of prescribed burns and/or thinnings conducted on oak woodland stands.
- Dominants and co-dominants will be released by thinning riparian mixed hardwood stands. Those include hackberry, green ash, black walnut, chinquapin oak, bur oak and other trees exhibiting good form and high vigor.
- TSI practices will retain a minimum of 30 percent of existing mast and fruit bearing trees within a stand.
- TSI practices will retain snags, and trees with cavities or other attributes benefiting wildlife, when thinnings are performed.
- TSI tree felling will be completed for training support or safety.
- A number of mature trees that are in decline and are scarred, injured and have cavities, but are still wind firm, will be retained in the timber management areas for future snags within riparian mixed hardwood stands.
- Basal area per acre may be reduced to 65 square feet per acre during the initial thinning of a riparian mixed hardwood stands. The areas to manage for riparian mixed hardwood stands are shown in Figure 10 **Error! Reference source not found.**

### **Commercial Harvest**

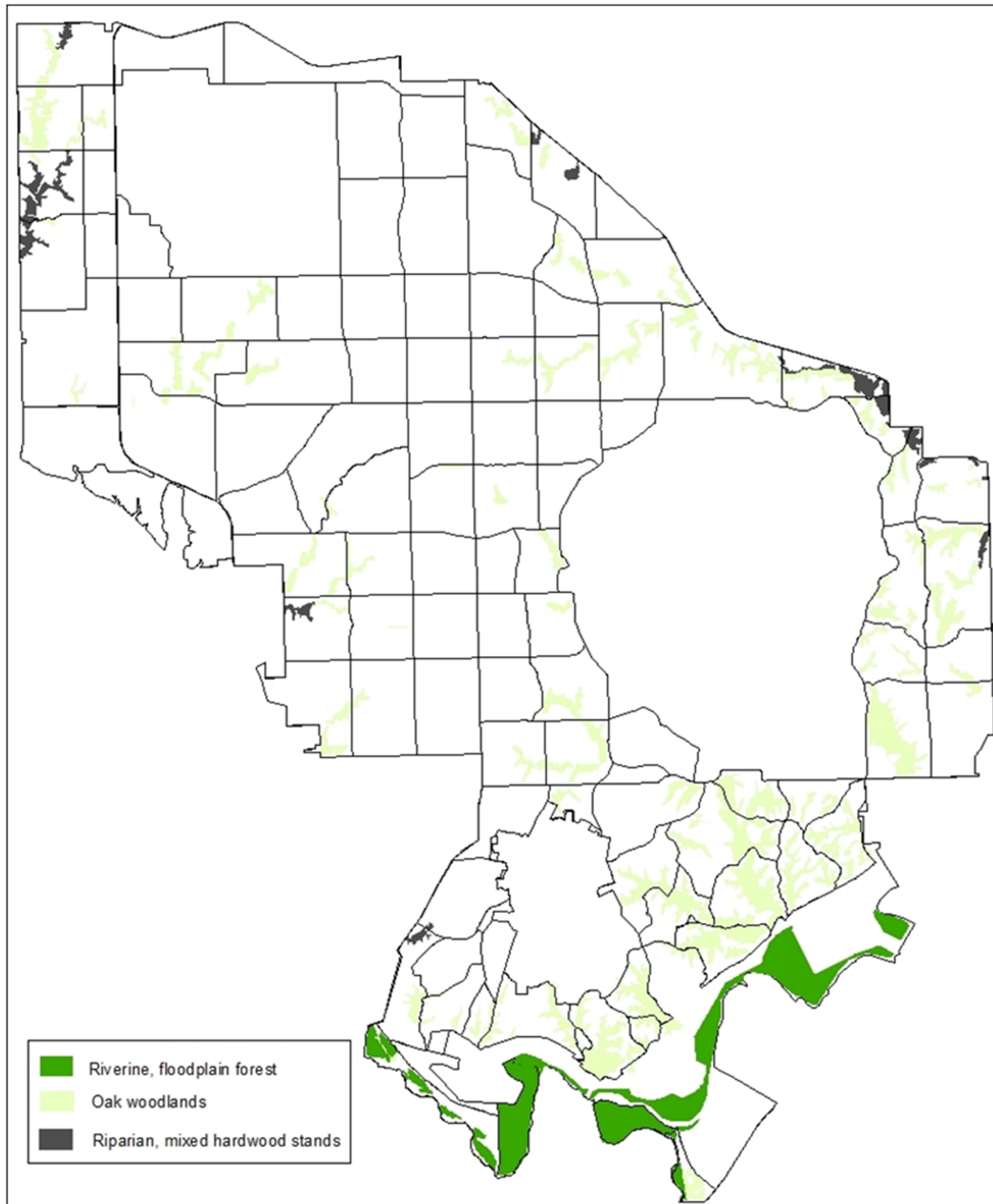
Commercial harvests will be employed to thin or regenerate a stand when merchantable timber is present and market conditions are favorable. Harvests will be performed by contract. Preparation and implementation of commercial timber harvests will occur according to the Forest Stand Management Plan.

Commercial timber harvests have the potential to affect cultural resources. Thus, these activities will be reviewed prior to execution in accordance with the procedures described in Appendix G.

### ***Commercial Harvest Management Actions:***

- Timber harvest conducted within riverine, floodplain forest will favor older, larger diameter living and dead trees in closed canopied stands.
- Trees to be commercially harvested will be selected and marked.
- The location of skid trails, log decks, and erosion control features will be identified.
- Each timber sale applicant will meet in person with Conservation Branch staff to discuss the proposed sale conditions and pertinent contract stipulations prior to being granted right-of-entry to the site.
- Timber harvests will be monitored and specifications consistent with contractual obligations will be enforced.

- Site impacts will be evaluated, and negative impacts to sites will be resolved.
- All proposed timber sales will be reviewed by and coordinated with the Cultural Resources manager.



**Figure 10 - Areas targeted to manage for riverine floodplain forest, oak woodlands, and riparian, mixed hardwood stands, where use of fire is problematic.**

### **Tree Planting**

Tree plantings may be used to restore cover after soil borrow projects are performed, to widen existing woodlands, or to rehabilitate degraded eagle habitat. New plantings may be performed by either contractor or in house staff, dependent upon the size of the planting and the scope of maintenance desired.

Planting and maintenance of trees have the potential to affect cultural resources. Thus, these activities will be reviewed prior to execution in accordance with the procedures described in Appendix G.

***Tree Planting Management Actions:***

- Increase width of riverine, floodplain forests to increase species richness; the most beneficial effects will occur when forests are 200-600 m wide.
- Where possible, connect riverine, floodplain forest stands with other hardwood stands.
- Maintain walnut forest plantings to include TSI thinnings and selective harvest.
- All proposed tree planting and tree plantation maintenance activities will be reviewed by and coordinated with the Cultural Resources manager.
- Supplemental tree plantings made within riverine floodplain forests will use cottonwood, sycamore and bur oak tree species.
- Maintain firebreaks around new tree plantings for the initial 5-8 years after first planted.

**Integrated Pest Management (IPM)**

See Section 5.4

***IPM Management Actions:***

- Perform forest pest surveillance and control.
- Implement Tartarian honeysuckle control plan, by applying foliar herbicide spray in late-fall while other trees are dormant, yet Tartarian honeysuckle remains active.
- Control sericea lespedeza established within woodland tracts.
- Survey for location of kudzu plants.
- Control kudzu plants.
- Emerald ash borer: Develop protocol and emerald ash borer response plan to implement if emerald ash borer is determined to be present on, or near Fort Riley.

## **CHAPTER 5: SPECIALIZED MANAGEMENT**

Fort Riley generally practices ecosystem-based habitat management practices to achieve the overall natural resources goals. The focus of ecosystem-based management activities is to manipulate vegetation and vegetative communities so that the floral and

faunal community associated with that ecosystem is favored rather than targeting specific wildlife species. However, certain activities will be performed with the intended benefit of specific species, or select groups of species or to support the installation's military training and testing missions. These activities, generally, will not conflict with the general policies established in Section 2.2 of adaptive ecosystem-based management practices accepted for use in the Flint Hills ecoregion. The overall strategy in performing these activities is to comply with the Endangered Species Act of 1973; with Executive Order 11990, *Protection of Wetlands*; with the North American Wetlands Conservation Act of 1989; with the Sikes Act (P.L. 86-797) and the Sikes Act Improvement Act of 1997 (P.L. 105-85); to meet specific military, terrain, fisheries and wildlife management objectives; and to enhance hunting and fishing opportunities.

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## SECTION 5.1: AGRICULTURE OUTLEASES

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### **Hay Fields**

Hay cutting in contracted leases is allowed on Fort Riley (Figure 7). The goals of hay-cutting are to maintain open space for military training, reduce the potential for wildfires, reduce and suppress woody plant encroachment onto the prairie, maintain wildlife nesting and brood rearing cover, reduce sericea lespedeza, reduce the installation's expense for grounds maintenance mowing, and respond to local and regional demand for livestock feedstock or possibly bio-cellular production. Hay-cutting is timed to reduce detrimental effects on breeding birds, provide adequate forage quality, provide adequate regrowth, and interrupt the development of viable noxious weed seed. Large, warm-season grasslands are mowed on a rotational system with some subunits left idle in each year rather than annually cut for hay. This not only provides rest and recovery for grasslands, but also provides habitat for species requiring litter build up and residual standing dead vegetation, such as the Henslow's sparrow and western harvest mouse.

Hayfields are harvested by contract within the terms of the Land Use Regulations of leases. Warm season grasses may be cut during the period of July 15 to August 31 each year. Designated areas may only be harvested in either odd calendar years or even calendar years. Those currently so designated are shown on Figure 7. Lessees are to follow the schedules designated on the Tract Maps they are provided.

Cool season grasses may be cut during the period May 1 to September 30 except in those areas infested by sericea lespedeza. In such areas, the cool season grasses may be cut only from May 1 to July 31. Only those areas harvested prior to June 20 are allowed to be cut a second time each season irrespective of infestations of sericea lespedeza.

A strip of unmowed vegetation that is at least 25-feet wide is left around the perimeter of firebreaks and food plots that are in areas cut for hay if the vegetation in that strip is not experiencing shrub encroachment. If an unmowed strip contains higher than desired quantities of shrubby vegetation, that entire strip may be mowed or otherwise treated in order to reduce the shrub component.



Lessees may improve or restore grassland areas within their respective leases, upon approval of the Conservation Branch. Restoration and improvement of grassland work may include brush control by mowing, reseeding of areas that were previously cultivated, overseeding of existing stands of grass, constructing permanent structures, removal of undesirable trees by cutting or clipping, and spraying noxious weeds, other undesirable plants or both.

Hay-cutting activities and activities to restore or improve grassland areas have the potential to affect cultural resources. Thus, these activities will be reviewed prior to execution in accordance with the procedures described in Appendix G.

### **Croplands**

The firebreak crop fields are generally grown and harvested by contracted producers (lessees) within the terms of the Land Use Regulations of leases. These crops are to be managed in a manner that provides for year-round fire protection, does not unduly expose the leasehold to erosion or infestation with noxious weeds, provides wintertime food for wildlife, provides reasonable opportunity for profit by lessees, and increases the biodiversity of the installation. Under normal circumstances, lessees may only plant grain sorghum, corn, soybeans or sunflowers. No-till farming may be utilized only if soybeans were the previous year's crop and only if the lessee receives prior approval.

To supplement the winter food supply of wildlife, currently issued contracts require that the lessee shall leave 8 to 16 rows of the crop grown standing in the field. The location of where the strips are located along the field edge to facilitate fall burning. Unharvested grain is left standing at least until March 15 of the year after it is planted. Within 10 days of harvest, the lessee tills a strip, as designated by the Conservation Branch, no more than one-half the width of the field, or 100-feet wide, whichever is less. The untilled portion of the field remains untilled until March 15 of the following year.

Repair of erosion that does occur is considered required firebreak maintenance. The leasehold shall be leveled periodically by the lessee using normal farm equipment. In addition, the lessee shall control any Kansas-listed noxious weed within the leasehold.

The lessee will plow the entire length of each constructed terrace in the even calendar years of the lease. Plowing will be conducted so as to move soil upward on both faces of each terrace. The requirement to mow waterways is removed from firebreak field leases. Conservation Branch staff or others contracted by the Conservation Branch will accomplish this work, as required.

Planting, cultivation and harvest of existing fields, firebreak maintenance activities, and activities to establish new firebreak fields have the potential to affect cultural resources. Thus, these activities will be reviewed prior to execution in accordance with the procedures described in Appendix G.

### **Agriculture Outleases Management Actions**

- Conduct pre-bid lease meeting open for all potential bidders.
- Meet, in person, with each lessee, to discuss the lessee's management plan, lease conditions, and Land Use Regulations, prior to granting the lessee right-of-entry to the leased property. Provide lessees an up-to-date access map.
- Monitor leases and enforce specifications consistent with Land Use Regulations.
- Provide a map of known sericea lespedeza infested areas within the lease to each lessee, as requested.
- Consult with and advise lessees who desire to perform conservation work associated with their lease.
- Hay-cutting activities and planned activities to restore or improve grassland areas will be reviewed by and coordinated with the Cultural Resources manager.
- Provide lessees a list of personnel within the DPTMS Range Support staff who are authorized to give access to the leased areas by February 1 of each year.
- Notify lessees of Army plans to perform maintenance or construction activities that would impact their lease(s).
- Annually inspect all firebreaks for renovation needs; plan to renovate structures, as needed, in all fields of two firebreak units per year.
- Review each firebreak field to ensure that existing buffer strips are functional. Establish functional filter strips where any are found to be inadequate.
- Remove scattered trees and brush along firebreak field edges to improve crop production.
- Complete scheduled repairs to existing structures (mostly terraces) in firebreak fields.
- Construct new firebreaks, as needed, to protect new ranges or other facilities.
- Planting, cultivation and harvest of existing fields, firebreak maintenance activities, and activities to establish new firebreak fields will be reviewed by and coordinated with the Cultural Resources manager.
- Establish terraces, silt traps, and waterways, as appropriate, on firebreak areas not leased.
- Annually review, amend and update the Land Use Regulations.
- Communicate with Command Group on hay harvest extension issue.
- Inspect firebreak waterways and mow as needed.

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## **SECTION 5.2: RARE SPECIES**

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Protection and management of rare species is conducted in accordance with the Endangered Species Act, the Kansas Nongame and Endangered Species Conservation Act, and the Bald and Golden Eagle Protection Act. The strategy is to implement the installation's management plans (Appendix C).

**Threatened & Endangered (T&E) Species Management Actions**

- Consult with the USFWS on actions not covered herein that may affect federally-listed species.
- Conference with the USFWS on actions not covered herein that may affect federally proposed or candidate species.
- Discuss with KDWP on actions not covered herein that may affect Kansas-listed species.
- Maintain updated GIS habitat maps and data layers for all T&E species.
- Report all observations of state-listed species to KDWP.

**Piping Plover**

- Establish a "*no disturbance*" buffer zone to protect nesting piping plovers, if any are found.
- Construction, operations and maintenance activities, demolition, operation of vehicles, detonation of explosives, and recreational pursuits will be controlled to protect sandbars from adverse impacts.
- Report to the USFWS Kansas Field Office and KDWP all observations of piping plovers on Fort Riley.

**Topeka Shiner**

- Consult with the USFWS prior to construction of water-impounding structures on any stream identified in Appendix C, Figure 2.
- Enforce prohibition of bait-fish collection.
- Protect all streams shown in Appendix C, Figure 2 from activities that result in channel destruction or alteration, increase water turbidity, or remove vegetation filter strips.
- Control construction, operations and maintenance, demolition, operation of vehicles, timber harvest, detonation of explosives, and recreational pursuit activities within 50 feet on either side of the streams shown in Appendix C, Figure 2.
- Monitor stream habitat and restore as needed. Restoration actions that may be required include bank reconstruction, establishing revetments, and/or planting vegetative filter strips at least 50-foot wide.
- Activities to restore or improve stream banks will be reviewed by and coordinated with the Cultural Resources manager.

- Construction and maintenance of roads and hardened, low water fords will follow protocol approved by the USFWS in road maintenance consultations conducted in 2001 (see Appendix C, section 3.4.2.5).
- Partner with the Riley County Conservation District to achieve actions off-post within the Wildcat Creek watershed that will improve habitat conditions on Fort Riley.

### **Northern Long-eared Bat**

- Conservation Branch personnel will survey for northern long-eared bats utilizing acoustic and visual methods. All observations, including sighting reports from non-affiliated personnel, will be maintained in maps and GIS databases.
- Adhere to protocol identified within the White-nose Syndrome (WNS) National Plan <https://www.whitenosesyndrome.org/response-plans/-a-national-plan-for-assisting-states-federal-agencies-and-tribes-in-managing-white-nose-syndrome-in-bats-the-national-wns-plan> to address slowing the spread of white-nose syndrome. Under no circumstances should clothing, footwear, or equipment that was used in bat hibernaculae from a WNS affected region be used on Fort Riley.
- If a northern long-eared bat is documented on Fort Riley, implement the conservation practices described in Section VI of the 2015 U.S. Army Environmental Command Biological Evaluation (see Appendix C) concerning military smoke and obscurants, pesticide use and pest control. In instances where a desired action is not described in the Biological Evaluation, or effects are anticipated that are different from those described, the installation will consult with USFWS prior to initiating that action.

### **Whooping Crane**

- Monitor local bird sighting reports to stay apprised of incidents when whooping cranes are present in areas where Fort Riley aircraft may operate. Additionally, Fort Riley staff requests USFWS and KDWP provide similar confidential reports received.
- Restrict aircraft flight when whooping cranes are present. A "*no fly*" buffer zone will be established and maintained around the area being used by one or more whooping cranes. An altitude restriction of 2,000 AGL will be in effect for the "*no fly*" zone, with the width ranging from 0.5 NM (nautical miles) to 1.5 NM.
- Inform pilots when "*no fly*" zones are in effect through Local Notice to Airmen (NOTAMs).
- Provide educational material to Fort Riley personnel to recognize whooping cranes, and be made aware of the importance of promptly reporting encounters with this bird in the field.
- Any projects to construct new or modify existing aerial structures will be reviewed by Conservation Branch prior to project implementation for need of re-siting or incorporating line markers.

**Bald Eagle Management Actions**

- Maintain updated GIS habitat maps and data layers for eagle species.
- Any projects to construct new or modify existing aerial structures will be reviewed by Conservation Branch prior to project implementation for need of re-siting or incorporating line markers.
- Any projects to construct new or modify existing electric transmission lines will be reviewed by Conservation Branch prior to project implementation for need to incorporate construction guidelines specified to protect eagles against electrocution.
- Construction, demolition, off-road operation of vehicles, timber harvest, detonation of explosives and recreational pursuits will be controlled within “*minimum disturbance*” buffer zones when eagles are in the Fort Riley area.
- Follow USFWS National Bald Eagle Management Guidelines.
- Protect trees required to maintain integrity of communal roosts.
- Minimize nesting conflicts on human-made structures.
- Protect bald eagles from chemical impacts.
- Provide information to aviators through Local NOTAMs.
- Selective thinning and other silviculture management practices designed to conserve or enhance habitat, including prescribed burning close to the nest tree, will be undertaken outside of the nesting and breeding seasons. Precautions will be taken to prevent crown fire or fire climbing the nest tree.
- Timber harvesting operations, including road construction and chain saw operations, will be avoided within 200 m of a nest during the breeding season.
- Maintain Fort Riley’s Eagle Incidental Take Permit (PER0029485) that allow for military and construction activities to continue in designated nesting territories and monitor those activities for compliance.

**Eastern Black Rail**

- Conservation Branch will survey for the eastern black rail and its habitat. All observations, including sighting reports from non-affiliated personnel, will be maintained in GIS databases.
- Any activities, projects, or construction that eliminates or greatly degrades impoundments or constructed wetlands on Fort Riley will be reviewed by Conservation Branch staff prior to project implementation to determine effects on potential eastern black rail habitat.
- Locations of reported sightings will be evaluated to obtain habitat descriptions of the sighting location. Data collected will be recorded in order to create a more specific habitat description used by this species on Fort Riley to improve species

tracking and identification. Such information can then be referenced when considering future actions that require NEPA analysis.

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### **SECTION 5.3: FORT RILEY SPECIES AT RISK MANAGEMENT ACTIONS**

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#### **Henslow's Sparrow**

- Tracts of land known to be used for nesting will be designated as Henslow's sparrow breeding habitat. Fort Riley will retain unburned grasslands within Henslow's sparrow habitat areas annually. Specific locations selected for habitat protection will vary annually, to allow all grasslands to receive appropriate management actions.
- Woody encroachment into grasslands reduces the habitat quality of grasslands. Woody encroachment will be reduced through cutting of trees scattered through grasslands, and mechanical and chemical treatments to reduce shrub encroachment into grasslands, to the extent appropriate.

#### **Regal Fritillary**

- Prairie areas containing a variety of wildflowers, particularly the species identified as preferred food plants for regal fritillaries, will be identified and maintained.
- Dense, monoculture stands of sericea lespedeza reduce the numbers of milkweeds, violets and other native forbs growing in grasslands, apparently creating conditions less suited for regal fritillaries and not to the known benefit of any other native species or the military mission. Woody encroachment, including encroachment of shrubs, into grasslands while providing benefit to other native species, reduces available habitat for regal fritillaries and provides little benefit to the military mission. Therefore, the presence of sericea lespedeza will be reduced to the extent feasible and woody encroachment will be reduced to the extent appropriate.
- Infestations of noxious weeds and encroachments of woody species will be controlled through the use of mechanical and chemical treatments, to the extent feasible. Practices may include burning, mowing, spot-spraying herbicides, or a combination of these. Late-winter and early-spring burns will favor growth of wildflowers. Regal fritillary grassland tracts may be best maintained by prescribed burning two out of every five years.
- Aerial spraying to control sericea lespedeza will generally be restricted to those fields identified as "go-back" or brome by Freeman and Delisle (2004). Spot and patch, or direct, ground-spraying by truck, ATV, or backpack equipment will generally occur in fields identified as native prairie. When circumstances require aerially spraying in tallgrass prairie parcels, the spraying action will occur in late-summer, when most violets and other flowering forbs have already senesced, to minimize the effects on these important food plants to regal fritillaries.

### **Texas Horned Lizard**

- Visit locations of reported Texas horned lizard sightings to obtain habitat description of sighting location. Maintain log of habitats from which sightings are recorded to create more specific description of actual habitats used by this species on Fort Riley. Such information can then be referenced when considering future actions that require NEPA documents.
- Refrain from using insecticides in settings away from cantonment areas.

### **Rusty Blackbird**

- Survey for rusty blackbirds. All observations, including sighting reports from non-affiliated personnel, will be maintained in GIS databases.
- Locations of reported sightings will be visited to obtain habitat descriptions of the sighting location. Data collected will be recorded in order to create more specific description of actual habitats used by this species on Fort Riley so specific habitats utilized by the species can be tracked and identified. Such information can then be referenced when considering future actions that require NEPA analysis.
- Implement protocol to effectively control Tartarian honeysuckle within woodlands.
- Rusty blackbirds are known to forage in agricultural fields during migration and on their wintering grounds. Activities that establish agricultural crops and maintain available grain throughout the winter benefit rusty blackbirds by providing a winter food source while this species is present on the installation. Fort Riley will maintain cropped fields to serve as firebreaks around the installation's perimeter in such a manner as to retain grain throughout the winter.

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## **SECTION 5.4: ALL OTHER MANAGEMENT PLANS**

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### **Terrestrial Habitat**

The strategies to enhance terrestrial habitat characteristics are to provide supplemental food for wildlife, manage forbs, provide nesting and roost structures, remove obstructions and safety hazards, and report abandoned concertina wire to Range Control. Additional terrestrial habitat strategies center on locating and controlling noxious weed infestations.

Smooth brome dominated landscapes tend towards monoculture stands with little to no forb species. In an effort to improve grassland habitat, Fort Riley staff will continue to selectively spray stands of smooth brome with glyphosate. Applications of glyphosate (41%) at a rate of 36-40 oz in 10-20 gallons of solution per acre were broadcast in early winter after temperatures were cold enough to ensure that the native, warm-season grasses and forbs were dormant. Field assessments were done in all of the areas sprayed. Reduction in smooth brome competition was observed. The reduced competition resulted in exceptional, diverse stands of healthy native warm-season grasses and forbs. Areas with severe infestations of brome had markedly increased compositions of annual forbs while areas with moderate brome infestations supported an increased composition of perennial warm-season grasses and forbs, to include milkweed

species. Due to the recolonization of brome into treated areas, subsequent treatments are deemed necessary.

### ***Terrestrial Habitat Management Actions***

- Prepare an annual plan for planting/maintaining established food plots.
- Plant elk plots (totaling approximately 130 acres) in traditional elk travel corridors entirely to corn, soybeans, wheat, or winter peas for crop rotation and weed management.
- All food plots will be managed in conformance with the USFWS regulations concerning baiting, promulgated under Title 50 Code of Federal Regulations, Part 20.11.
- Pollinator food plots (158 plots totaling 500 acres) will be mowed/sprayed as needed to maintain quality.
- Continue to use glyphosate in smooth brome dominated landscapes in order to improve composition and diversity of perennial warm-season grasses and annual and perennial forbs.
- Activities to establish new food plots, will be reviewed by and coordinated with the Cultural Resources manager.
- Nesting structures will be cleaned and prepared prior to the start of the respective breeding season for eastern bluebird and purple martin.
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### **Pond and Lake Habitat**

The strategy for enhancing pond and lake habitat revolves around maintaining or increasing angling opportunities.

### ***Pond and Lake Habitat Management Actions***

- Mechanically remove trees from pond dams, as needed. Apply herbicides to cut stumps to prevent re-sprouting.
- Perform necessary modifications so that Rush Pond retains water.
- Chemically-control cattails where necessary. When possible, mow cattails prior to chemical application to enhance effectiveness of herbicide.
- Implement measures to correct fish populations, bio-mass and species assemblages, as indicated by results of annual fish monitoring actions.
- Renovate existing degraded ponds.

### **Stream Habitat**

The installation complies with all state and federal management requirements in projects that either directly or indirectly affect the water quality of its streams. The primary water quality strategy on Fort Riley is to minimize sedimentation of installation streams from both point source and non-point sources.

### ***Stream Habitat Management Actions***

- See 9.3.2.1.2., Topeka shiner.



- Establish vegetated filter strips, where needed, along streams.
- All proposed filter strip planting and maintenance activities will be reviewed by and coordinated with the Cultural Resources manager.
- Use best management practices to reduce silt transport during repair and construction of infrastructure.

### **Wetlands Habitat**

The strategies for wetland habitat management are to comply with wetlands laws and regulations, protect existing wetlands, create new wetlands, rehabilitate degraded wetlands, and use moist soil management principles to manage wetlands.

#### ***Wetlands Habitat Management Actions***

- Plant native grasses to provide wildlife nesting habitat adjacent to wetlands.
- All proposed grass planting and maintenance activities will be reviewed by and coordinated with the Cultural Resources manager.
- Perform NEPA documentation and obtain applicable federal and state permits for any action affecting wetlands other than wetland management actions (e.g., seasonal draw-downs, re-flooding, and planting native grasses).
- Seasonally conduct draw-down and re-flooding of shallow-water wetlands, managing these according to standard moist soil principles.
- Manage appropriate portion of Firebreak 3-11 wetland as an ephemeral or vernal pool wetland.

### **Nuisance Animal Control and Management**

Wildlife and feral animals on occasion conflict with Fort Riley residents. Nuisance complaints are most commonly received about birds in buildings, and skunks, raccoons and opossums in garbage cans or beneath buildings. Other complaints include snakes, bats, foxes, coyotes, rodents, and burrowing mammals. Feral cats and dogs are not considered major problems. European starling and pigeons are controlled as needed in hangers and other buildings. There are no other known exotic animal species present on Fort Riley that require control. However, feral swine were formerly present until extirpated in 2000. If they were to become reestablished, measures to remove them from Army property would be resumed. Stray animals control is outlined in Fort Riley's Integrated Pest Management Plan (Appendix E)

#### ***Nuisance Animal Control and Management Actions***

##### **➤ Birds**

- Fort Riley operates under an Inter-Agency agreement with USDA Aphis Wildlife Services to provide nuisance wildlife control.
- Fort Riley's Residential Communities Initiative partner (Corvias) hires local pest control contractors to resolve bird issues in housing areas.

- USDA-Wildlife Damage Control (WDC) Staff obtain special purpose permits from USFWS allowing personnel to handle migratory birds, and to take a limited number of nests (depredation) in garrison and tenant buildings.
- Removal of animals, insects, and their associated debris from buildings and structures will be reviewed by and coordinated with the Historic Architect, where appropriate.
- USDA-WDC will transport injured raptors to rehabilitators.
- USDA-WDC will investigate calls concerning alleged abandoned fledgling birds in garrison and tenant buildings; Corvias's contractor will handle similar calls from housing areas.
- USDA-WDC will conduct a non-lethal harassment program to move large roosts. The program will use pyrotechnics to move the roost, and is effective for 2,000-3,000 birds.
- USDA-WDC will use toxic bait to control European starlings and rock pigeons in hangars. Bait used will be species specific to blackbirds, and effective for pigeons, and will not provide secondary poisoning opportunities.
- USDA-WDC will use a pellet rifle to take individual, non-native birds that are a problem. Generally these birds are pigeons and starlings.
- USDA-WDC will install bird exclusion apparatus to minimize bird habitation of buildings.
- USDA-WDC will remove active, non-native bird nests whenever building occupants register complaints.
- Active barn swallow nests being used generally will not be removed. Exceptions may be made for nests near hospital entrances or food service areas, where bird excrement and territorial displays may lead to human health concerns.
- USDA-WDC will remove cliff swallow nests from structures only after fledglings have left nest.
- **Urban Coyote and Fox Management Plan**
  - USDA-WDC, in coordination with DES Conservation Law Enforcement Officers, will conduct surveillance of cantonment areas for problem coyotes and foxes. Problem coyotes are animals that have lost their fear for humans. Problem foxes are animals that den in or near areas frequented by children.
  - Removal is implemented when bold coyote behaviors are exhibited. If disease is suspected, the animals will be dispatched and tested for rabies and canine distemper.
  - Continuously provide educational materials to nearby residents to warn parents of the dangers of children playing with fox kits, as needed. If the education campaign is unsuccessful in keeping children from the kits, the foxes will be captured and euthanized.
- **Skunks, opossums, raccoons**

- USDA-WDC responds to complaints of skunks, opossums and raccoons. The response will vary dependent on the nature of the complaint. In cases where an animal is reported to be sick or cornered in a location, USDA-WDC is to get to the complaint location as soon as possible and capture the animal. In most other instances, the USDA-WDC will go to the complaint location the next working day to set traps for the intruding animal. Animals that are captured will be euthanized. When rabies is suspected, samples will be taken for laboratory analysis.
- **Feral and Exotic Animals**
  - Feral cats and dogs, when captured, will be taken to the Fort Riley Veterinary Clinic. The clinic will determine if an animal is fit for adoption or should be euthanized.
  - Baseline surveillance for sign will be continued to detect the presence of feral hogs on Fort Riley. Aerial elk and deer surveys will also be used to look for feral hogs.
- **Beavers**
  - USDA-WDC consults with the Conservation Branch on a case by case basis to address beavers in wetlands. The following options are considered: removing all beavers and associated beaver construction projects; allowing all beavers to remain and adjust level of beaver pond by use of pond levelers; or selectively removing some, but not all of the beavers.
- **Bats**
  - Corvias' Pest Contractor will handle all bat issues in housing areas. USDA-WDC will respond to all bat issues in garrison and tenant buildings.
  - Bats will be excluded from buildings. Minor exclusion procedures, e.g., installing foam and screens, will be performed by USDA-WDC and the DPW's pest control contractor. More complex procedures will be implemented by pest control contractors.
- **Deer/ Elk**
  - KDWP is the principle point of contact with adjacent landowners who complain of elk depredation that occurs off of the installation.
- **Gophers**
  - USDA-WDC will conduct integrated control measures in cantonment areas where gophers create health and security hazards, or where excessive activity leads to aesthetic concerns. Such areas include parade fields, athletic fields and berms. Control measures will include trapping and subterranean placement of strychnine baits. Control efforts will target the entire area of local infestation rather than only the area of immediate concern. For example, rather than treating only the perimeter of parade fields where gopher mounds are visible from the road, the entire parade field will be treated.
- **Ground squirrels, badgers**

- USDA-WDC will remove problem ground squirrels and badgers from the flood levees, MAAF and other areas where their presence poses problems.

### **Cantonment Area Management**

The Installation Design Guide and the Landscape Master Plan (LMP) are Fort Riley's principal planning documents for cantonment area management. The LMP presents background information on landscape maintenance, planting techniques, pruning, fertilization, disease and pest treatment, and planting design guidelines. The strategy is to improve the appearance of the installation and facilities by appropriate landscape development and develop, initiate and maintain progressive programs for grounds management, utilization, and conservation.

A Programmatic Agreement (PA) has been negotiated between Fort Riley and Kansas' State Historic Preservation Officer on management of the Historic District. This agreement incorporates the Historic Landscape and Cultural Resource Management Plans by reference into the PA. The Historic Landscape Management Plan delineates the boundaries and targeted landscape objectives applied to the District. The overall strategy in the Historic District is to plant and maintain the landscape to coincide with historic landscape design, plant palettes, and possible use patterns.

### ***Cantonment Area Management Actions***

- Landscape plantings will include fruit and seed producing trees, shrubs and flowering plants. All plantings will be planned and conducted to minimize shelter for skunks, raccoons, and snakes, and to increase viewing and diversity of migratory songbirds.
- Removing and replacing plant materials that occur within the Historic District will be reviewed by the Cultural Resources manager and coordinated through the Management Agronomist.
- Update urban forestry inventory and management database, identifying hazard trees for pruning or removal as funding is provided.
- Spray tree species for pest infestations, as needed and evaluated through Integrated Pest Management principles.
- Coordinate mosquito control with the Medical Activity (MEDDAC) Preventive Medicine Branch. Preventive Medicine monitors mosquito levels, and orders that control actions be initiated when mosquito populations exceed threshold levels.
- Manage pest control contract to control "weedy" species along roads, parking areas, and other cantonment areas, and to control trees along levees.

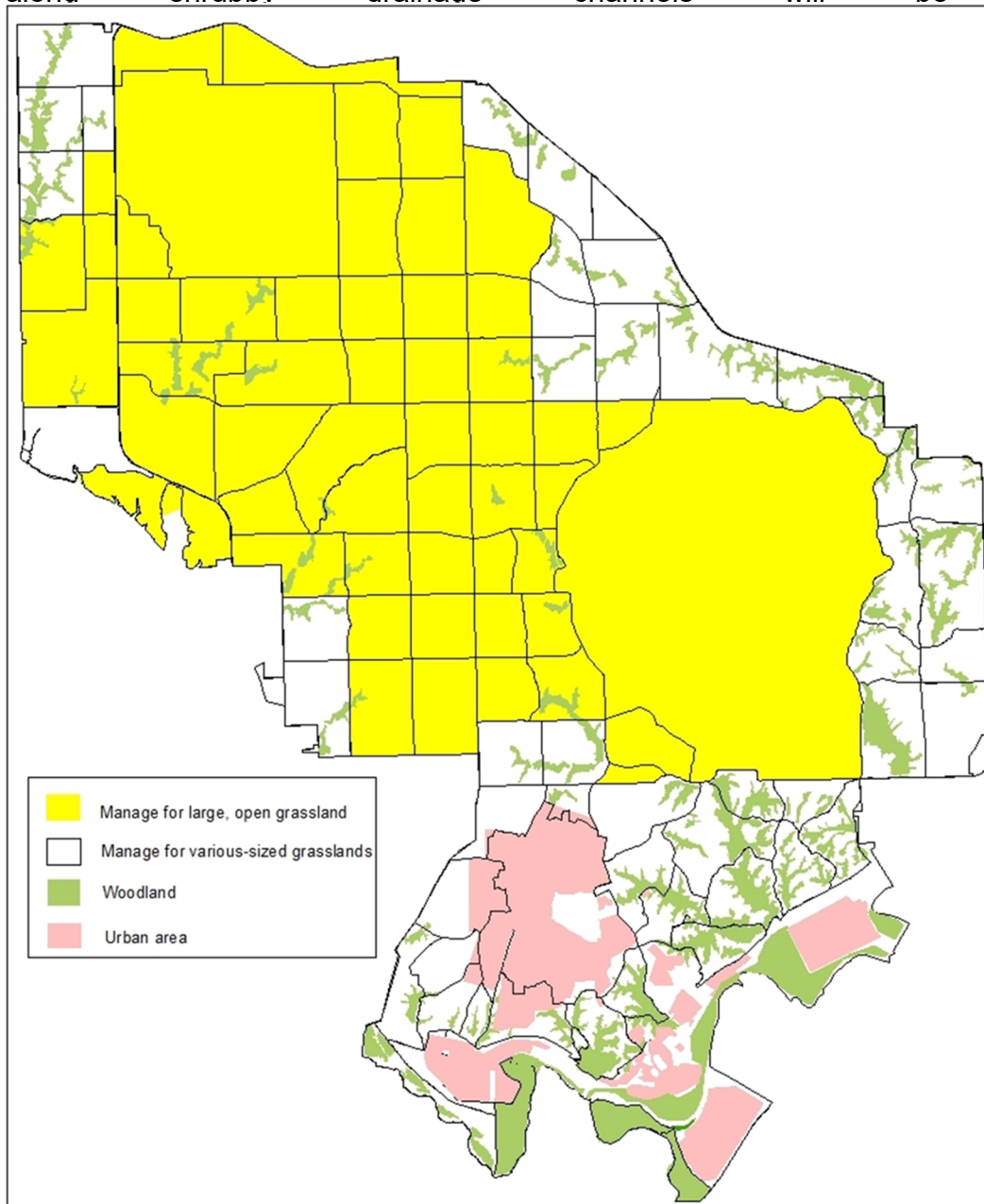
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## **SECTION 5.5: LANDSCAPE-SCALE MANAGEMENT SUMMARY**

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All of Maneuver Areas E, H, J, K, L, O and Q, the Douthit Gunnery Complex Box and parts of Maneuver Areas A, B, D, G, and N (Figure 11) will be managed to favor tallgrass species and native prairie in a predominately open grassland of large field size. Wooded

areas will be restricted predominately to the riparian corridor of the larger streams and drainage channels that bisect the grasslands. The spatial extents of the wooded areas associated with streams and drainage features and shrub patches will be reduced moderately overall. The number of individual wooded features present within these maneuver areas will be moderately reduced. Hedgerows bisecting grassland fields and woodlots associated with formerly used home sites that are surrounded by grassland fields will be commonly eliminated or converted to shrubby features. Individual shrub fields greater in size than one acre will be severely reduced, with the objective to reduce the landscape level shrub component outside of woodlands to less than 0.35%. Almost all trees that are scattered within grassland fields and many of the larger trees within and along shrubby drainage channels will be eliminated.



**Figure 11 - Areas targeted to manage for large grassland tracts, woodlands, and grasslands of various sizes.**

It is anticipated that the overall spatial extent of wooded areas in these areas will be reduced by less than 10% during the life of this plan, with most of the decrease being due to reduction of spatial extent of shrub patches. The area comprising cropland in these areas will remain nearly constant during the life of this plan. Water resources such as ponds will not be developed in areas that drain to Topeka shiner streams.

All of Maneuver Areas C, F, I, M and P, all of Training Areas 3-17, and 19-24, and parts of Maneuver Areas A, B, D, G, and N (Figure 11) will be managed to favor tallgrass species and native prairie in grassland fields of a variety of sizes. These grassland areas will be interspersed, sometimes extensively, with wooded areas composed predominately of trees. The spatial extents of woodland areas currently present within these areas will be reduced slightly. Most trees that are scattered within grassland fields will be eliminated, while only a few hedgerows bisecting grassland fields, and woodlots associated with formerly used home sites will be removed. Such wooded features generally will only be eliminated when necessary to allow construction of desired infrastructure and when a single such feature bisects a grassland field that is considered not to be high-quality habitat for a species in decline only because it is bisected by that wooded feature. Individual shrub fields greater in size than one acre will be severely reduced, with the objective to reduce the landscape level shrub component outside of woodlands to less than 0.50%. It is anticipated that the overall spatial extent of wooded areas in these areas will be reduced by less than 15% during the life of this plan, with almost the entire decrease being due to reduction of spatial extent of the invasive shrubs. The area comprising cropland in these areas may increase by up to 5% during the life of this plan. Water resources such as ponds may be developed in these areas, but will not increase in overall coverage by more than 10% during the life of this plan. If developed, ponds will generally be for the principal purpose of enhancing erosion control and will not impound waters inhabited by Topeka shiners.

All of Training Areas 1, 2 and 18 (Figure 11) will be managed to favor riverine floodplain forest. The spatial extents of woodland areas currently present within these areas will be increased. It is anticipated that the overall spatial extent of wooded areas in these areas will be increase by approximately 5% during the life of this plan, with almost the entire increase being due to expansion of spatial extent of the invasive shrubs.

**CHAPTER 6: GENERAL INVENTORY AND MONITORING**

Continued monitoring of species and habitats is necessary to provide data about the effects of management actions and military training on the land. Inventory is conducted to attain indicators of overall ecosystem integrity, capability of lands to sustain military missions, renewable product surpluses, and status of sensitive species and habitats. The strategy is to regularly monitor the important resources to determine trends, distribution,

and impact of land uses upon those resources, and apply resultant data to implement adaptive ecosystem management strategies.

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### **SECTION 6.1: FLORA INVENTORY AND MONITORING**

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- The Vegetation Planning Level Survey is conducted approximately every 10 years to assess the status of Fort Riley's floral composition and to inventory and map certain species across the installation. The most recent survey was conducted by the Kansas Biological Survey in 2012.
- The ITAM program will monitor bare ground and potential erosion concerns across the installation. ITAM is the primary component to repair and reseed such areas.
- Re-evaluate installation-wide density and coverage of sericea lespedeza.
- Conduct forest stands inventories.

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### **SECTION 6.2: FAUNAL INVENTORY AND MONITORING**

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- Faunal species surveys are all conducted by in-house staff generally on an annual basis
- Surveys for Topeka shiners are required by the 2002 Road Maintenance Biological Opinion. Surveys for other sensitive species are highly critical in importance due to their potential to affect Fort Riley's military mission.

#### **Fish**

- Electrofish to sample fish communities in Moon and Breakneck lakes and Beck and Vinton ponds.
- Electrofish to sample fish communities in LaGrange, Avery and Stone ponds.
- Every fifth year, electrofish to sample fish communities in Funston Lake and Dale, Goens, Pritchard, Stortz, Blue, Gaches and Rich ponds.
- Analyze data of fish inventory and recommend actions based upon the data collected.

#### **Upland Game**

- Conduct spring whistle counts for northern bobwhite.
- Conduct spring crow counts for ring-necked pheasant.
- Conduct lek counts for greater prairie-chicken from late-March to late-April. Standardized routes will not be established. Lek counting routes will be driven in each Maneuver Area with large grassland tracts, with each Maneuver Area surveyed twice. Any active lek located by sound will be visually confirmed and marked on a map. If time and circumstance allow, flush counts will be made on each lek.
- Conduct fall covey counts for northern bobwhite.

**Big Game**

- Conduct elk aerial surveys each winter to determine total population size, antlered-to-antlerless ratios, and the breakdown of age classes of bulls.
- Conduct annual nocturnal deer spotlight surveys following standardized routes, late in the autumn.

**Threatened and Endangered Species**

- Surveys to locate piping plovers will be performed every 7-10 days between April 15 and May 15 and between July 10 and August 31. Survey sites view approximately 40% of Milford Reservoir's shoreline on Fort Riley and more than 76% of riverine sandbar habitat.
- Annually monitor existing sandbar habitat, documenting suitability for least terns and piping plovers.
- Update GIS map layers on the server.
- Float the Kansas and Republican rivers before July 1 each year to search for nesting least terns and/or piping plovers. If a nesting attempt is confirmed, monitor it weekly to determine its status and outcome.
- Surveys for Topeka shiners will be conducted every other year in streams in which this species has been found. Surveys will be conducted a minimum of one out of every five years in streams in which Topeka shiners have not been found.
- Execute surveys for northern long-eared bats, as described in Section 8.5 of Appendix C.
- Periodically survey for eastern black rails in the spring and fall in areas where the species has been previously found or where apparently suitable habitat exists.

**Bald Eagles**

- Search for bald eagle nesting activity December through March. Monitor any active eagle nest to determine the status and outcome of the nesting attempt. Notify the USFWS Kansas Field Office of the nest discovery and updates of nesting activity.
- Weekly, survey bald eagle use of diurnal habitat when wintering eagles are expected to be present on Fort Riley.
- Weekly, monitor nocturnal roosts when wintering bald eagles are in the area, generally from October 15 to March 15.

**Rare Species**

- Surveys for Henslow's sparrows will be conducted during the breeding season, approximately May 15 to August 31. A quantitative survey methodology will be used to locate Henslow's sparrows.



- Loggerhead shrike abundance data will be collected incidentally while performing other surveys.
- Surveys for regal fritillaries will be conducted in native tallgrass prairies. Record the numbers of regal fritillaries seen, as well as areas containing appropriate food plants for both adults and caterpillars.
- Data collected will be maintained in a database updated annually.
- Sighting records for all rare species, such as the rusty blackbird, Texas horned lizard and white-faced ibis, will be collected and maintained when these species are observed incidentally to other fieldwork.

### **Migratory Birds**

- Conduct surveys for breeding birds.
- Conduct winter raptor surveys along four standardized routes each year from January 1 to mid-March.
- Monitor use of nesting structures (eastern bluebird, purple martin).
- Conduct Christmas Bird Counts on Fort Riley following standard protocol.

### **Small Mammals**

- Monitor use of bat roosting structures.

### **Amphibians and Reptiles**

- Conduct amphibian calling survey.
- Conduct installation-wide one day survey in early-May.
- Annually survey vernal pools for species' use.

### **Aquatic Surveys**

- KDWP monitors selected streams on Fort Riley as part of a state-wide program to monitor and assess streams throughout the state. These surveys have been conducted every two years since 1990.

### **Invertebrate Surveys**

- Coordinate annually with USDA-APHIS (Animal and Pest Health Inspection Service) to install traps on Fort Riley for invasive, non-native insects, at targeted movement areas.
- Inspect woodlands to determine extent of spread when forest pests are present.

### **Wildlife Harvest Monitoring**

- All persons hunting small game, waterfowl, deer, elk and turkey are required to submit harvest records each day they hunt. This data is submitted electronically via iSportsman. Game harvest and angler/hunter participation will be monitored to assess a variety of biological and non-biological elements related to harvest management strategies.
- Manage and update iSportsman web portal.
- Angler activity and fish harvest will be monitored via iSportsman.
- Firearms deer hunters are required to report harvested deer data via iSportsman. Data collected from harvested deer include gender, antler measurements, and harvest location of deer.
- Hunters are required to report beard size, and spur length of all spring turkeys harvested. These data will be compiled and summarized and used to make comparisons from year to year.

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### **SECTION 6.3: OUT YEAR PROJECTS**

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- Perform 10-year review and update of installation's floristic Planning Level Survey (PLS).
- Update sericea lespedeza coverage.
- Analyze efficacy of seasonal burns on Sericea lespedeza control.
- Perform 10 year review and update of installation-wide Forest Planning Level Survey.
- Perform a PLS to document the extent of salt cedar (Tamarisk) invasion along the Kansas River and its woodlands.
- Perform timber rattlesnake survey.
- Perform hognose snake survey.
- Perform and update Urban Forest and Plant Inventory.
- Conduct DNA analysis of Fort Riley's elk herd.
- Investigate seasonal migrant species monitoring strategies.
- Assess array and abundance of pollinator species present on Fort Riley

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### **SECTION 6.4: PAST AND PRESENT ACADEMIC RESEARCH PROJECTS**

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Research is conducted on Fort Riley to provide scientific and statistically rigorous data analysis to assess effects of the military mission on natural resources, assess and evaluate the effects of natural resources management decisions, and enhance the understanding of natural resources functions for adaptive management.

Fort Riley cooperates with various entities to conduct scientific research directed to installation specific natural resources management issues. The primary mechanism has

been through local and regional academic institutions. Some have been fully funded by the U.S. Army or cooperating partners, conducted in whole on the installation. Others have been part of a regional effort funded through other mechanisms as a broader effort.

### **Academic Institution Research Projects**

Recently completed or ongoing academic research projects that have been undertaken:

- KSU CO-OP Unit study to evaluate regal fritillary habitat and perform regal fritillary density estimation on Fort Riley was completed in 2016. Much of the protocol used to assess those parameters has been continued to date by in-house personnel.
- KSU CO-OP Unit study to evaluate Greater Prairie-Chicken responses to natural and anthropogenic disturbances fieldwork was completed in the fall of 2021. Data analysis and write up for this project should be completed early in 2022.
- Access and assistance for a SERDP (Strategic Environmental Research and Development Program) study spearheaded by the University of Nebraska-Lincoln investigating global climate change was provided. The study objectives are to develop models to detect ecological regime shifts, identify components of adaptive capacity relevant to resilience, and identify species and techniques that may serve as leading indicators of thresholds of changing ecological regimes.
- Idaho CO-OP Unit study to evaluate variation of migration distances of rough-legged hawks was initiated in 2020 and is scheduled to continue through 2023. Fort Riley was used as a trapping location, three birds were fitted with GPS transmitters in 2020.
- SERDP Project RC-2702: Full Cycle Phenology: This Strategic Environmental Research and Development Program (SERDP) project investigated potential climate change effects on American kestrels (*Falco sparverius sparverius* and *F.s. paulus*) on Department of Defense (DoD) lands across the nation. Kestrels are relatively abundant on many installations, are relatively easy to capture and monitor in nest-boxes, and show differential responses to climate change across their range. DoD Legacy Resource Management Program-Project Number 17-838: DoD Snake Fungal Disease Survey-Natural Resource Manager Training and Data Collection. Ophidiomycosis (formerly referred to as Snake Fungal Disease, SFD), an emergent pathogen on the North American landscape poses a threat to snake population health and stability: This project developed outreach materials and sampling protocols, conducted training sessions for military natural resource managers to enable them to sample for SFD on their respective installations, and test snakes sampled on DoD installations for *O. ophidiicola* (fungal pathogen that causes SFD) DNA.
- DoD Legacy Resource Management Program along with Vermont Center for Ecostudies and Kansas State University Research: Migration ecology and connectivity of at-risk grassland birds: The project objectives included; determining migratory routes, stopover sites, and wintering areas of two DoD Priority At-Risk grassland bird species(Grasshopper Sparrow and Eastern Meadowlark),

determining population connectivity between breeding, migration, and wintering sites, identify habitats used during the non-breeding season (Upland Sandpiper).

### **In-house Conservation Branch Research Projects**

Recently completed or ongoing in-house research projects that have been undertaken:

- Evaluation of effectiveness of glyphosate treatments in smooth brome dominated areas.
- Monitoring regal fritillary density across the installation in relation to changes in vegetation communities utilizing distance sampling techniques.
- Monitoring grassland bird species densities across the installation in relation to changes in vegetation communities utilizing distance sampling techniques.

### **Forest Ecosystem Inventory Projects**

The most recent planning level survey of forest vegetation was initiated in 2012 and completed in 2015. This is the third forest inventory performed on Fort Riley. This project updated previous inventories that were performed initially in 1988-1989 and also during 1998-2000. The second forest inventory was the primary effort that incorporated measurement of wildlife habitat characteristics of the woodlands.

### **Urban Forest and Plant Inventory Projects**

This 1994 project identified trees and perennial plants located in Fort Riley cantonment areas. This inventory is outdated.

### **ITAM Research Projects**

Geomorphic Landform maps and soil relationships being tested throughout the Army for data that can be used for remote prediction of relative soil strength. Final reports have been prepared by Desert Research Institute, Division of Earth and Ecosystem Sciences for the U.S. Army Engineer Research and Development Center Cold Regions Research and Engineering Laboratory.

## **CHAPTER 7: PUBLIC AFFAIRS AND SAFETY**

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### **SECTION 7.1: LAW ENFORCEMENT PROGRAM**

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Effective conservation law enforcement is a critical component of an overall natural and cultural resources management program. Effective enforcement maximizes compliance with federal and state laws and regulations and Army and Fort Riley regulations. The most important aspects are protecting fish and game populations from over-harvest, protecting threatened and endangered species from harassment, preventing felony theft of timber, protecting cultural resource sites from being damaged or looted, and protecting sensitive habitats. Law enforcement officers also play a critical role in public safety, installation force protection, ensuring non-interference with the military mission by

recreationists, and education of the public. Fort Riley DES SOP #74 (Appendix O) specifically addresses the “Conservation Law Enforcement Program” at Fort Riley.

### **Objectives**

The objectives of an effective conservation law enforcement program at Fort Riley are:

- Support the mission by providing law enforcement, security, and protection of natural/cultural resources and facilities.
- Enhance the quality of outdoor recreation on the installation by providing timely emergency response.
- Protect Soldiers and recreationists by providing effective law enforcement.
- Provide environmental education to outdoor recreationists.
- Assist in collection of research and biological survey data.
- Provide trend analysis for law enforcement violations pertaining to conservation.

### **Authority, and Operations**

The Fort Riley Police Department will provide, when available, a Criminal Investigator for conservation and three Conservation Law Enforcement Officers (C.L.E.O.s). All staff members when providing law enforcement support are under the authority of the Chief of Police. Military Police personnel may augment the C.L.E.O. section at the request of the Chief of Police to provide additional coverage during peak hunting periods.

### **Jurisdiction**

Fort Riley is entirely Exclusive Federal Jurisdiction, meaning only Military and Department of the Army Civilian Police (DACP) officers and USFWS Special Agents have the authority to enforce hunting and fishing regulations on the installation. Law enforcement officers from the KDWP do not have that authority, but often interact with DES personnel and USFWS Special Agents to cooperatively investigate cases on-post and cases involving Soldiers off-post. KDWP Conservation Officers may not enter Fort Riley for the sole purpose of arresting a violator without prior coordination of the Staff Judge Advocate and the Fort Riley Police Department except as authorized under federal authority.

Federal magistrate court is used to adjudicate civilian violators who are issued Central Violation Bureau (CVB) Notices, informally known as DA 1805s. Military violators are cited either under the Uniformed Code of Military Justice (UCMJ) or issued a CVB notice. The Staff Judge Advocate may assist in determining the charges when dealing with all violators.

The Environmental Division Chief, DPW, under authority delegated by the Garrison Commander, may administratively suspend or revoke the hunting, fishing, and/or trapping privileges of violators in accordance with the suspension schedule in FR 210-15.

### **Enforcement Activities**

Law Enforcement staff will routinely patrol the installation, including the range area north of Rubio Road (formerly known as Vinton School Road). These personnel routinely check hunters and anglers for possession of required licenses and permits as well as conducting bag and creel checks. Special operations such as check points during hunting seasons and the use of decoy deer missions during the firearms deer season have been conducted. It is anticipated that these types of activities will continue.

Evidence and observations indicate that the most frequent violations of laws and regulations have involved failure of hunters to complete daily registration forms, failure of anglers to abide by creel limits, recreating in unauthorized areas, and theft of timber and fuelwood. Failure to possess Kansas and installation permits occurs more frequently with anglers than with hunters.

### **Training**

Law Enforcement staff may have the basic knowledge in the scientific principles of fisheries and wildlife biology, animal damage control, botany, forestry and cultural resources. Staff assigned to these positions will attend an approved Law Enforcement Academy and be in compliance with AR 190-56. In addition, staff will attend the Fort Riley Police Department's two week police training program.

In-service training is an important part of maintaining proficiency and certification of Police Officers. In-service will be offered on a semi-annual basis provided support can be acquired from the Military Police Battalion. In addition, Police Officers will be afforded the opportunity to attend workshops sponsored by the KDWP and the National Military Fish and Wildlife Association, budget permitting.

Specialized training for Military Police who augment the CLEO. staff will be provided from staff within the Fort Riley Police Department.

### **Investigative Priorities**

Investigative priorities will be determined by the Fort Riley Chief of Police.

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## **SECTION 7.2: ENVIRONMENTAL AWARENESS**

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Fort Riley recognizes the critical importance of education and environmental awareness to a comprehensive natural resources management program. Fort Riley is committed to education for Soldiers within the training scenarios and community outreach as well as the specific objectives listed below.

### **Military Personnel Awareness**

Many venues for educating Soldiers about natural resources management exist. The Conservation Branch provides various media avenues intended to minimize damage to training lands and to protect the environment by fostering a conservation ethic in Soldiers and their leaders. Additionally, the Public Affairs Office (PAO) supports educational outreach by publishing articles to the Fort Riley webpage and social media.

➤ **Actions**

- The Conservation Branch provides attendees of the bi-weekly Range Safety Officer Course information about natural and cultural resources management and protection.
  - Conservation Branch personnel provide Hazardous Plants and Animals briefings to Soldiers. Information about hunting and fishing and other natural resources-related recreation is also presented.
  - Some classes taught as part of the DPW Environmental Management System training program cover aspects of natural and cultural resource protection. Classes such as Environmental Team Training, Hazard Communication, and others devote small portions of instruction to natural resources protection measures.
- **Enhance educational efforts as a compliance element within the installation's rare species management plans.**
- The ITAM SRA program makes available ITAM materials on-line to attendees of the bi-weekly Range Safety Officer Course. These materials include soldier field cards, maps, range SOPs, and Range and Safety Regulations.
  - ITAM or the Conservation Branch will take any unscheduled opportunity to speak to Soldiers on environmental protection. Avenues include Officer Professional Development, NCO Professional Development and Unit Safety Days.

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### **SECTION 7.3: COMMUNITY OUTREACH**

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Proper implementation of a natural resources management program requires the participation of surrounding communities.

➤ **Actions**

- Provide information and educational materials to the military, general public, and other requesters regarding Fort Riley's native ecosystem and its management within the mission framework and DoD and Army policy.
- The Conservation Branch produces many publications for distribution to Fort Riley outdoor recreationists. These include booklets, brochures, hunting/fishing maps, fact sheets, regulation summaries, and hunting/fishing tips.
- The Conservation Branch also distributes brochures, pamphlets, and other publications produced by the KDWP, USFWS, the KSU Cooperative Extension Service, and other conservation organizations.
- The Conservation Branch staff presents briefings, slide shows, tours and talks to various conservation and civic organizations and professional groups, as requested.
- The Conservation Branch provides natural resource education programs to school groups, as requested.

- Children’s Fishing Derbies are supported.
- Conservation Branch staff provides presentations and information to meetings of the Fort Riley Outdoorsmen Group.
- News releases are distributed through the PAO to area newspapers and other media, when applicable.
- PAO covers high-interest events on various social media outlets.
- Honor requests from local radio stations for interviews with Conservation Branch personnel.

## **CHAPTER 8: OUTDOOR RECREATION PROGRAM (QUALITY OF LIFE)**

Quality of Life is the installation’s key process supporting Soldiers and Family. Hunting, angling, fuelwood-cutting, and non-consumptive recreation (e.g., bird watching) are among the natural resource-based recreational activities pursued on Fort Riley that enhance quality of life.

Army Regulation (AR) 200-1 and DoDI / DoDM 4715.03 provides the primary guidance for outdoor recreation programs and opportunities. Army regulations specify that “the appropriate environmental directorate will address the biological management of game species and natural resources while the Directorate of Family and Moral, Welfare and Recreation (DFMWR) addresses the movement of persons, special events, and organization elements of outdoor recreation”. Army Regulations define outdoor recreation as those programs and activities that depend on natural resources, such as hunting, fishing, hiking, and bird watching.

### **Quality of Life Strategy**

The strategy to enhance the quality of life for Fort Riley’s soldiers and families is to provide optimal opportunity for sustainable, high quality hunting, angling, fuelwood cutting and non-consumptive uses to the maximum number of users, taking into account safety and the military mission. This strategy supports at least 15,000 hunting trips and 20,000 angling trips while maintaining other recreational uses.

### **Hunting, Fishing and Trapping Authority**

The Sikes Act (P.L. 86-797) and the Sikes Act Improvement Act of 1997 (P.L. 105-85) establishes policy for hunting, fishing, and trapping on military installations. The law covers access, issuance of hunting and fishing permits, and use of fees generated from the sales of installation hunting and fishing permits. Hunting and fishing are consistent with all applicable federal and Kansas laws and regulations and FR 210-15.

All KDWP regulations for lawful hunting methods, equipment, bag limits, hunting hours, and season lengths are enforced on Fort Riley. All federal laws and regulations for migratory bird hunting also are in force. All KDWP regulations for lawful fishing methods,



equipment, creel limits, length limits, and season lengths are enforced on Fort Riley. Fort Riley's hunting and fishing regulations are, in some aspects, more restrictive than Kansas and Federal regulations and are in no case more liberal.

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## **SECTION 8.1: PUBLIC ACCESS**

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Fort Riley policy regarding public access, as stated in FR 210-15, is consistent with the Sikes Act, as amended (P.L. 105-85), DoDI and DoDM 4715.03, and AR 200-1.

The military mission takes priority over all outdoor recreation. The installation or portions of it may be closed, without prior notice, for mission and security considerations. Fort Riley is not a public recreation area but is instead a military training installation that allows natural resources-based recreation only when it is compatible with the military mission and security.

Fort Riley currently allows the public, as well as Soldiers and their Families, to participate in natural resources-based recreation. Fort Riley has a policy allowing certain forms of recreation to coexist with some types of military training. Access for recreation is precluded for safety or security reasons, or if a bona fide impairment of the military mission would occur, as determined by the Installation Commander.

### **Outdoor Recreation Areas**

Outdoor Recreation Areas are established to provide regulated, safe access for recreationists and fuelwood cutters and to prevent interference with the military mission. One of the most critical functions is to make boundaries easily identifiable. They correspond, generally, with Military Training Areas and Maneuver Areas, and are generally delineated by improved, hardened roads. The Fort Riley Outdoor Recreation and Fuelwood Cutting Map is shown as Figure 12**Error! Reference source not found.**

### **Access Procedures**

The access procedures protect Soldiers and recreationists and minimize interference with the military mission by limiting recreationists' access and munitions based upon scheduled training and security considerations. Access is prohibited to any area not listed as open for recreation. Live-fire training, aerial artillery, and demolition are the main types of training that preclude access. Shotgun hunting (using size 2 shot or smaller), archery hunting, angling, fuelwood cutting, and non-consumptive recreation can coexist with maneuver training unless the coexistence presents a safety or security risk.

Natural resources-based outdoor recreational activities on Fort Riley take place only in areas authorized by the Conservation Branch in coordination with the DPTMS, Range Safety Office. The authorized areas can change daily, depending on the schedule of the installation's military trainers. Access to any area that is not listed as open for hunting, fishing, trapping, non-consumptive outdoor recreation, or fuelwood cutting is prohibited. Outdoor recreationists may learn of open areas via iSportsman. iSportsman is an automated check-in-out system by which recreationists are able to view open areas and check-in/check-out via the world-wide web using smart phones and other compatible

electronic devices. Individuals can register at the Fort Riley iSportsman webpage ([www.fortriley.isportsman.net](http://www.fortriley.isportsman.net)).

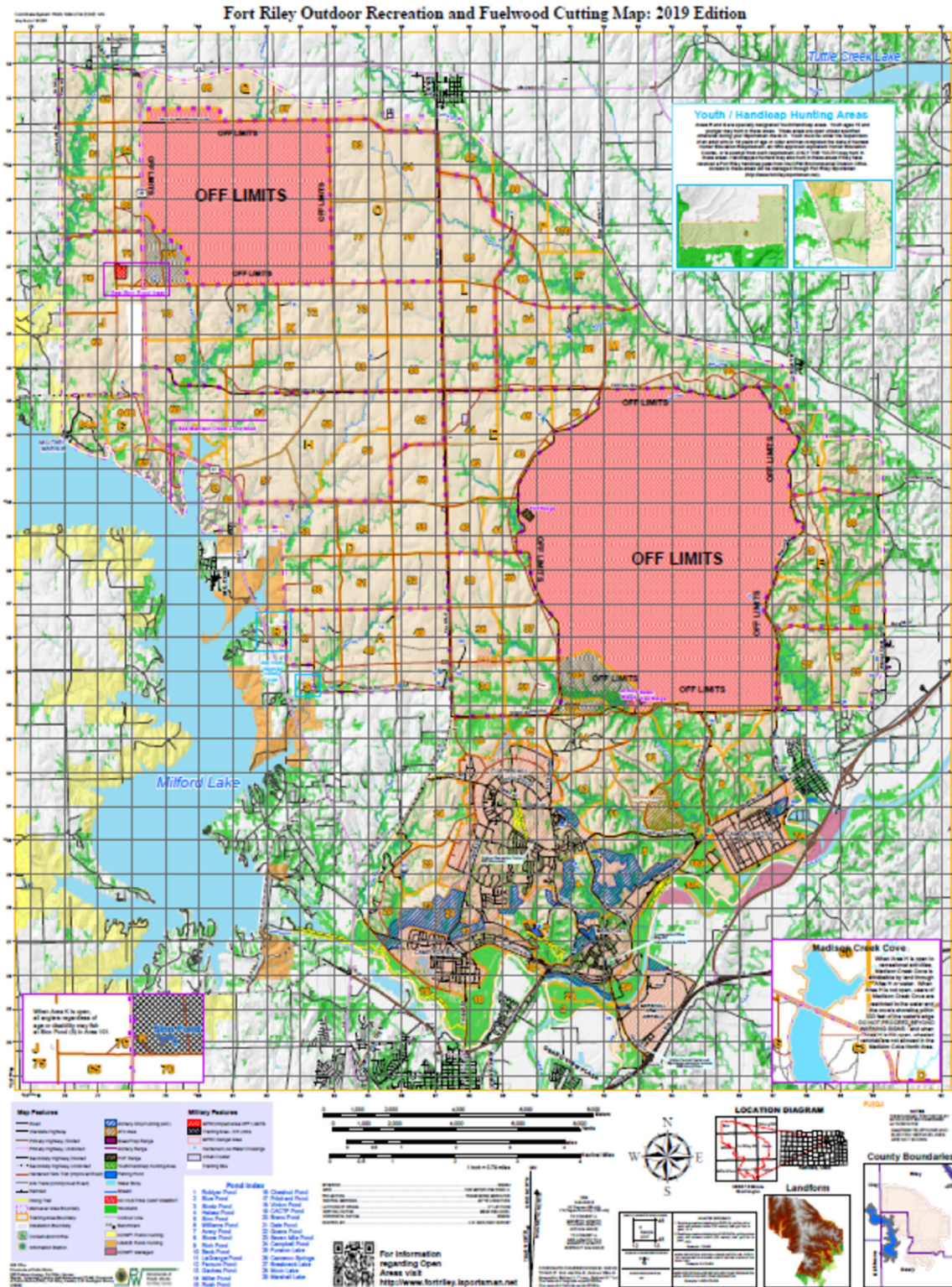


Figure 12 - Example of Fort Riley's fuelwood and public access map

Any person accessing Fort Riley, including recreationists who will traverse areas north of Rubio Road, who appears to be over the age of 16, is required to possess a valid DoD ID card or Fort Riley Access badge or pass. People who do not have the required ID card or access badge can apply for a pass at the installation's Visitor Control Center, (Building 885, adjacent to Marshall Army Air Field, exit 301, U.S. Interstate 70) or acquire a one day electronic pass at <https://pass.aie.army.mil/riley/>.

A valid government issued driver's license is required to obtain an access pass or badge. Additionally, any non-DoD person entering the installation, regardless of affiliation, must pass a criminal background check. Vehicle registration and proof of insurance are required for every vehicle that is driven on the installation.

Privately-owned vehicle access to Fort Riley (including the areas north of Rubio Road) for recreational activities is allowed. All vehicles operated on Fort Riley for recreational purposes must display a Fort Riley Recreation Motor Vehicle Permit. These permits are available on the Fort Riley iSportsman page.

Vehicular access to any area North of Rubio Road and East of U.S. Highway 77 requires people to use Old Highway 77 south gate. Vehicular access may sometimes be available through the Douthit Range Complex entrance gates. To access an area west of U.S. Highway 77, people can use any existing road.

Everyone recreating in a Fort Riley training area must use iSportsman. Check-in and Check-out may be done with any personal device with internet access or at the Fort Riley Visitors Center KIOSK at bldg. 886 during normal business hours.

### **Access Restrictions**

Rifle hunting, handgun hunting and shotgun hunting with shot larger than #2 are restricted to those areas that do not have Soldiers training in them and specifically listed an "Open Rifle Hunting Area" in iSportsman. Access for firearms deer hunting generally is not an issue because this season is established concurrent with the Thanksgiving and Christmas training holidays. During those training holidays, the installation is, generally, fully accessible.

Shotgun hunting using shot #2 or smaller, archery hunting and other forms of non-consumptive outdoor recreation generally may occur in areas that may have Soldiers conducting non-live fire training. These areas may only be accessed if listed as an "open shotgun hunting area" in iSportsman.

Human population density and the number of improved facilities require that all parts of the installation south of Rubio Road be closed to rifle and handgun hunting. This portion of the installation is open only to archery and shotgun hunting using #2 shot and smaller. Exceptions to this restriction are that .22 rimfire rifles and handguns loaded with "short" cartridges may be used to take treed raccoons and that ammunition containing shot size larger than No. 2 may be used within 50 meters of the edge of the Kansas River, the

Republican River, the Smoky Hill River, or Marshall Lake as long as the training area adjacent or within these listed bodies of water is listed as open for shotgun hunting.

### **Handicapped Access**

Access to hunting and angling recreational opportunities by disabled persons is required to comply with the Americans with Disabilities Act of 1990, and to provisions within the Sikes Act that ensure disabled veterans and other persons with disabilities have access to the same outdoor recreation opportunities as those who are not disabled. This includes activities such as fishing, hunting, trapping, wildlife viewing, boating and camping on military lands. Fort Riley currently supports access by disabled persons by waiving some installation regulations that are potentially impediments to recreation. Specific regulations that directly address Fort Riley access by disabled persons are:

- Any disabled person who holds an approved special permit from the KDWP is not required to purchase a Fort Riley Hunting Permit.
- A permanently disabled person who holds an approved special permit from the KDWP may hunt from a motor vehicle.
- Any disabled person with a handicap placard on his or her vehicle is authorized to use secondary trails not marked on the Outdoor Recreation Map to include any pathway on which the vegetation is absent or markedly reduced across the entire width of the trail.
- All other Kansas or Federal laws or regulations or Fort Riley regulations are enforced. Disabled persons may hunt from a motor vehicle only when in compliance with license and permit requirements, seasons, and bag limits, and other related laws and regulations.

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## **SECTION 8.2 WILDLIFE HARVEST MANAGEMENT**

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Animals hunted on Fort Riley include northern bobwhite, ring-necked pheasant, greater prairie-chicken, waterfowl, mourning dove, Wilson's snipe, American woodcock, fox squirrels, cottontail rabbit, white-tailed deer, elk and wild turkey. Furbearer species are badger, bobcat, mink, muskrat, opossum, raccoon, red fox, , striped skunk, coyote, and beaver.

### **Management Strategy**

Game harvest management combines an ecosystem approach with harvest control. Ecosystem management influences the availability of game species for harvest and the biological carrying capacity of each species. For example, management that favors native grasses and reduces woody vegetation will likely benefit greater prairie-chickens but may depress abundance of northern bobwhites.

Harvest control influences the number of game animals removed from the population each year. Harvest control objectives are based on sociological carrying capacity and desired population dynamics. For example, deer and elk populations are maintained

below their respective biological carrying capacities to reduce the incidence of deer and elk collisions with vehicles and limit crop depredation on lands adjacent to Fort Riley.

The KDWP establishes harvest regulations that are applicable on Fort Riley. Bag limits established by KDWP may be further restricted by the Conservation Branch to ensure a sustainable harvest of game species. In no case will Fort Riley regulations be less restrictive than Kansas regulations.

The overall strategy is to harvest wildlife species based on the concept of sustained yield, in harmony with the military mission. Sustained yield harvest management seeks to balance the sustained production of animals with hunter satisfaction. Hunting opportunity may be limited by military training, security measures, safety considerations, and qualitative aspects.

➤ **Upland Game**

- Fort Riley follows season dates, bag limits and shooting times established by KDWP, except that hunting jackrabbits is prohibited on Fort Riley.

➤ **Deer**

- Establish and coordinate firearms deer season dates under Kansas Regulation KAR 115-25-9a.
- Establish and print the annual Fort Riley Deer Hunting Fact Sheet.
- Fort Riley will make available for issue an appropriate number of archery and firearms deer permits based on survey data, harvest information and deer management goals.
- An annual harvest of at least 180 animals with at least 60% of those antlerless is considered necessary to achieve desired population control. A firearms hunter success rate (percent of tags successfully filled) of at least 40% annually is desired.

➤ **Elk**

- Fort Riley will coordinate with KDWP in establishing annual numbers of elk permits and season dates.

➤ **Wild Turkey**

- Fort Riley follows season dates, bag limits and shooting times established by KDWP.
- An unlimited number of fall wild turkey hunters will be allowed. There will be no permit allocation system among user groups for these.
- Access procedures for spring wild turkey hunting will be announced in the Spring Turkey Fact Sheet that is published prior to the season.

➤ **Furbearer**

- Furbearer management will include establishing trapping regulations and seasons, and issuing trapping permits on Fort Riley according to the FR 210-15 and the annual Fort Riley Trapping Fact Sheet.
- **Migratory Bird**
  - Fort Riley follows season dates, bag limits and shooting times established by KDWP and the USFWS.

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### **SECTION 8.3: FISH HARVEST MANAGEMENT**

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The overall objective for sport fishing is the active management of 29 ponds and lakes to sustain a biomass of fish in harvestable-sizes to support 20,000 fishing trips annually on the installation.

#### **Management Strategy**

The KDWP establishes harvest regulations that are applicable on Fort Riley. Creel limits established by KDWP may be further restricted by the Conservation Branch to ensure a sustainable harvest of fish species. In no case will Fort Riley regulations be less restrictive than Kansas regulations.

The overall strategy is to harvest fish species based on the concept of sustained yield, in harmony with the military mission. Sustained yield harvest management seeks to balance the sustained production of fish with angler satisfaction. Sustained yield is not always the appropriate harvest strategy. Some lakes are managed on a put-and-take concept. Angling opportunity may be limited by military training, security measures, safety considerations, and qualitative aspects.

- **Sport Fish**
  - Eighteen of the ponds will be managed as put and take catfish fisheries (Sevenmile, Beck, Campbell, Chestnut, Miller, Farnum, Halasz, Stortz, Roblyer, Williams, Sinn, Rush, Dale, Goens, Bravo, CACTF, Blue, Gaches and Cameron Springs). Annual stockings of 8,000 to 13,000 pounds of harvestable-sized channel catfish will be conducted to support this strategy. Eight lakes and ponds will be managed as largemouth bass fisheries (Breakneck, Beck, Pritchard, Rich, Avery, Stone, Lagrange, Moon, and Vinton). Fingerling largemouth bass will be stocked as necessary to augment existing populations.
  - Moon Lake and Cameron Springs will be managed as put-and-take rainbow trout fisheries. Annual stockings of 12,000 pounds of harvestable-sized rainbow trout will be conducted to support this strategy.
  - Mowing will be performed around fishing ponds to better provide angler access to the water body.
  - Large predatory fish (e.g., flathead catfish and largemouth bass) will be stocked into ponds and lakes to control population imbalances, such as overcrowded gizzard shad and excess crappies.

- Any water body that experiences any environmental concern, or is suspected to have a problem, will be closed immediately to angling. The water will not be reopened to angling until the problem is fixed and the water is deemed safe after testing by MEDDAC Preventative Medicine personnel.

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## **SECTION 8.4: PERMITS AND FEE STRUCTURE**

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Permits and fees for hunting and fishing shall be in accordance with applicable Kansas and federal laws and in compliance with DoDI 4715.03, Enclosure 3(6)(c)(3).

### **Fishing Permits**

Fort Riley entered into a Community Fisheries Assistance Program agreement with the KDWP beginning in January 2004. As part of the agreement, Fort Riley would no longer charge a separate fee for fishing on the installation. The loss of fishing permit revenue is reimbursed by the KDWP through no-cost fish stockings of channel catfish and rainbow trout. Subsequently, the only permit needed to fish on Fort Riley is a Kansas Fishing License, unless fishing for trout in Cameron Springs or Moon Lake, in which case a Kansas Trout Stamp is also needed during the Kansas Trout Season.

### **Hunting Permits**

Installation hunting permits are not required for individuals under age 16, age 65 and older, and persons who hold an approved special permit from the KDWP for a physical handicap. A fee is charged to each individual wishing to hunt on Fort Riley who is between the ages 16 and 64 who are otherwise not excluded from purchase. An administrative fee of no more than 10% of the total permit cost may be charged by the installation's Special State Permit vendor. As directed by Army regulations, all Special State Permit fees collected will be deposited directly into the installation's Fish and Wildlife Receiving Account.

The fee for a Fort Riley Hunting Permit was set at \$25 in 2006. Separate, additional, no cost Fort Riley access permits are required to trap furbearers, to deer and elk hunt, and spring turkey hunt. Any changes to the fee structure will be made in FR 210-15 and updated accordingly in future revisions of the INRMP.

The possession of a Fort Riley permit and appropriate Kansas and federal licenses and stamps entitles the permittee to hunt in areas open to such recreation until the end of the calendar year. The Fort Riley permits do not constitute a guarantee of access on any or all days during the period for which it is issued.

Fort Riley permits are generally allocated equally among user groups. Most permits are available to an unlimited number of permittees. However, when restricting the overall number of permittees is necessary to achieve natural resources management objectives or maintain a safe installation, permits are distributed by impartial procedures, such as a first-come, first-serve basis or by a random drawing. Priority for distribution of any Fort Riley Permit may, however, be given to Active Duty Military Personnel when they are

deemed to be at a disadvantage in accessing hunting areas or fully utilizing a set hunting season

Fort Riley sold 862 hunting permits in 2017, 1083 in 2018, 1,135 in 2019, 1,047 in 2020 and 1020 in 2021.

### **Hunter Education**

Kansas and Fort Riley regulations require that all individuals born on or after July 1, 1957 complete an approved (State or Canadian Province issued) Hunter Education Course prior to purchasing any Kansas Hunting License. Certain exemptions are permitted by the state of Kansas. Youth younger than 16 may hunt without hunter education if directly supervised by a licensed adult 18 or older. Anyone 16 or older may purchase a deferral of hunter education, called an apprentice hunting license, for the same price as a regular hunting license. The holder must be under the direct supervision of a licensed adult 18 years or older and may be purchased no more than two times.

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## **SECTION 8.5: OTHER RELATED OUTDOOR RECREATION**

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Fort Riley supports multiple-use outdoor recreation that includes consumptive and non-consumptive uses. Primary consumptive uses, besides hunting and angling, are fuelwood-cutting, wildflower and mushroom gathering, berry picking and shed antler collecting. Non-consumptive pursuits include hiking, photography, bird watching, and mountain biking.

- A \$20 Fuelwood Cutting Permit is required to obtain fuelwood from across the installation. Permits are purchased through the Fort Riley iSportsman website.
- All persons in areas open for outdoor recreation north of Rubio Road during the installation's firearms deer season must wear the following safety clothing, which must be colored blaze (international) orange: a cap or hat and an outer cover of a coat, vest, sweater, coveralls, or shirt. The outer cover must have at least 200 square inches of orange-colored surface visible, covering both front and back. In addition, from September 1 to May 31, all recreating individuals must wear at least one article of blaze orange clothing when not in a stationary position.
- Flowers, berries, nuts, fruits, and stems of plants may be taken for human consumption without a permit.
- Flowers and foliage of plants may be taken for ornamental purposes without a permit, provided that not more plant material is taken by any one individual each day than can fit into a standard "three-pound coffee can" (six-inch diameter opening). Plants may not be dug or otherwise uprooted from Fort Riley.
- Camping on Fort Riley is prohibited, except under special authorization from the Conservation Branch Chief or in designated areas.
- Open fires (campfires, barbecue pits, bonfires, etc.) are prohibited on Fort Riley, except in specially designated areas and as permitted by the Fort Riley Fire Department.



- Swimming in the installation's streams, lakes, and ponds is prohibited.
- Use of metal detectors for recreational uses is prohibited.
- Recreational operation of Off-Road Vehicles is permitted only in designated portions of Training Area 10 and as outlined for specific uses in annual Fact Sheets and FR 210-15. Off-Road Vehicles are motorized vehicles (excluding boats) not registered and licensed for highway use.

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## **SECTION 8.6: OUTDOOR RECREATION SAFETY**

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Fort Riley's safety record for natural resources-related recreation is excellent. Only two reported hunting accidents have occurred on Fort Riley since 1988 despite more than 6,000 hunting trips being taken annually. Both of these occurred during upland game bird hunting as a result of hunters "swinging through" a flushed bird, firing, and hitting another hunter. Neither accident was fatal or resulted in severe injury. No drownings have occurred in Fort Riley lakes and ponds. No recreationists have been injured during training activities. No Soldiers, while on-duty, have been injured by recreationists.

Safety requires that hunting access be limited because of hunter density as well as military training. Antlerless elk hunters are staggered throughout the season to limit the number of hunters at any one time. Firearms deer hunting is limited by assigning hunters to one of two hunting areas, and hunters must remain in their assigned area to prevent overcrowding and to distribute hunter density.

Effective law enforcement of access restrictions and safety checks of firearms and boats contributes toward making opportunities to recreate safer.

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## **SECTION 8.7: QUALITY OF LIFE MANAGEMENT ACTIONS**

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- Seek Conservation Partnerships to leverage installation funds to support hunting and fishing recreation at current levels.
- Collect and manage income from the sales of hunting permits.
- Provide basic information and explanatory material to users on recreational opportunities at Fort Riley.
- Provide recreational briefing for all individuals wishing to recreate on the installation.
- Provide web-based deer hunter briefing for all individuals wishing to hunt deer, elk and spring turkey on the installation, focusing on game management, safety, and access procedures.
- Provide self-service information and educational materials to recreational users on safety and non-interference with the military mission.
- Provide staff during regular duty hours to answer the questions and concerns of customers.
- Manage hunter and angler access.

- Collect and analyze harvest data.
- Operate fuelwood program

## **CHAPTER 9: IMPLEMENTATION**

This chapter describes the organization, manpower, actions, and budget requirements necessary to implement this INRMP.

### **Organization, Roles, and Responsibilities**

The Conservation Branch is Fort Riley's principal implementing agent of this INRMP. The Conservation Branch coordinates with the other operations responsible for implementing specific portions of the plan to ensure an orderly and coordinated implementation.

The DPW, DES and the DPTMS are the directorates most directly responsible for management of natural resources at Fort Riley. The specific responsibilities of the DPW through its Conservation Branch are forestry, agronomy, rangeland, fish and wildlife, prescribed fire and pest management, as well as establishing partnerships with outside entities. The DPTMS is responsible for soil and erosion management and evaluating the mission effects on the natural resources.

Hunting and Fuelwood permits are available over the internet through the Fort Riley iSportsman website. The Conservation Branch issues any additional special, no cost permits to recreate on the installation via the iSportsman website.

The DES, Fire Department is responsible for controlling wildfires and leads, with a Conservation Branch staff member embedded as the Wildland Fire Manger, prescribed burning. The DES is also responsible for enforcing hunting and fishing regulations on Fort Riley through civilian conservation officers.

The Veterinary Activity, a sub activity of the MEDDAC, is responsible for the prevention and control of communicable diseases of wildlife on Fort Riley in cooperation with the Conservation Branch. Zoonotic diseases, pests, and wildlife borne diseases are monitored cooperatively between the MEDDAC's Preventive Medicine Service and the Conservation Branch.

### **Manpower**

A mix of professional and non-professional series government employees, contractors, military personnel, and university staff currently implement the activities related to this INRMP.

Ongoing training of personnel involved in the implementation of this plan will continue to be undertaken. That training is provided by various professional societies. Subject to budget and manpower constraints, installation staff will attend each of the following:

- National Military Fish and Wildlife Association annual training sessions.
- North American Wildlife and Natural Resources Conference.
- Society of American Foresters annual national and regional conferences.
- The Wildlife Society conferences.
- The Kansas Arborists' Association Conference.
- The North American Weed Management Conference.
- Weed Science Society of America Conference.
- The DoD Triennial Pest Management Conference.
- The Kansas Natural Resources Conference.

Other conferences and workshops may be included depending on availability of funds and their direct applicability to specific projects and program priorities. An example would be continued participation in Partners in Flight.

Priority will be given to training required to maintain certifications, such as certification for DoD pesticide applicator and National Wildfire Coordinating Group (NWCG), Wildland Firefighter ("Red Card"). Technical training in GIS, prescribed burning, wetlands management, pest management, and other skills-enhancement programs directly applicable to fundamental resources management are the types of training that will be given secondary priority in funding.

### **Program Priorities**

Preparation and implementation of this INRMP is required by the Sikes Act and various Army Regulations and thus must be funded according to DoD Instruction 4715.3, OMB Circular A – 106 rules and Department of Army Policy. This document is a Federal Facilities Compliance Agreement for which a NEPA document has been completed prior to its final approval.

Funding is not unlimited, however, and projects and programs described in this Plan must be prioritized. The metrics below (Table 1) list the programs and projects, and their priorities. These priorities reflect funding guidelines provided by IMCOM, other installation Operation, Management and Administration (OMA) supported actions, and projects implemented with program specific funds (Ag/grazing, Forestry, and Hunting and Fuelwood Permit Fee funds).

### **Program Administration Costs**

- Personnel salaries (government and contractor)
- Natural resources management supplies and equipment
- Providing routine computer upgrades
- Updating GIS equipment and coverages

- Obtaining updated aerial photography
- Provision of required training

### **Implement Funding Options**

Implementation of this INRMP is financed from the following sources:

- Installation OMA budgetary allocations funding Common Levels of Support.
- Installation OMA funding for non-recurring environmental projects and sustainment, revitalization and maintenance of facilities.
- Revenues generated from the sale of fuelwood, timber, and other forest products.
- Revenues generated from the sale of installation hunting and fishing permits.
- Revenues generated from the agricultural outlease program.
- Funds and resources donated to the installation from non-governmental organizations.
- The annual cost to fully implement this INRMP is estimated to be approximately \$1.6 million.

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### **REFERENCES**

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- Abel, H.J. 1982. *Sport Fishery Management Plan for the Fort Riley Military Reservation*. Prepared by Herb Abel, consulting Fisheries Biologist, Wakefield Kansas for U.S. Army, Fort Riley, Kansas - Directorate of Facilities Engineering.
- Althoff, D.P., J.W. Rivers, J.S. Pontius, P.S. Gipson, P.B. Woodford. 2001. *Bird Population Trends at Fort Riley, Kansas, 1999 – 2000*.
- Althoff, D.P., P.S. Gipson, J.S. Pontius, and P.B. Woodford. 2006. Plant community and bare ground trends on Fort Riley, Kansas: implications for monitoring of a highly disturbed landscape. *Transactions of the Kansas Academy of Science* 109(3/4):101-119.
- Army (Office of the Assistant Secretary of the Army). 2004. *The Army Strategy for the Environment: Sustain the Mission – Secure the Future*. 12 pp.
- Bailey, R.G. 1995. *Descriptions of the ecoregions of the United States*. 2d ed. Rev and expanded. Misc. Publ. No. 1391. U.S. Department of Agriculture, Forest Service, Washington, D.C.
- Blocker, J.D. 1999. *An Examination of Remotely Sensed Derived Vegetation Indexes and Maneuver Damage Assessment at Fort Riley, Kansas*. Unpublished M.S. thesis, Department of Geography, Kansas State University, Manhattan.
- Bollinger, E.K., P.B. Bollinger, and T.A. Gavin. 1990. Effects of hay-cropping on eastern populations of the bobolink. *Wildl. Soc. Bull.* 18:142-150.

- Busby, W.H., J.R. Parmelee, C.M. Dwyer, E.D. Hooper, and K.J. Irwin. 1994. *A Survey of the Herptofauna on the Fort Riley Military Reservation*. Kansas Biological Survey Report No. 58. 79 pp.
- Carter, J.W. Upland Sandpiper. IN Schneider, KJ and DM Pence, eds. 1992. *Migratory nongame birds of management concern in the Northeast*. US Dep. Inter, Fish and Wildlife Service, Newton, Corner, MA. 400 pp.
- CEC (Commission for Environmental Cooperation). Ecological Regions of North America – Toward a Common Perspective. 1997. ISBN 2-922305-18-X. <http://www.cec.org>.
- CERL (U.S. Army Corps of Engineers - Construction Engineering Research Laboratory) Environmental Resources Team, Champaign, Illinois (P. DuBois and C. Phillips). 1991. *LCTA Report for Fort Riley, 1989-1990 (Preliminary Draft)*.
- Collins, S.L., A.K. Knapp, J.M. Briggs, J.M. Blair, and E.M. Steinauer. 1998. Modulation of diversity by grazing and mowing in native tallgrass prairie. *Science* 280:745-747.
- Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. U.S. Fish and Wildlife Service, Office of Biological Services, Washington, D.C. Publ. No. USFWS/OBS-79/31. 107 pp.
- Crocoll, S.T. Red-shouldered hawk. 1994. *In The Birds of North America*, No. 107, (A. Poole and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C. The American Ornithologists' Union.
- Cully, J.F. Jr., and H. L. Michaels. 2000. Henslow's sparrow habitat associations on Kansas tallgrass prairie. *Wilson Bulletin* 110(1):115-123.
- Dechant, JA, ML Sondreal, DH Johnson, LD Igl, CM Goldade, MP Nenneman and BR Euliss. 1999. *Effects of management practices on grassland birds: northern harrier*. Northern Prairie Wildlife Research Center, Jamestown, ND. 14 pp.
- Dechant, JA, ML Sondreal, DH Johnson, LD Igl, CM Goldade, MP Nenneman and BR Euliss. 1999. *Effects of management practices on grassland birds: grasshopper sparrow*. Northern Prairie Wildlife Research Center, Jamestown, ND. 14 pp.
- Delisle, J.M., C.C. Freeman, and D.L. Peterson. 2012. Vegetation Survey and Mapping of the Fort Riley Military Reservation, Kansas. Open-file Report 174. Kansas Biological Survey. Lawrence, KS. 78 pp.
- Diersing, V.E., R.B. Shaw, S.D. Warren, and E.W. Novak. 1988. A user's guide for estimating allowable use of tracked vehicles on nonwooded military training lands. *Journal of Soil and Water Conservation* 43:191-195.

- Evans, D.E. and R.A. Fischer. 1997. Species Profile: Cerulean Warbler on military installations in the southeastern United States. Tech. Report SERDP-97-12, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.
- Fitzgerald, J. 1997. Partners in Flight Landbird Conservation Plan for Physiographic Region 33: The Osage Plains (Draft version).
- Freeman, C. C. and J. M. Delisle. 2004. Vegetation of the Fort Riley Military Reservation, Kansas. Open-file Report No. 119. Kansas Biological Survey. Lawrence, KS. 110 pp.
- Goran W.D., L.L. Radke and W.D. Severinghaus. 1983. *An Overview of the Ecological Effects of Tracked Vehicles on Major U.S. Army Installations*. U.S. Army Corps of Engineers, Construction Engineering Research Laboratory.
- Gipson, P.S., J.K. Veatch, R.S. Matlack and D.P. Jones. Health Status of a Recently Discovered Population of Feral Swine in Kansas. *Journal of Wildlife Diseases*, 35(3), p. 624-627.
- Herkert, JR. 1999. Effects of management practices on grassland birds: Henslow's sparrow. Northern Prairie Wildlife Research Center, Jamestown, ND. 14 pp.
- Hoch, G.A. 1997. Mapping and Monitoring of Disturbance from Military Training at Fort Riley Kansas and an Investigation into the Stability of Grassland Ecotones Using Satellite Remote Sensing. Unpublished M.S. thesis, Division of Biology, Kansas State University, Manhattan.
- Horak, Gerald J. 1985. *Kansas Prairie-Chickens*. Kansas Fish and Game Commission Wildlife Bulletin 3. Pratt, KS. 65 pages.
- Joern, A. 2005. Disturbance by fire frequency and bison grazing modulate grasshopper assemblages in tallgrass prairie. *Ecology* 86(4):861-873.
- Johnson, D.H. 1995. Management of northern prairies and wetlands for the conservation of neotropical migratory birds. In Thompson, F, ed. *Management of Midwestern Landscapes for the Conservation of Neotropical Migratory Birds*. USDA Forest Service. Gen Tech. Report NC-187.
- Johnson, F.L. 1982. Effects of tank training activities on botanical features at Fort Hood, Texas. *Southwestern Naturalist* 27:309-314.
- Kamler, J.F. 1998. Ecology and Interspecific Relationships of Mammalian Predators on Fort Riley Military Reservation, Kansas. Unpublished M.S. thesis, Division of Biology, Kansas State University, Manhattan.
- Kansas Department of Health and Environment. 1 May 1987. *Kansas Water Quality Standards, K.A.R. 28-16-28d*.

- Kansas Fish and Game Commission (Moss, R.E. and K. Brunson). 1981. *Kansas Stream and River Fishery Resources Evaluation*.
- Kansas State University - State and Extension Offices of Forestry, Manhattan, Kansas (K. Lynch). 1986. *Map of Fort Riley Forest Types*.
- Keating, J.F., K. Cherry, J. Haley, B. Musser, C. Phillips and J. Swanson. 1994. The cumulative effect of fire and military training on small mammal assemblages. 14<sup>th</sup> North American Prairie Conference, Kansas State University, Manhattan, KS.
- Knopf, FL. 1994. Avian Assemblages on altered grasslands. *Stud. in Avian Biol.* 15:247-57.
- Kuchler, A.W. 1974. *A New Vegetation Map of Kansas*. *Ecology*, Vol. 55, No. 3, pp. 586-604.
- Launchbaugh, J.L., and C.E. Owensby. 1978b. *Kansas Rangelands: Their Management Based on a Half Century of Research*. Kansas Agricultural Experiment Station Bulletin 622.
- Lanyon, W.E. 1995. Eastern meadowlark (*Sturnella magna*). In *The Birds of North America*, No. 160 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA and the American Ornithologist's Union, Washington, DC.
- Lauver, C.L. Natural Community Analysis of Fort Riley Military Reservation, Feb 1994, Report #59. Kansas Biological Survey Report No. 59. 31 pp.
- Leis, S.A., D.M. Engle, D.M. Leslie Jr., and J.S. Fehmi. 2005. Effects of short- and long-term disturbance resulting from military maneuvers on vegetation and soils in mixed prairie. *Environmental Management* 36:849-861.
- Leis, S.A., D.M. Leslie Jr., D.M. Engle, and J.S. Fehmi. 2007. Small mammals as indicators of short-term and long-term disturbance in mixed prairie. *Environmental Monitoring and Assessment* 137(1-3):75-84.
- Leslie, M, G.K Meffe, Hardesty, D.L. Adams, 1996, *Conserving Biodiversity on Military Lands: A Handbook for Natural Resources Managers*, The Nature Conservancy, Arlington, VA.
- Li, Q., P.D. Ayers, and A.B. Anderson. 2006. Prediction of impacts of wheeled vehicles on terrain. *Journal of Terramechanics* 44(2):205-215.
- Louzada, J., A.P. Lima, R. Matavelli, L. Zambaldi, and J. Barlow. 2010. Community structure of dung beetles in Amazonian savannas: role of fire, disturbance, vegetation, and landscape structure. *Landscape Ecology* 25(4):631-641.
- Madison, L.A. 1998. Influence of Food Plots on Over-Winter Survival, Hunting Vulnerability, and Movement Patterns of Northern Bobwhites with Notes on the

- Metabolizable Energy of Food Plot Grains. Unpublished Ph.D. dissertation, Division of Biology, Kansas State University, Manhattan.
- Michaels, H.L. 1997. Landscape and Fine Scale Habitat Associations of the Loggerhead Shrike and Henslow's Sparrow on Fort Riley Military Installation, Kansas. Unpublished M.S. thesis, Division of Biology, Kansas State University, Manhattan.
- Milchunas, D.G., K.A. Schulz, and R. B. Shaw. 2000. Plant community structure in relation to long-term disturbance by mechanized military maneuvers in a semiarid region. *Environmental Management* 25:525-539.
- Moldenhauer, R.R. and D.J. Regelski. 1996. Northern parula. *In* The Birds of North America, No. 215, (A. Poole and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C. The American Ornithologists' Union.
- Mosher, T.D. 1999. An Evaluation of Channel Catfish Populations in Kansas State Fishing Lakes. Kansas Department of Wildlife and Parks.
- Owensby, C.E., and K.L. Anderson. 1969. "Effect of Clipping Date on Loamy Upland Bluestem Range." *Journal of Range Management* 22:351-354.
- Parsons, Harland Bartholomew and Associates, Inc., 1999. The Programmatic Environmental Assessment for the Real Property Master Plan and Ongoing Mission Fort Riley, Kansas.
- Page, K.M. 1998. Determining Abundance of Selected Species of Mammalian Predators on Fort Riley Army Installation, Kansas. Oak Ridge Institute of Science and Education, Oak Ridge TN.
- Perlut, N.G., A.M. Strong, T.M. Donovan, and N.J. Buckley. 2006. Grassland songbirds in a dynamic management landscape: behavioral responses and management strategies. *Ecological Applications* 16:2235-2247.
- Pitts, R.M., LeValley, M.J. and S. Klinger. 1987. *Mammals of Fort Riley, Kansas*. Transactions of the Kansas Academy of Science. 90(102):75-80.
- Poyry, J., S. Lindgren, J. Salminen, and M. Kuussari. 2004. Restoration of butterfly and moth communities in semi-natural grasslands by cattle grazing. *Ecological Applications* 14(6):1656-1670.
- Prosser, C.W., K.K. Sedivec, and W.T. Barker. 2000. Tracked vehicle effects on vegetation and soil characteristics. *Journal of Range Management* 53:666-670.
- Pyle, R.M. 1986. The Audubon Society Field Guide to North American Butterflies. Alfred A. Knopf, Inc. New York, NY.



- Quist, M.C. 1999. *Structure and Function of Fish Communities in Streams on Fort Riley Military Reservation*. Unpublished M.S. thesis, Division of Biology, Kansas State University, Manhattan.
- Quist, M.C., P.A. Fay, C.S. Guy, A.K. Knapp, and B.N. Rubenstein. 2003. Military training effects on terrestrial and aquatic communities on a grassland military installation. *Ecological Applications* 13(2):432-442.
- Rahmig, C.J., W.E. Jensen, and K.A. With. 2009. Grassland bird response to land management in the largest remaining tallgrass prairie. *Conservation Biology* 23:420-432.
- Richardson, C. 1994. *The Evaluation of Food Plots for Northern Bobwhite Food*. Unpubl. Data, Division of Biology, Kansas State University, Manhattan,
- Robel, R.J., N.A. Barnes, K.W. Bookout, B.L. Hettenbach, and L.D. Prawl. 1987. *Important Furbearers of the Fort Riley Military Installation*. Unpublished M.S. thesis, Division of Biology, Kansas State University, Manhattan.
- Robel, R.J. 1969. "Food Habits, Weight Dynamics and Fat Content of Bobwhites in Relation to Food Plantings in Kansas." *Journal of Wildlife Management*. 38:653-664.
- Rykiel JR., E.J. 1985. Towards a definition of ecological disturbance. *Australian Journal of Ecology* 10(3):361-365.
- Sample, L.J. 1996. *Water Quality Impacts from Low Water Fords on Military Training Lands*. Unpublished M.S. thesis, Department of Biological and Agricultural Engineering, Kansas State University, Manhattan.
- Samson, F. and F. Knopf. 1994. Prairie conservation in North America. *BioScience* 44:418-421.
- Schaeffer, D.J., T.R. Seastedt, D.J. Gibson, D.C. Hartnett, B.A.D. Hetrick, D.W. Kaufman, A.P. Schwab, E.E. Herricks and E.W. Novak. 1990. Field Bio assessments for selecting test systems to evaluate military training lands in tallgrass prairie. *Env. Management* 14:81-93.
- Schroeder, R.L. 1982. Habitat suitability index models: Pileated woodpecker. U.S. Dept. Int., Fish Wildl. Serv. USFWS/OBS-082/10.39. 15 pp.
- Schweitzer, D.F. 1987. Element Stewardship Abstract for *Speyeria idalia*, regal fritillary. The Nature Conservancy. Arlington, VA. 13 pp.
- Snyder, P.R. 2000. *Assessment of Activity Transmitters Based on Behavioral Observations of Coyotes, Bobcats, and Raccoons*. Unpublished M.S. thesis, Division of Biology, Kansas State University, Manhattan.

- Sousa W.P. 1984. The role of disturbance in natural communities. *Annual Review of Ecology and Systematics* 15(4):353-391.
- Stauffer, D.F. 1994. Habitat Suitability Index Model; Ovenbird. College of Forestry and Wildlife, VA Tech, Blacksburg, VA.
- Towne, G., and C. Owensby. 1984. "Long-term Effects of Annual Burning at Different Dates in Ungrazed Kansas Tallgrass Prairie." *Journal of Range Management* 37:392-397.
- Turner, M.G. 1989. Landscape ecology: the effect of pattern on process. *Annual Review of Ecological Systems* 20:171-197.
- U.S. Army Corps of Engineers, Kansas City District (Leo A. Daly). September 1987. *Installation Master Plan Report for Fort Riley, Kansas*.
- U.S. Army Corps of Engineers. 1994. Commander's Guide to Environmental Management.
- U.S. Army, Assistant Chief of Staff for Installation Management. 1997. Army Goals and Implementing Guidance for Natural Resources Planning Level Surveys (PLS) and Integrated Natural Resources Management Plan (INRMP).
- U.S. Army Environmental Command. May 2015. Informal Conference & Management Guidelines on the Northern Long-eared Bat (*Myotis septentrionalis*) for Ongoing Operations on Installation Management Command Installations.
- U.S. Army, Headquarters Forces Command, Policy Memorandum 200-97-1. *Implementation of Ecosystem Management*.
- U.S. Army Environmental Center. 1997. Guidelines to Prepare Integrated Natural Resources Management Plans for Army Installations and Activities. USAEC. Aberdeen proving Grounds, MD. Pp 37.
- U.S. Army Environmental Center. 1994. *Army Environmental Manager's Handbook: Threatened and Endangered Species Management*. U.S. Army Corps of Engineers - Construction Engineering Research Laboratory.
- U.S. Army, Fort Riley, Kansas - Directorate of Engineering and Housing (Phillips, B.C.). 1988b. *Fort Riley Natural Resources Management Plan; Part III, Range Management*.
- U.S. Army, Fort Riley, Kansas - Directorate of Engineering and Housing, Natural Resources Branch. 1988a. *Sport Fishery Management Report*.
- U.S. Army, Fort Riley, Kansas - Directorate of Engineering and Housing, Natural Resources Branch (Abel, Herb). 1989c. *Fort Riley Natural Resources Management Plan; Part III -Fish and Wildlife Management*.

- U.S. Army, Fort Riley, Kansas - Directorate of Engineering and Housing, Environmental and Natural Resource Division. 1988c. *Fort Riley Natural Resources Management Plan: Part II - Land Management Grounds Maintenance and Landscaping Planting Plan*.
- U.S. Army, Fort Riley, Kansas - Directorate of Engineering and Housing, Environmental and Natural Resources Branch (Abel, Herb). 1989f. *Sport Fishery Management Plan for the Fort Riley Military Installation*.
- U.S. Army, Fort Riley, Kansas - Directorate of Engineering and Housing. 1987. *Installation Design Guide*.
- U.S. Army, Fort Riley, Kansas - Directorate of Engineering and Housing. 25 April 1994. Comments from Fort Riley on the August 1993 Draft Integrated Natural Resource Management Plan.
- U.S. Army, Fort Riley, Kansas - Directorate of Facilities Engineering. 1982. *Five Year Wildlife Management Plan: Fort Riley Military Reservation, Kansas*. Prepared by Van Doren Hazard Stallings, Topeka, Kansas.
- U.S. Army, Fort Riley, Kansas - Directorate of Facilities Engineering, Environmental Office. 1981. *Environmental Impact Statement for Fort Riley, Kansas. Preliminary Report*.
- U.S. Army, Fort Riley, Kansas. Directorate of Environment and Safety. April 1993. *Fort Riley Forestry Management Plan*.
- U.S. Army, Fort Riley, Kansas. Directorate of Environment and Safety. 1994. Cooperative Agreement for the Conservation and Development of Fish and Wildlife Resources on Fort Riley Military Reservation
- U.S. Department of Army, Fort Riley. Strategic Planning Office. 2000. *Installation Strategic Plan*.
- U.S. Department of Army, Fort Riley. Directorate of Resource Management. 2000. *Economic Impact Summary (1 Oct 99 – 30 Sep 00)*.
- U.S. Department of Agriculture - Soil Conservation Service. 1960. *Soil Survey of Geary County, Kansas*.
- U.S. Department of Agriculture - Soil Conservation Service. 1975. *Soil Survey of Riley County and Part of Geary County, Kansas*.
- U.S. Department of Agriculture - Soil Conservation Service. 1987. *Hydric Soils of the United States*.
- U.S. Department of Agriculture - Soil Conservation Service. 1988. *Kansas Standard and Specifications for Range Seeding*. Section IV. TG Notice KS-174.

- U.S. Department of Defense. Undated. *DoD Commander's Guide to Biodiversity*.
- U.S. Department of Defense. 1996. DoD Instruction 4715.3, *Environmental Conservation Program*.
- U.S. Environmental Protection Agency - Environmental Review Branch, Wetlands Protection Section, Region VII, Kansas City, Kansas. July 1989. *Wetland Listing for Region VII: Iowa, Kansas, Missouri, Nebraska*.
- U.S. Fish & Wildlife Service, Denver, Colorado. 1984. *American Peregrine Falcon Recovery Plan (Rocky Mountain/Southwest Population)*. Prepared in cooperation with the American Peregrine Falcon Recovery Team, 105 pp.
- U.S. Fish & Wildlife Service, Kansas State Office. February 1992. Summary Report: A Survey of Threatened and Endangered Species on Fort Riley Military Reservation.
- Van Horne, B., and P.B. Sharpe. 1998. Effects of tracking by armored vehicles on Townsend's ground squirrels in the Orchard Training Area, Idaho, USA. *Environmental Management* 22(4):617-623.
- Walk, J.W., and R.E. Warner. 2000. Grassland management for the conservation of songbirds in the Midwestern USA. *Biological Conservation* 94(2):165-172.
- Warner, R.E. and Etter, S.L. 1989. Hay-cutting and the survival of pheasants: A long-term perspective. *J. Wildl. Manage.* 53:455-461.
- White, P.S., and S.T.A. Pickett. 1985. Natural disturbance and patch dynamics: an introduction. pp. 3-13. In: *The ecology of natural disturbance and patch dynamics*. S.T.A. Pickett and P.S. White [eds.], Academic Press, Orlando, Florida.
- Wright, H. A., and A.W. Bailey. 1982. *Fire Ecology: United States and Southern Canada*. John Wiley & Sons, New York.
- York, T.P., N.E. West, R.J. Mueller, and S.D. Warren. 1997. Toleration of traffic by vegetation: life form conclusions and summary extracts from a comprehensive data base. *Environmental Management* 21:121-131.

## TABLES

**Table 1 - Designated surface water use categories on Fort Riley, determined by the KDHE.**

Stream	Segment #	Expected Aquatic Life	Contact Recreation	Domestic Supply	Food Procurement	Ground Water Recharge	Industrial Water Use	Irrigation Use	Livestock Watering Use
HUC 8: 10250017									
Republican River	1	E	B	Y	Y	Y	Y	Y	Y
Fourmile Creek	67	E	b	Y	Y	Y	Y	Y	Y
HUC 8: 10270101									
Kansas River	6	S	B	Y	Y	Y	Y	Y	Y
Kansas River	7	S	B	Y	Y	Y	Y	Y	Y
Threemile Creek	15	E	C	N	Y	N	N	Y	Y

B= Primary contact recreation stream segment is by law or written permission of the landowner open to and accessible by the public; b= Secondary contact recreation stream segment is not open to and accessible by the public under Kansas law; C= Primary contact recreation stream segment is not open to and accessible by the public under Kansas law; E= Expected aquatic life use water; S=special aquatic life use water; Y = Yes (use is designated); N = No (use is not designated)

**Table 2 - Prioritized metrics list of INRMP tasks to be accomplished annually.**

All tasks below are performed annually according to priority and availability of funding and manpower unless otherwise noted. The annual overall cost to fully implement this plan is approximately \$1004K, including approximately \$700K for in-house projects and supplies. Supplies and equipment include agricultural type tractors and implements, skid steer loaders and attachments, survey equipment, wildland fire apparatus, herbicides and seed.

Priority 1 projects are those that have a direct military training impact or are regulatory requirements. Priority 2 projects should be completed to maintain the long-term health of Fort Riley's grassland prairie, but are not regulatory in nature or likely to cause a short term effect on military training. Priority 3 projects are generally BMP's that should be completed as time and resources allow.

Grassland Management	Priority		
<b>Prescribed Burning Actions</b>			
Annually update Prescribed Burn Strategic Plan.	1		
Seasonally adjust Prescribed Burn Strategic Plan.	1		
Annually retain old growth prairie for Henslow's sparrow habitat.		2	
Collaborate with DES & DPTMS on prescribed burn plan.	1		
DPTMS review firebreak operations.	1		
Incorporate Henslow's sparrow habitat into Burn Strategic Plan.		2	
Do not burn prairie-chicken areas, mid-April to mid-August.		2	
Maintain firebreaks to manage areas in smaller parcels.		2	
Only certified personnel conduct burning and firefighting.	1		
Each spring publish bulletin re: Soldier safety during burning.		2	
Each spring publish articles re: safety during burning.		2	
Burn Crew training will be IAW Integrated Wildland Fire MGMT Plan	1		
Burn approximately 30,000-35,000 acres annually. Approximately \$350K annually	1		
<b>IPM Actions</b>			
Remove scattered trees from grassland areas through contract at \$100K per year	1		
Implement Shrub Reduction Strategic Plan. Approximately \$50K		2	
Evaluate and amend, as needed, Shrub Reduction Strategic Plan.		2	
Rotary mow 150 acres of shrub infested grasslands annually.		2	
Ground-spray 150 acres of shrub infested grasslands annually.		2	
Skid steer mulcher treat 150 acres annually.		2	
Cut large trees in shrubby areas of forest edge/upland ecotone.			3
Annually update GIS data layers of tree clipping activities.		2	
Evaluate hedgerows for possible cutting or removal.			3
Evaluate TCI plantings in grasslands for removal.			3
Ground-spray musk thistle-infested areas.	1		
Ground-spray Johnson grass-infested areas.	1		
Ground-spray bindweed-infested grasslands annually.	1		
Update the IPMP.	1		
Annually prepare pesticide report.		2	
All pesticide applicators will be certified for such actions.	1		
<b>Partnerships Management Actions</b>			
Manage Fort Riley's ACUB program.	1		
Participate in regional conservation workshops and meetings.		2	
Assist with management programs on lands around Fort Riley.			3
<b>Soil Management Actions</b>			
Gully erosion repair, as necessary.		2	
Excavate rock for LRAM projects.		2	
Close off unauthorized stream crossings and repair sites.		2	

Repair lands damaged by maneuver training.		2	
Harden drainage ditches damaged during training events.		2	
Monitor soil erosion and soil compaction.		2	
Construct hardened fords, following approved protocol.		2	
Maintain fords, following approved protocol.		2	
Implement plan on borrow areas.		2	
Manage digging permit program.		2	
Conduct soil borrow actions in accordance with Borrow Area Mgmt plan.	1		
<b>Forest Management</b>			
<b>Prescribed Burning Management Actions</b>			
Suppress fire from riverine, floodplain forest stands.			3
Conduct prescribed burns within oak woodlands.			3
Exclude burns from riparian mixed hardwood stands when prescribed			3
<b>TSI Management Actions</b>			
Perform Forest Stands Management Plan actions.			3
Target non-oaks when thinning oak woodlands.			3
Retain a minimum 40 sq. ft. of basal area/ac in oak woodlands.			3
Retain at least 20-pole size trees/acre in oak woodlands.			3
Retain a crown cover of at least 50% in oak woodlands.			3
Retain at least 30% of existing mast and fruit bearing trees.			3
Retain snags and trees with cavities when thinning.			3
Retain a number of mature trees in decline for future snags.			3
Retain minimum 65 sq. ft. of basal area/ac in mixed hardwoods.			3
TSI tree felling for training support or safety.		2	
<b>Commercial Harvest Management Actions</b>			
Harvest within floodplain forest will favor larger diameter trees.	1		
Select and mark trees to be commercially harvested.			3
Meet, in person, with each timber sale applicant.			3
Monitor timber harvest and enforce specifications.			3
Prohibit fuelwood cutting in floodplain forest.			3
Identify skid trails, log decks, and erosion control features.			3
Conduct site impact evaluation; resolve negative impacts.			3
<b>Tree Planting Management Actions</b>			
Increase width of floodplain forests.			3
Connect floodplain forest with other stands, where possible.			3
Maintain walnut forest plantings.			3
Plant cottonwoods, sycamores and oaks within floodplain forests			3
Maintain firebreaks around newer tree plantings for 5-8 years.			3
<b>IPM Management Actions</b>			
Perform forest pest surveillance and control.		2	
Implement Tartarian honeysuckle control plan. Contract approximately \$50K per year in treatment.	1		
Control sericea lespedeza. Contract approximately \$50K per year	1		

Survey for kudzu plants.	1		
Control Caucasian bluestem. Contract approximately \$50K per year.	1		
Develop protocol to survey for emerald ash borer.	1		
Develop/implement response plan for positive emerald ash borer findings.	1		
<b>Specialized Management</b>			
<b>Agriculture Outleases Actions Approximatly \$140K per year</b>			
Conduct prebid lease meeting open for all potential bidders. FY 26			3
Meet with each lessee prior to granting right-of-entry.	1		
Provide lessees an up-to-date access map.	1		
Monitor leases and enforce specifications IAW LUR's.		2	
Provide a sericea lespedeza infestation map to lessee, as asked.			3
Advise lessees on conservation work associated with lease.			3
Provide lessees staff list authorized to grant access before 1 Feb.	1		
Notify lessees of Army activities impacting leases.		2	
Annually inspect all firebreaks for renovation needs.	1		
Renovate structures, as needed, in two firebreak units per year.	1		
Review firebreaks for functioning buffer strips.	1		
Repair filter strips found to be inadequate.	1		
Construct new firebreaks for new ranges or other facilities.		2	
Establish structures, as needed, on firebreak areas not leased.	1		
Annually review, amend and update the LUR's.		2	
Communicate with Command on hay harvest extension.		2	
Inspect firebreak waterways.	1		
Mow firebreak waterways, as needed.		2	
<b>T&amp;E Species Actions</b>			
Consult with USFWS on actions that may affect listed species.	1		
Confer with USFWS when actions may affect proposed or candidates sp.	1		
Discuss with KDWP actions that may affect listed species.	1		
Obtain collection permits to possess any listed species.	1		
Maintain updated GIS data layers for all T&E species.	1		
Report to KDWP observations of state-listed species.	1		
<b>Piping Plover</b>			
Protect nesting piping plovers, if found.	1		
Protect sandbars from adverse impacts.	1		
Report to USFWS observations of piping plovers.	1		
<b>Topeka Shiner</b>			
Enforce prohibition of bait-fish collection.	1		
Protect streams from channel destruction. Required by BO	1		
Protect streams from increases in water turbidity. Required by BO	1		
Protect streams from removal of vegetative filter strips.	1		
Control operations within 50 feet of Topeka shiner streams. Required by BO	1		
Monitor stream habitat.	1		



Restore stream habitat, as needed.	1		
Remove largemouth bass and green sunfish from Wind Creek.			3
Road maintenance will follow approved protocol in 2001 BO and this INRMP.	1		
Continue RCCD Partnership actions off-post in Wildcat Creek		2	
<b>Northern Long-eared Bat</b>			
Annually conduct acoustic surveys.	1		
Where possible, retain dead/dying trees in woodlands.	1		
Fort Riley personnel adhere to WNS prevention national plan.	1		
Implement practices in Biological Evaluation if species documented.	1		
<b>Eastern Black Rail</b>			
Monitor known locations for during spring and fall migration	1		
<b>Whooping Crane</b>			
Monitor reports for whooping crane sightings.	1		
Establish “no fly” zones when whooping cranes are present.	1		
Issue local NOTAMs when “no fly” zones are in effect.	1		
Educate Fort Riley personnel to identify whooping cranes.		2	
Review aerial structures projects for need of line markers.	1		
<b>Bald Eagle Management Actions</b>			
Remove potential roost trees in the training areas. Contract approximately \$50K per year.	1		
Review aerial structures projects for need of line markers.	1		
Review transmission line projects to prevent electrocution.	1		
Implement USFWS Bald Eagle Guidelines around nesting and roosting activities	1		
Protect trees required to maintain integrity of communal roosts.	1		
Minimize nesting conflicts on human-made structures.	1		
Protect bald eagles from chemical impacts.	1		
Provide information to aviators through Local NOTAMs.	1		
Management near nest trees occur outside of nesting season.	1		
Avoid timber operations within 200 m of nest during breeding.	1		
<b>Fort Riley Species At Risk (SAR) Management Actions</b>			
<b>Henslow’s Sparrow</b>			
Designate Henslow’s sparrow breeding habitat.		2	
Retain old-growth prairie for Henslow’s sparrow habitat	1		
Reduce woody encroachment into grasslands.	1		
<b>Regal Fritillary</b>			
Identify & maintain areas containing a variety of wildflowers.	1		
Reduce woody encroachment.	1		
Monitor sericea lespedeza infestations in regal fritillary habitats.	1		
Control sericea lespedeza infestations in regal fritillary habitats.	1		
Restrict aerially-spraying in regal fritillary habitats.	1		
<b>Texas Horned Lizard</b>			
Document habitat of reported Texas horned lizard sightings.			3

Maintain log of Texas horned lizard sightings habitats.			3
Minimize insecticide use away from cantonment areas.			3
<b>Rusty Blackbird</b>			
Train Conservation personnel to recognize rusty blackbirds.	1		
Document habitat of reported rusty blackbird sightings.	1		
Maintain log of rusty blackbird sightings habitats.	1		
Maintain updated GIS data layers for rusty blackbirds.	1		
Implement protocol to control Tartarian honeysuckle in woods.			3
<b>Terrestrial Habitat Actions</b>			
Annually develop food plot plan.			3
Implement food plot plan. Approximately \$25K annually with funds from the sale of hunting permits and donations.			3
Maintain compliance with regulations concerning baiting.	1		
Mow alfalfa food plots as needed after nesting season			3
Apply glyphosate to smooth brome, non-native grass areas. Approximately \$50K annually		2	
Clean and set out nesting structures for eastern bluebird.			3
Clean and set out nesting structures for purple martin.			3
<b>Pond and Lake Management Actions</b>			
Place discarded Christmas trees into fishing ponds.			3
Remove trees from pond dams, as needed.			3
Control cattails in fishing ponds.			3
Implement measures to correct fish populations, as needed.			3
Renovate existing, degraded ponds.			3
<b>Stream Management Actions</b>			
Repair stream filter strips, as needed.	1		
Reduce silt transport during construction actions.	1		
<b>Wetlands Management Actions</b>			
Plant native grasses adjacent to wetlands.			3
Historic Architect reviews grass planting and maintenance actions.	1		
Perform NEPA and obtain permits, as needed.	1		
Seasonally draw-down and reflood shallow-water wetlands.			3
Manage Firebreak 3-11 as an ephemeral or vernal pool wetland.		2	
Create small vernal pools.			3
<b>Nuisance Animal Control Management Actions</b>			
Obtain permits to handle migratory birds.	1		
Obtain permits to take nests (depredation).	1		
Transport injured raptors to rehabilitators.			3
Investigate calls concerning fledgling birds.	1		
Conduct non-lethal harassment to move large roosts.		2	
Use toxic bait to control starlings and pigeons in hangars.		2	
Use a pellet rifle to take problem, non-native birds.	1		
Install bird exclusion apparatus on buildings.	1		
Remove non-native bird nests, when problem.	1		

Survey cantonment areas for problem coyotes and foxes.		2	
Remove bold coyotes.		2	
Educate residents to not play with foxes, as needed.	1		
Respond to complaints of skunks, opossums and raccoons.		2	
Take captured feral cats and dogs to Vet Services.			3
Address problem beavers in wetlands.		2	
Exclude bats from buildings.		2	
Control gophers in cantonment areas.	1		
Remove problem ground squirrels and badgers.		2	
<b>Cantonment Area Actions</b>			
Prioritize fruit and seed producing trees, shrubs and plants.			3
Update urban forestry inventory, identifying hazard trees.	1		
Spray tree species for pest infestations, as needed.			3
Coordinate mosquito control with Preventive Medicine.	1		
Manage pest control contract.	1		
<b>INVENTORY &amp; MONITORING</b>			
<b>Flora Inventory and Monitoring</b>			
ITAM monitors bare ground and vegetation cover.		2	
Conduct remote sensing to monitor soil disturbance.		2	
Monitor LRAM-repaired sites.		2	
Conduct Forest stand inventories.			3
<b>Fish</b>			
Electrofishing to sample fish in Moon Lake.			3
Electrofishing to sample fish in Breakneck Lake.			3
Electrofishing to sample fish in Beck Pond.			3
Electrofishing to sample fish in Vinton Pond.			3
Electrofishing to sample fish in LaGrange Pond.			3
Electrofishing to sample fish in Avery Pond.			3
Electrofishing to sample fish in Stone Pond.			3
Every fifth year, electrofishing to sample fish in Dale Pond.			3
Every fifth year, electrofishing to sample fish in Goens Pond.			3
Every fifth year, electrofishing to sample fish in Pritchard Pond.			3
Every fifth year, electrofishing to sample fish in Stortz Pond.			3
Every fifth year, electrofishing to sample fish in Blue Pond.			3
Every fifth year, electrofishing to sample fish in Gaches Pond.			3
Every fifth year, electrofishing to sample fish in Rich Pond.			3
Every fifth year, electrofishing to sample Funston Lake.			3
Write report of fish inventory.			3
<b>Upland Game</b>			
Distance sampling for northern bobwhite.			3
Distance sampling for ring-necked pheasant.			3
Lek counts for greater prairie-chicken.			3
Conduct fall covey counts for northern bobwhite.			3

<b>Big Game</b>			
Elk aerial surveys each winter.		2	
Annual nocturnal deer spotlight surveys.		2	
<b>Threatened &amp; Endangered Species</b>			
Surveys for piping plovers.	1		
Monitor existing sandbar habitat	1		
Update GIS map.	1		
Float the Kansas and Republican rivers before July 1.	1		
If a nesting attempt is confirmed, weekly monitor it.	1		
Surveys in streams in which Topeka shiners are known to have occurred.	1		
Surveys in streams without known Topeka shiners.	1		
Surveys for northern long-eared bats.	1		
Monitor known locations for the eastern black rail	1		
<b>Bald Eagles</b>			
Search for nesting bald eagles.	1		
Monitor any active eagle nest.	1		
Winter weekly survey of diurnal habitat.	1		
Monitor nocturnal roosts.	1		
<b>Rare Species</b>			
Survey for Henslow's sparrows.		2	
Document loggerhead shrike sightings.			3
Survey for regal fritillary butterflies in native prairies.	1		
Maintain data collected in a GIS database.		2	
Document Texas horned lizard sightings.		2	
Document rusty blackbird sightings.			3
Document white-faced ibis sightings.			3
<b>Migratory Birds</b>			
Conduct distance sampling for breeding birds.			3
Conduct Winter raptor surveys.			3
Monitor use of nesting structures.			3
Conduct Christmas Bird Count survey for winter birds.			3
<b>Small Mammals</b>			
Monitor use of bat roosting structures.			3
<b>Amphibians and Reptiles</b>			
Amphibian calling survey.			3
Installation wide survey in early-May.			3
Annually survey vernal pools.			3
<b>Invertebrate Surveys</b>			
USDA-APHIS install traps for invasive, non-native insects.		2	
Inspect woodlands to determine spread of forest pests.		2	
<b>Wildlife Harvest Monitoring</b>			
Collect hunting harvest data.		2	
Manage and update iSportsman web portal.		2	

Collect fish harvest data via iSportsman.			3
Collect deer harvest data via iSportsman.		2	
Collect data from harvested spring turkeys.		2	
Write the annual harvest report.			3
<b>Out Year Projects</b>			
Perform 10-year update of floristic PLS. Contract approximately \$30k FY23	1		
Update sericea lespedeza coverage. \$25K FY 24	1		
Perform 10 year update of Forest PLS. \$50K FY 24			3
PLS of Tamarisk invasion along the Kansas River. In house			3
Timber rattlesnake survey. In house			3
Hognose snake survey. In house			3
<b>RESEARCH PROJECTS</b>			
<b>Academic Institution Research Projects</b>			
Elk on Fort Riley DNA analysis			3
<b>Conservation Research Projects</b>			
Evaluate effectiveness of glyphosate in smooth brome fields.			3
Collect and analyze regal fritillary and monarch distance sampling data	1		
Collect and analyze breeding bird surveys	1		
<b>ITAM Research Projects</b>			
ERDC-CERL DRI Soil Testing		2	
<b>LAW ENFORCEMENT</b>			
Provide environmental education to outdoor recreationists.		2	
Assist in collection of research and biological survey data.		2	
Analyze violation trends.		2	
Interact with KDWP staff to investigate poaching cases.		2	
Routinely patrol the installation.	1		
Check recreationists for licenses and bag and creel limits.	1		
Special operations, such as check points and decoy deer.			3
Obtain in-service training.			3
<b>Environmental Awareness</b>			
<b>Military Personnel Awareness</b>			
Enhance education within the rare species management plans.		2	
Brief environmental training to the Range Safety Officer Course.	1	2	
Provide Hazardous Plants and Animals briefings.		2	
Unscheduled opportunity to speak on environmental protection.		2	
Provide Soldier Field Cards through Sustainable Range Program	1		
<b>Community Outreach Actions</b>			
Collaborate with PAO to release natural resource and outdoor recreation information through various outlets.		2	
Release environmental awareness information through social media		2	
Distribute news releases through the Public Affairs Office.		2	
Honor requests for radio station interviews.			3
Mail information and educational materials to requesters.			3

Produce publications to Fort Riley outdoor recreationists.			3
Distribute publications produced by other organizations.			3
Present talks to organizations, as requested.			3
Provide programs to school groups, as requested.			3
Provide information to the Fort Riley Outdoorsman Group.			3
Support Children's Fishing Derbies.			3
<b>OUTDOOR RECREATION</b>			
<b>Quality of Life</b>			
Support at least 5,000 hunting and 20,000 fishing trips annually.		2	
<b>Access Procedures</b>			
Manage open area notifications via iSportsman.		2	
Operate self-service check-in/out via iSportsman.		2	
<b>Deer</b>			
Establish deer season dates and hunting regulations.	1		
Establish and print deer hunting fact sheet.		2	
<b>Elk</b>			
Cooperate with KDWP in elk permit numbers and season dates.			3
<b>Turkey</b>			
Provide spring turkey hunting fact sheet			3
<b>Furbearer</b>			
Update the annual Fort Riley Trapping Fact Sheet.			3
Issue trapping permits.			3
<b>Sport Fish</b>			
Stock 8,000-13,000 lbs. of harvestable channel catfish.		2	
Stock fingerling largemouth bass, as needed.			3
Stock 12,000 lbs. of harvestable rainbow trout.		2	
Mow around fishing ponds.			3
Stock large predatory fish to control population imbalances.			3
Close any water body for environmental concerns.	1		
<b>QOL Management Actions</b>			
Seek partnerships to leverage installation funds.		2	
Manage income from the sales of hunting permits.			3
Provide information to recreational users.			3
Provide general recreational briefing for all recreational users on the installation.	1		
Provide species specific briefing for all deer, elk and spring turkey hunters.	1		
Provide informational materials to recreational users.			3
Provide staff to interact with customers as resources allow.			3
Conduct boating safety courses (DFMWR performs).			3
Manage recreational access			3
Provide logistical assistance for the FROG archery range			3
Operate fuelwood program			3
<b>IMPLEMENTATION</b>			

Program Administration Costs			
Personnel salaries (government and contractor)	1		
Natural resources management supplies and equipment used for numerous individual projects. Approximately \$700K per year.	1		
Providing routine computer upgrades		2	
Updating GIS		2	
Obtaining updated aerial photography		2	
Provision of required training		2	

## APPENDICES

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### **APPENDIX A: LIST OF FEDERAL LAWS AND EO'S GOVERNING NATURAL RESOURCES MANAGEMENT ON MILITARY LANDS**

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- Governing Conservation Laws and Executive Orders Army Regulation 200-1
- Bald and Golden Eagle Protection (Eagle) Act of 1940 [16 USC 668]
- Bob Stump National Defense Authorization Act for FY 2003, Public Law 107-314
- Clean Air Act (CAA) (1955) [42 USC 7401]
- Clean Water Act (CWA) (1972) [33 USC 1251] [PL 92-500]
- Conservation and Rehabilitation Program on Military and Public Lands (PL 93-452)
- Conservation Programs on Military Reservations (Sikes Act) [16 USC 670] [PL 86-797]
- Emergency Wetlands Resources Act of 1986 [16 USC 3901]
- Endangered Species Act (ESA) [PL 93-205]
- Federal Actions to Address Environmental Justice in Minority and Low-Income Populations (EO 12898)
- Erosion Protection Act [33 USC 426]
- Facilitation of Cooperative Cooperation [EO 13352]
- Facilitation of Hunting Heritage and Wildlife Conservation (EO 13443)
- Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), as amended [7 USC 136]
- Federal Land Policy and Management Act of 1976 [43 USC 1701]
- Federal Noxious Weed Act of 1974, as amended [7 USC 2801]
- Fish and Wildlife Conservation Act of 1980 [16 USC 2901] [PL 96-366]
- Fish and Wildlife Coordination Act of 1934 [16 USC 661]
- Food, Agricultural, Conservation and Trade Act of 1990 (Pesticide Reporting) [7 USC 136I]
- Hunting, Fishing and Trapping on Military Lands
- Invasive Species [EO 13112]
- Lacey Act of 1900
- Migratory Bird Treaty Act (1918) [16 USC 703] [PL 65-186]
- Multiple-Use Sustained Yield Act of 1960 [16 USC 528]
- National Environmental Policy Act of 1969 (NEPA) [42 USC 4321] [PL 91-190]



- North American Wetlands Conservation Act [16 USC 4401]
- Outdoor Recreation on Federal Lands
- Outleasing for Grazing and Agriculture on Military Lands [10 USC 2667]
- Protection and Enhancement of Environmental Quality [EO 11514]
- Protection of Wetlands [EO11990]
- Recreational Fisheries [EO 12962]
- Responsibilities of Federal Agencies to Protect Migratory Birds (EO 13186)
- Safe Drinking Water Act of 1974, as amended [42 USC 300] [PL 93-523]
- Sikes Act Improvement Act of 1997 {P.L. 105-85}
- Soil and Water Resources Conservation Act of 1977 [16 USC 2001]
- Timber Sales on Military Lands [10 USC 2665]
- Watershed Protection and Flood Prevention Act [16 USC 1001] [33 USC 701]
- Exotic Organisms [EO 11987]
- Floodplain Management [EO 11988]
- Intergovernmental Coordination Act (1968) [42 USC 4231] [PL 90-577]
- Protection of Wetlands [EO 11990]

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## **APPENDIX B: LIST OF ACTIVITIES OCCURRING ON A REGULAR BASIS AT FORT RILEY TO CONDUCT AND SUPPORT THE INSTALLATION'S ASSIGNED TRAINING MISSION**

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### **Training Activities**

Training activities typically scheduled each year include the following.

- **Douthit Gunnery Complex gunnery exercises.** Digital Multi-Purpose Range Complex (DMPRC) and Digital Multi-Purpose Training Complex gunnery exercises are typically scheduled six times annually. Each unit has up to 58 combat vehicles (M1 or M2) firing throughout the gunnery exercise. Battalions use approximately 58 square miles (145 square kilometers) of training area that includes the Impact Area and the western strip training area. Gunnery exercises include live-fire training events.
- **Range 18 gunnery exercises.** Gunnery exercises at Range 18 are typically scheduled seven times annually. Each unit has up to 58 combat vehicles (M1 or M2) firing throughout the gunnery exercise. Battalions use approximately 28 square miles (70 square kilometers) of training area during MPRC gunnery exercise training at Range 18 (including the impact area and training areas 6 through 9). Range 18 gunnery exercises are live-fire training events.
- **Brigade Battle Simulation Exercises.** Brigade Battle Simulation Exercises are typically scheduled six times annually. The simulated battles are conducted on computers inside the battle simulation center, and information is passed back and forth between the subordinated commanders and tactical operation centers. Brigades use approximately 1.6 square miles (4 square kilometers) of training area during a Brigade Battle Simulation Exercise. Brigade Battle Simulation Exercises are conducted without ammunition.
- **Company/Team Situational Training Exercise.** Company/Team Situational Training Exercises are typically scheduled twice annually. These exercises are conducted to prepare the subordinate units within the brigade, which is scheduled to conduct a National Training Center rotation. A brigade may have up to 174 combat vehicles (M1 or M2), along with its combat support units, maneuvering throughout the training area during the exercise. Thus, brigades use approximately 40 square miles (100 square kilometers) of maneuver training area during Company/Team Situational Training Exercises. Company/Team Situational Training Exercises are blank-fire training events.
- **Field Artillery External Evaluation.** Field Artillery External Evaluations are typically scheduled twice each year. During these Evaluations, Field Artillery battalions evaluate their M109 howitzer crews, fire direction centers, and forward observers on Artillery tables and call for fire procedures. Field Artillery battalions may have up to 24 M109 howitzers firing throughout the exercise. Battalions use approximately 44 square miles (110 square kilometers) of training area during Field Artillery External Evaluations (including the Impact Area and Training Areas 5 through 16). Field Artillery External Evaluations are live-fire training exercises.

- **Engineer/Field Artillery MPRC and Range 18 gunnery training.** Douthit and Range 18 gunnery-training exercises are typically scheduled six times for Engineer/Field Artillery use each year. Engineer and Field Artillery battalions qualify their combat vehicle crews on the 50 caliber machine gun tables. Each unit has up to 34 combat vehicles (M113 or M109) firing throughout the gunnery training. Battalions use approximately 28 square miles (70 square kilometers) of training area during Range 18 gunnery training, including the impact area and training areas 6 through 9. During Douthit Complex gunnery training, battalions use approximately 58 square miles (145 square kilometers) of training area, including the impact area and the western strip training areas. Douthit Complex and Range 18 gunnery training exercises are live-fire training events.
- **Annual Training (AT).** Only one annual training period is scheduled during most years. During an annual training period, a brigade-sized unit uses all of Fort Riley's training areas and ranges. A brigade may have up to 174 combat vehicles (M1 or M2), along with its combat support units, maneuvering throughout Fort Riley training areas. AT periods use approximately 126 square miles (315 square kilometers) of training area, including both of the impact areas. AT periods are both live-fire and blank-fire training events.
- **Expert Infantryman's Badge and Expert Field Medical Badge training events.** Expert Infantryman's Badge and Expert Field Medical Badge training events are each typically scheduled once a year. Infantry and medical Soldiers participate in the training and testing of common tasks expected of each. Combat vehicles (M1 or M2) are not used to support either event. Both events require approximately 1.6 square miles (4 square kilometers) of training area. Soldiers participating in both events are required to qualify expert with their individual weapon prior to the training event. Both training events are conducted with a small amount of blank ammunition.
- **Platoon Situational Training Exercises.** Each battalion conducts Platoon Situational Training Exercises to prepare for Company/Team Situational Training Exercises (which, as discussed above, are typically scheduled twice each year). Platoon Situational Training Exercises last typically three weeks and precede each Company/Team Situational Training Exercise. A battalion may have up to 58 combat vehicles (M1 or M2) maneuvering throughout the training area during the exercise. Battalions use approximately 18 square miles (45 square kilometers) of maneuver training area during Platoon Situational Training Exercises. Platoon Situational Training Exercises are blank-fire training events.
- **Combat Aviation Brigade Training Exercises.** Rotary wing aircraft operations on Fort Riley include Helicopter Landing Zone operations and Nap of the Earth flight operations, wherein aircraft may fly as low as 3 feet above ground level. Aircraft also conduct firing exercises on the Douthit Gunnery Complex Screening Range. Aircraft conduct training flights over both government- and private-owned lands, generally at 500 feet above ground level or higher. Fort Riley's CAB typically executes 21,200 helicopter flight hours annually and air traffic counts in and around the airfield usually exceed 10,000 a month.

***Support Activities***

Many “ongoing activities” support the public works and commercial service functions required to allow people to live and work on the installation. Such activities are similar to those conducted in any non-military community of equal size, and include the following types:

- Administrative operations.
- Airfield operations.
- Facilities repair, maintenance, construction, and alteration.
- Fuel and petroleum storage and dispensing.
- Grounds maintenance.
- Hospital, medical, and dental clinic operations.
- Installation and community support services.
- Natural and cultural resources management and environmental protection.
- Recreation.
- Road and right-of-way maintenance.
- Utility operations including infrastructure maintenance, repair, construction, and alteration.
- Warehousing and supply storage.
- Vehicle and equipment maintenance and repair.

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## APPENDIX C: MANAGEMENT PLANS OF FORT RILEY THREATENED AND ENDANGERED SPECIES AND SPECIES OF CONSERVATION CONCERN

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The purpose of the following management plans is to define conservation goals and describe the actions that will enable achievement of those conservation goals for each species of conservation concern on Fort Riley. Additionally, each management plan describes the monitoring efforts that will be put forth to assess the consequences of our management actions on protected species. The overarching conservation goals of each species management plan include the following:

- Protect species of conservation concern while present on Fort Riley. This includes but is not limited to individuals, nests, roosting locations, and offspring.
- Maintain or increase the abundance and quality of habitat specific to each species of conservation concern.
- Educate the public on the presence and description of species of conservation need.
- Monitor the presence/absence of rare species over time, in addition to the environment they were observed in.

### **BALD AND GOLDEN EAGLE MANAGEMENT PLAN**

This management plan is based on and is consistent with the Bald and Golden Eagle Protection Act (Eagle Act) of 1940, as well as the National Bald Eagle Management Guidelines. The U.S. Fish and Wildlife Service (USFWS) developed these Guidelines to advise land managers with bald eagles when and under what circumstances the protective provisions of the Eagle Act may apply to their activities. The Guidelines are intended to help people minimize impacts to bald eagles, particularly where they may constitute “take<sup>5</sup>” or “disturbance<sup>6</sup>” of eagles, which are prohibited by the Eagle Act. Before performing any action that may take or disturb bald eagles, the proponent must first coordinate with the USFWS through the Fort Riley Conservation Branch, Directorate of Public Works.

#### **Eagle Information**

**Description: Bald Eagle.** Adult bald eagles are unmistakable in the field, with their white heads and tails contrasting sharply with the dark brown body plumage. Immature bald eagles are all dark with some degree of white mottling occurring on the body, and may be confused with golden eagles, turkey vultures and ospreys.

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<sup>5</sup> The Act defines “take” as “pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb.”

<sup>6</sup> “Disturbance” means: “to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment”.

**Description: Golden Eagle.** Golden eagles are as large as bald eagles, much larger than other raptors. All ages of birds display a golden nape, from which the species derives its name. Adult golden eagles are all dark, while juvenile birds typically have white wing patches and a white tail with a dark, terminal band. In flight, golden eagles show a relatively small head soar with wings slightly in a dihedral, whereas bald eagles have a larger head and keep wings nearly flat when soaring.

**Habitat/Ecology.**

Bald eagles are most frequently observed using riverine or lacustrine habitats, particularly those with large trees in close proximity. Bald eagles feed primarily on fish, with injured or sick waterfowl and carrion also being opportunistically taken. Generally, prey availability is not a problem as long as eagles have access to open water feeding areas.

Isolation and protection from human disturbances are factors that generally appear important to bald eagles. The amount of isolation necessary is not completely clear. Stalmaster and Newman (1978) recommended protecting areas 75-100 m wide to minimize disturbances to wintering eagles and Stalmaster and Kaiser (1997) found increased distances to noise decreased disturbance to roosting bald eagles. The tolerance to human disturbance appears to vary greatly among individual bald eagles (Mike Lockhart, USFWS, pers. comm.), with older birds, generally, being more intolerant than juveniles or sub adults (Stalmaster and Newman 1978, Stalmaster and Kaiser 1997).

Specific perch sites preferred by bald eagles vary depending on time of day and weather conditions. Selected daytime perches are most often the tallest trees, particularly those near water with open branches. Bald eagle roosting habitat consists of tall trees that provide protection from the wind. Eagles may use several roosts on a single wintering site, with use of the different roosts dependent upon weather conditions (Edwards 1969, Ingram 1965). Communal roosts are used annually.

Bald eagle nesting habitat is similar to its wintering habitat. A good area has a suitable nest tree, many perches that provide a view of the territory, and a feeding area. Nest trees are large, dominant trees, and are relatively isolated from human disturbance. Primary habitat for bald eagles on Fort Riley exists in the riverine woodlands that border the Kansas, Republican, and Smoky Hill rivers, as well as the shorelines of Milford Lake, which have large trees.

The first bald eagle nest was discovered on Fort Riley in 2004 near Milford Lake along Madison Creek. This same nesting territory has been used through 2021, presumably by the same pair. Since 2004 a total of nine nests have been discovered on Fort Riley and 19 bald eagle nests have been observed outside of, but in close proximity to Fort Riley. These 28 bald eagle nests account for an estimated 16 different nesting territories (Figure 13).

Three communal winter roost sites are known to occur on Fort Riley; two along the Kansas River, and one along Madison Creek upstream from Milford Lake. Roost sites are typically utilized on Fort Riley during the period, 15 October to 31 March. The number

of eagles using the roosts varies nightly. The highest documented roost count occurred in 1999, when 388 bald eagles were counted at the Kansas River roost

Golden eagles are a western bird, nesting in mountains and on cliffs. In migration and during winter, the species will move into valleys and plains, and infrequently is observed on Fort Riley. Golden eagles primarily eat small mammals and birds, but will also consume snakes and carrion.

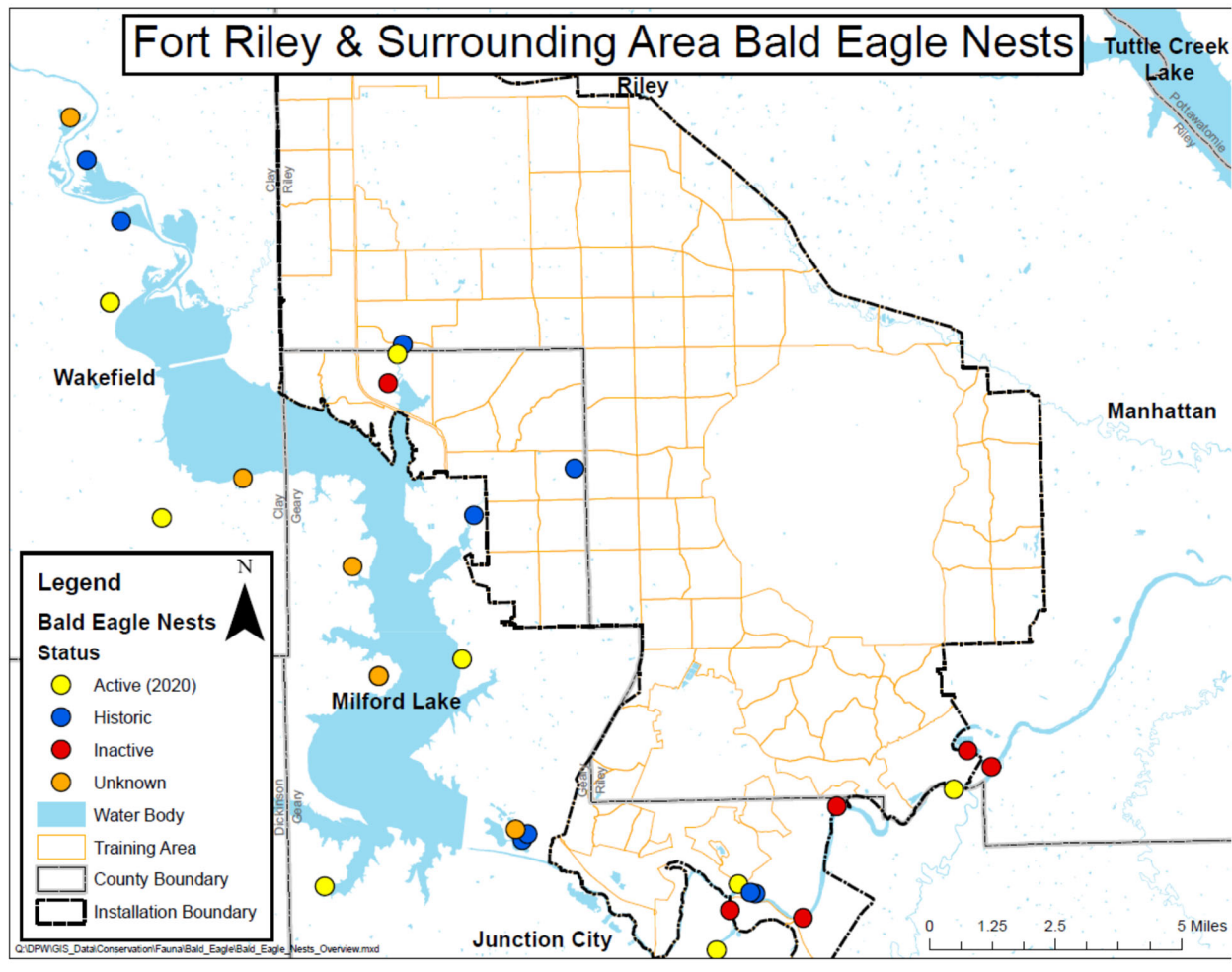


Figure 13 - Bald eagle nest sites in and around the Fort Riley area.

**Eagle Management Prescriptions and Actions**

***Protect eagles from human-induced injury and mortality.***

Many laws and regulations exist to protect eagles against shooting or trapping, and to minimize lead-poisoning by requiring the use of non-toxic shot when hunting waterfowl.

Additional restrictions against shooting eagles seem unwarranted, as does further education about these restrictions.

Other hazards to eagles include electrocution on power lines, tower and line strikes, and exposure to chemicals. Many transmission lines, poles, and towers exist on Fort Riley that may pose some degree of threat to eagles.

***Prescription. Minimize the risk of eagle electrocution on power lines***

**Action.** To safeguard against eagle electrocution, any projects to construct new or modify existing electric transmission lines on Fort Riley will be reviewed by the Conservation Branch prior to project implementation. Techniques protecting eagles from electrocution employing industry-accepted best management practices will be incorporated into the project designs when needed.

***Prescription. Minimize the risk of eagle collisions with aerial structures***

**Action.** Techniques employing industry-accepted best management practices are available to mark or otherwise design aerial structures so that the hazard of eagles colliding with them is eliminated or greatly reduced. Line markers, such as aviation balls and colored spiral dampers, and similar markers for towers and guy lines will be used as needed to make these structures more visible to eagles. Any projects to construct new or modify existing aerial structures on Fort Riley will be reviewed for need of re-siting or using line markers, incorporating guidelines established by the USFWS for the siting of communication towers and wind-powered generators. Areas of particular concern are within one mile of a river or Milford Lake shoreline because eagles use rivers and lakes as travel lanes.

***Prescription. Minimize nesting conflicts on human-made structures***

**Action.** Where bald eagles are likely to nest in human-made structures (e.g., cell phone towers), and such use could impede operation or maintenance of the structures or jeopardize the safety of the eagles, the structures will be equipped with either (1) devices engineered to discourage bald eagles from building nests, or (2) nesting platforms that will safely accommodate bald eagle nests without interfering with structure performance.

***Prescription. Protect eagles from chemical impacts***

**Action.** The storage and use of all pesticides, herbicides, fertilizers, and other chemicals on Fort Riley shall be conducted in strict accordance with label directions and restrictions. All general use and military chemicals on Fort Riley shall be used, stored, and disposed of in accordance with directions, restrictions and/or guidelines established by the manufacturer and/or Department of the Army.

***Prescription: Protect eagles from human activity***

Disruption, destruction, or obstruction of roosting and foraging areas can negatively affect bald eagles. Disruptive activities in or near eagle foraging areas can interfere with feeding, reducing chances of survival. Wintering bald eagles rely on established roost sites where the eagles are somewhat sheltered from the wind and weather. Activities that permanently alter communal roost sites and important foraging areas can altogether



eliminate the elements that are essential for feeding and sheltering bald eagles. Where a human activity agitates or bothers eagles to the degree that causes injury or substantially interferes with breeding, feeding, or sheltering behavior and causes, or is likely to cause, a loss of productivity or nest abandonment, the conduct of the activity constitutes a violation of the Eagle Act's prohibition against disturbing eagles.

Eagles are unlikely to be disturbed by routine use of roads, homes, and other facilities where such use pre-dates the eagles' successful nesting, roosting and foraging activity in a given area. Therefore, in most cases *ongoing* existing uses may proceed with the same intensity with little risk of disturbing eagles. Thus, vehicle traffic on established, hardened roads and bridges, Army aircraft flight on established arrival and departure routes, and established Army aircraft traffic pattern flight within the protected area are not subject to this requirement.

***Prescription: Protect foraging eagles on Fort Riley from disturbance***

**Action.** Implement prescriptions within the USFWS National Bald Eagle Guidelines for nesting and roosting eagles not otherwise covered by a USFWS Bald Eagle Permit issued to Fort Riley.

***Prescription: Protect roosting eagles on Fort Riley from disturbance***

**Action.** Implement prescriptions within the USFWS National Bald Eagle Guidelines for roosting eagles not otherwise covered by a USFWS Bald Eagle Permit issued to Fort Riley. Additional restrictions may be established around any active bald eagle roost on lands controlled by Fort Riley. Application of those restrictions will depend on the size and location of the roost and the likelihood of the proposed action to cause significant disturbance

***Prescription: Protect nesting eagles***

**Action.** Implement prescriptions within the USFWS National Bald Eagle Guidelines for nesting eagles not otherwise covered by a USFWS Bald Eagle Permit issued to Fort Riley. Additional restrictions may be established around any active bald eagle nest on lands controlled by Fort Riley. Application of those restrictions will depend on the location of the nest and the likelihood of the proposed action to cause significant disturbance

***Prescription: Educate installation's personnel about requirement to protect eagles***

**Action.** Information is provided to aviators through Local NOTAMs (Notices to AirMen) regarding eagle concentrations and behaviors in an attempt to minimize aircraft conflicts with eagles. Additional programs will be developed, as needed.

***Prescription: Protect and conserve eagle habitat on Fort Riley***

**Action.** The presence of bald eagles on Fort Riley depends primarily on the availability of riparian woodland habitat that provides suitable roosting and nesting trees required by the species. Surveys demonstrate that bald eagles utilize virtually every stretch of the Kansas, Republican, and Smoky Hill rivers' riparian woodlands and the tree-lined, Milford Lake shoreline within the installation's boundaries. Large roost trees along the Kansas and Republican rivers will generally be protected from removal to provide suitable habitat.

Regeneration of cottonwood and sycamore seedlings will be aided by planned treatments of Tartarian honeysuckle to promote better light penetration to the forest floor.

Conversely, large potential nest trees north of Rubio Road will be removed to discourage nesting activities that might conflict with military training. Removal actions will occur during the non-nesting season and for trees that do not have an active or inactive nest unless a permit is acquired from the USFWS.

Golden eagles use open fields for hunting and perching on the ground or in trees. Habitat is not considered limiting for golden eagles, and no specific measures to protect or create habitat will be undertaken.

***Prescription: Protect bald eagle nest and roost trees on Fort Riley***

**Action.** Trees whose presence is required to maintain the integrity of communal eagle roosts or nest sites on Fort Riley will be protected and preserved by retaining mature trees and old growth stands, particularly within ½ mile from water. The strategy for riverine forests is to increase the width of forested floodplain corridors and promote large, mature to overmature stands. These stands will have high canopy closure and an open to intermediate sub-canopy to favor species typically occurring in floodplain forests.

**Action.** Avoid clear cutting or removal of overstory trees within 100 m of a nest at any time. Removal of individual trees near an active nest may be warranted to promote safety for humans or eagles.

**Action.** Selective thinning and other silviculture management practices designed to conserve or enhance habitat, including prescribed burning close to a nest tree, will be undertaken outside of the breeding season. Precautions will be taken to prevent crown fire or fire climbing the nest tree.

**Action.** Timber harvesting operations, including road construction and chain saw operations, will be avoided within 200 m of a nest during the breeding season.

**Eagle Monitoring Plan**

***Search for bald eagle nesting attempts on Fort Riley***

Surveys for eagle nesting attempts on Fort Riley will be conducted each year. Surveyors will scan riparian timber to look for pairs of eagles and also for nests.

***Monitor nesting pairs of bald eagles found on Fort Riley***

If an active nest is confirmed, it will be monitored to determine the status and outcome of the nesting attempt. Monitoring will be carried out from a vantage point as far from the nest as possible that allows good visibility with optical equipment. Activity of the eagles, including any indications of stick placement, copulation, incubation, or feeding will be documented at each visit. The USFWS Kansas Field Office will be notified promptly upon the discovery of any suspected nesting bald eagles on Fort Riley.

***Monitor wintering eagles on Fort Riley***

Diurnal habitat of bald eagles on Fort Riley will be surveyed weekly when wintering eagles are expected to be present (about October 15 to about March 31). Information recorded will be number and age ratios of eagles at specific locations, weather conditions, snow or ice cover, and time of day. Roosts will be monitored when wintering eagles are in the area. Monitoring frequency for each roost will vary. Species-specific surveys for golden eagles will not occur, but all incidental sightings of this species will be recorded and maintained within GIS databases.

### **Literature Cited**

- Edwards, C.C. 1969. Winter behavior and population dynamics of American eagles in western Utah. Ph.D. Thesis, Brigham Young Univ. Provo, UT. 142 pp.
- Ingram, T.N. 1965. Wintering bald eagles at Guttenburg, IA-Cassville, WI, 1964-65. *IA Birdlife*. 35:66-78.
- Stalmaster, M.V., and J.L. Kaiser. 1997. Flushing Responses of Wintering Bald Eagles to Military Activity. *J. Wildl. Manage.* 61(4):1307-1313.
- Stalmaster, M.V., and J.R. Newman. 1978. Behavioral responses of wintering bald eagles to human activity. *J. Wildl. Manage.* 42:506-513.

## **PIPING PLOVER MANAGEMENT PLAN**

This management plan is based on and is consistent with the Endangered Species Act of 1973 (ESA), the Kansas Endangered Species and Nongame Conservation Act of 1975, and Army Regulations. Any action that may directly or indirectly affect the piping plover, or its preferred habitat, must be coordinated with the USFWS by the Conservation Branch that is not otherwise outlined in this plan.

### **Piping Plover Species Information**

#### ***Description***

***Plumage.*** The piping plover is a tiny shorebird, 6-7 inches in size. Piping plovers have a back the color of dry sand. They have a white rump, breast, and belly. Breeding adults possess a black forehead patch, orange legs, a short, black-tipped, orange bill, and a black breast band, which may be complete or incomplete.

#### ***Habitat/Ecology***

Piping plover nesting habitat is usually unvegetated sandbars or islands that provide good visibility in wide, riverine channels (Sidle and Harrison 1989; Whyte 1985). Vegetation should not exceed 25% of the ground cover for optimal use. Nests are shallow and inconspicuous depressions in an open, sandy area or gravelly patch. Piping plovers nest as solitary pairs and feed on aquatic invertebrates at or near the surface of the sand.

Conservation Branch personnel observed two piping plovers on Fort Riley in April, 1996, and one in September, 1996. The piping plovers were observed on sandy beaches of both the Kansas and Republican rivers.

River channelization, irrigation, and the construction of mainstem dams have eliminated much of the sandbar-nesting habitat used by these species throughout their range (Haig et al. 1988). These practices remove sandbars from river systems and degrade the sandbars that remain. Regulating river flow for navigation eliminates the scouring action of high water flow that removes vegetation from sandbars. The ensuing vegetation encroachment results in poor to no habitat on the remaining sandbars.

### **Piping Plover Management Prescriptions and Actions**

#### ***Protect individual piping plovers from human-induced injury***

The presence of unmarked power lines, towers and other structures into which piping plovers may fly is hazardous. Many transmission lines, poles, and towers exist on Fort Riley. All may pose some degree of threat to these species. However, techniques are available to mark such structures to eliminate or greatly reduce the hazard.

Human disturbance at nesting areas may inhibit courtship, incubation and brooding behaviors, and can trample nests and destroy young.

#### ***Prescription. Minimize the risk of piping plover collisions with aerial structures***

**Action.** Techniques are available to mark or otherwise design aerial structures so that the striking hazard is eliminated or greatly reduced. Line markers, such as aviation balls and colored spiral dampers, and similar markers for towers and guy lines may be used to make these structures more visible to piping plovers. Any projects to construct new or modify existing aerial structures on Fort Riley will be reviewed by Conservation Branch at least 30 days prior to project implementation to determine whether line markers are needed. Areas of particular concern are within one mile of a river or Milford Lake shoreline because these may be used as travel lanes.

#### ***Prescription. Protect piping plovers on nesting territories***

**Action.** A "no disturbance" buffer zone will be established without delay around any piping plover pair that exhibits courtship or breeding behavior on lands controlled by Fort Riley. Nesting sites will be similarly protected from human disturbance. All human activity not specifically approved by the USFWS will be excluded from the buffer zone until two weeks after the adults and any young produced there leave the nest vicinity. The size of the zone will be determined after conference with the USFWS.

Fort Riley cannot impose buffer zones on adjacent lands to protect courtship or nesting. However, if Fort Riley controls access to those portions of the Kansas and Republican rivers where nesting or courtship activity occurs, Fort Riley will prohibit all access to the nesting site through the installation until said access is specifically approved by the USFWS.

#### ***Protect and maintain piping plover habitat***

**Action.** Piping plover observations along the Kansas and Republican rivers indicate the rivers' potential as migratory habitat. Protecting and conserving piping plover habitat on Fort Riley requires protecting the habitat from adverse physical destruction.

***Prescription. Protect existing riverine habitat***

**Action.** All sandbars and shorelines of the Kansas and Republican rivers that are on Fort Riley are protected from adverse impacts. Adverse impacts include activities that result in channel destruction or alteration, or sandbar and beach destruction or alteration (impacts from water flow are excluded). The following activities are controlled within the normal river channel of the Kansas and Republican rivers on Fort Riley: construction; operations and maintenance activities; demolition; operation of vehicles; detonation of explosives; and recreational pursuits. Routine vehicle traffic on established bridges is not subject to this action. Fort Riley generally prohibits recreational use of ORVs on installation lands, allowing it only in a small, non-riverine area.

***Prescription. Educate Fort Riley personnel of the requirement to protect riverine habitat***

**Action.** Programs will be developed, as needed, to publicize the requirements of riverine habitat conservation and off-limits areas to all Department of Army personnel and contractors, and outdoor enthusiasts, who work, train or recreate on Fort Riley.

**Piping Plover Monitoring Plan*****Map existing piping plover habitat on Fort Riley***

The piping plover habitat map will document any location with a documented piping plover sighting. Mapped information will be incorporated into the Conservation Branch and ITAM programs' Geographic Information Systems (GIS). This information will be consulted when planning actions for the operation and maintenance of the installation and tactical training events during Training Requirements Integration (TRI).

***Search for piping plover nesting attempts on Fort Riley***

The Kansas and Republican rivers on Fort Riley will be floated to search for nesting piping plovers. The survey should occur 2-3 weeks after the springtime high water flow has subsided. This period varies from year to year, but usually occurs after mid-June. Suitable habitat will be walked to better locate the cryptic-colored birds.

***Monitor nesting piping plovers found on Fort Riley***

Confirmed nests will be monitored weekly to determine their status and outcome. Monitoring will be carried out from a vantage point as far from the nests as possible that allows good visibility with optical equipment. Activity of the birds, including any indications of courtship feeding, copulation, incubation, or feeding of the young, will be documented at each visit.

The USFWS Regional Kansas Field and KDWP offices will be notified promptly upon the discovery of any suspected nesting piping plovers on Fort Riley.

***Monitor migrating piping plovers on Fort Riley***

Piping plover habitat on Fort Riley will be surveyed at least once during the spring and the fall migration when migrating piping plovers are expected to be present (March 21 - May 31 and July 7 – September 15) and while surveying for other shorebirds during those

timeframes. Information recorded will be number of birds observed, location of birds, behavior of birds, and any bands or markings noticed on birds. Sightings will be reported to the USFWS Regional Kansas Field Office.

### **Literature Cited**

Haig, S., W. Harrison, R. Lock, L. Pfanmuller, E. Pike, M. Ryan and J. Sidle. 1988. Recovery Plan for Great Lakes and Northern Great Plains Piping Plover.

Sidle, J.G., and W.A. Harrison. 1989. Recovery plan for the interior population of the least tern (*Sterna antillarum*). USFWS. 107 pp.

Whyte, A.J. 1985. Breeding ecology of the piping plover (*Charadrius melodus*) in central Saskatchewan. M.S. Thesis, Univ. Sask. Saskatoon, SK.

## **TOPEKA SHINER MANAGEMENT PLAN**

This management plan is based on and is consistent with the ESA, the Kansas Nongame and Endangered Species Conservation Act of 1975, Army Regulations and the 2002 Biological Opinion by the USFWS for Road Maintenance on Fort Riley. Actions specified herein and throughout the INRMP shall serve as consultation for actions that are routine in nature and predictable in their outcome. Fort Riley will initiate separate consultation for actions that are not specifically outlined in this document. These actions are subject to any change in its listing status or if the species has been determined to be extirpated from Fort Riley streams.

### ***Topeka Shiner Species Information***

#### ***Description***

The Topeka shiner grows to a length of 2.25 inches. Its body is silvery, with a dark streak along each side, a dark chevron mark at the base of the tail fin, and a reddish dorsal fin. Breeding males may change colors, with bodies turning blue and all fins turning red. The Topeka shiner's scales have a distinct cross-hatching outline. Topeka shiners may be confused with sand shiners, suckermouth minnows and creek chubs, other minnow species that have a dark spot at the base of their tail fins and/or crosshatched scales.

#### ***Habitat/Ecology***

The Topeka shiner typically occurs in small, low order<sup>7</sup>, prairie streams with high water quality and cool temperatures (USFWS 1993). These streams generally are perennial. However, Topeka shiners may also occur in streams that become intermittent during the summer. Streams containing Topeka shiners are relatively undisturbed. They have not been impounded or channelized and usually do not drain areas subject to high silt loads

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<sup>7</sup> Stream order is a classification based on branching of streams. The smallest, unbranched, tributary streams that appear on a topographic, 7 1/2 minute quadrangle map (1:24,000 scale) are designated order 1.

in water runoff (Drilling 1986). These streams usually have clear water with a predominantly gravel or sand substrate. There is little rooted aquatic vegetation associated with Topeka shiner populations (Minckley and Cross 1959, Cross and Collins 1975).

Habitat conditions become unsuitable for this species when increased water turbidity creates a silt layer along the streambed, excess nutrient enrichment leads to stream eutrophication, or stream dewatering eliminates stable water levels of pools (USFWS 1993). Reduction in water quality due to groundwater depletion, artificial regulation of flows, and certain agricultural practices are detrimental to this species (USFWS 1993).

Topeka shiners have been found in six streams on Fort Riley. These are Wildcat, Sevenmile, Silver, Honey, Wind and Little Arkansas creeks (Appendix C, Figure 2).

Topeka shiners have not been found in Rush, Timber, Farnum and Madison creeks. No historical Topeka shiner collections are known from these three streams. These streams are not considered likely to support populations of Topeka shiners due to their discharge into Milford Lake. The USFWS (1998) cited mainstem reservoir development as a significant factor negatively affecting Topeka shiner populations. A study of fish fauna on Fort Riley found a definite “lake effect” influence on species in these streams (Quist 1999), where high populations of predatory fish inhibit the growth of native minnow populations. Milford Lake is not believed to be a “harbor” or “source” for Topeka shiners (Tabor pers. comm.).

Topeka shiners have not been found in Threemile, Fourmile and Forsyth creeks. However, all those streams are interconnected with streams where the Topeka shiner historically had been known to occur and may contain suitable habitat for the species. Consequently, they are considered potential habitat for the species. Appendix C, Figure 2 shows the streams and drainages on Fort Riley that are considered as actual and potential Topeka shiner habitat.

Topeka shiners were first observed on Fort Riley in 1995. Their last observance on Fort Riley was during the summer of 2011 when 1 individual was documented in Wildcat Creek and 1 individual was documented in Honey Creek. It is possible that the flood of 1993 reintroduced the species into the Wildcat Creek and Honey Creek drainages. Peek populations occurred until 2004, followed by a precipitous decline through 2011. Conversely, largemouth bass, bluegill and green sunfish populations have increased substantially during those same years.

### **Topeka Shiner Management Prescriptions and Actions**

#### ***Protect individual Topeka shiners from human-induced injury***

**Action:** Pesticides and other chemicals, if introduced into stream waters, may adversely affect Topeka shiners or the invertebrates upon which the fish feed. Mainstem reservoir developments and tributary impoundments have adversely impacted the species. Topeka shiner populations have been eliminated from streams both above and below

dams following the construction of stream impoundments in Kansas and Missouri (USFWS 1993). Impoundment of streams is also deleterious to congeneric species of



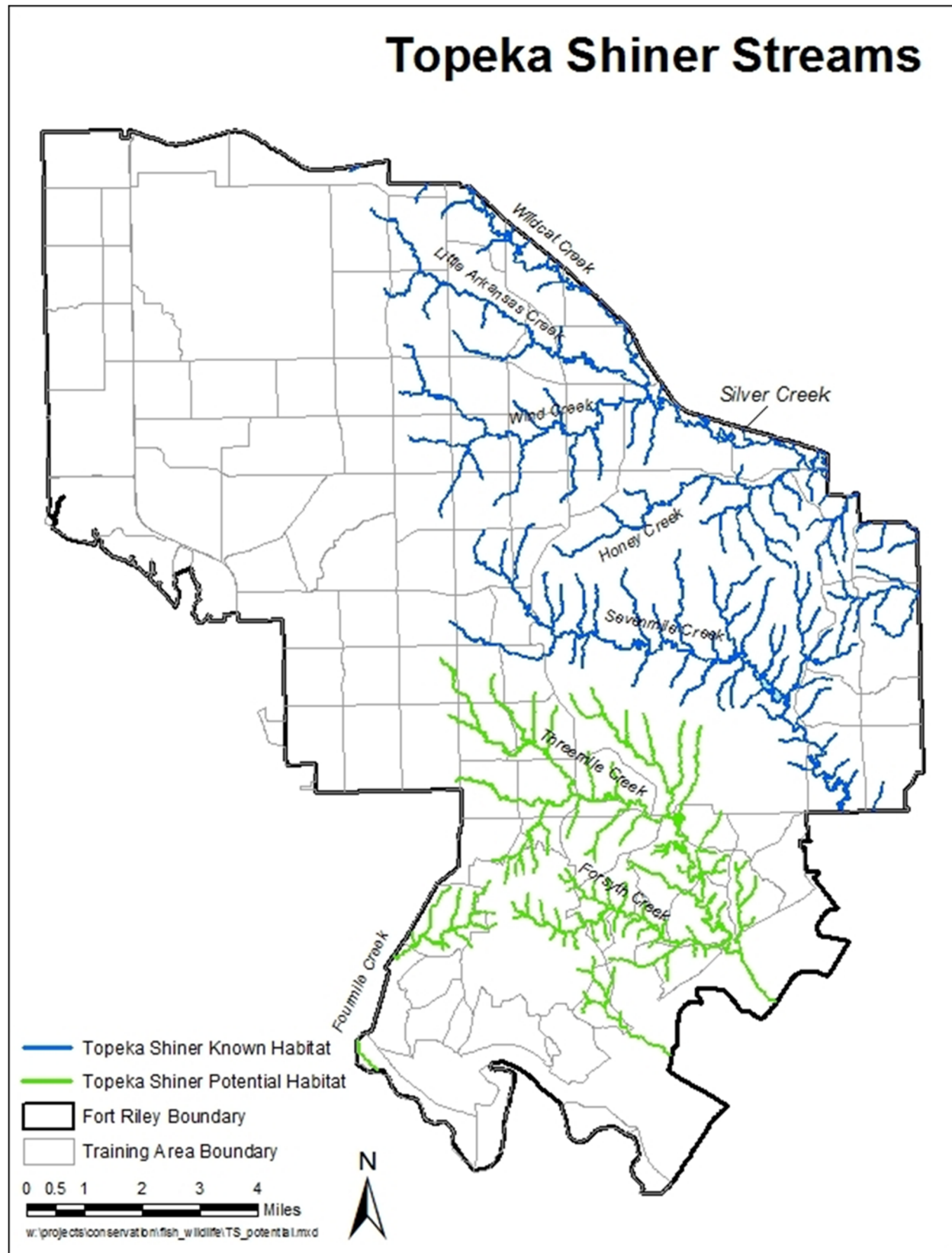


Figure 2 - Stream locations identified as possessing Topeka Shiner habitat.

Topeka shiners (Winston et al. 1991). Pond and lake construction has several negative impacts. The dams eliminate the scouring floods that create pool habitat downstream and maintain a rocky, silt-free substrate (USFWS 1993). Upstream habitat may be converted to deep, open water habitat behind the dam. Upstream populations seeking refuge in the impoundment during drought may be eaten by predatory fish. These predatory fish also move upstream and downstream from the impoundment where they pose a predatory threat that did not naturally exist to Topeka shiners (USFWS 1993).

***Prescription: Protect Topeka shiner streams from pesticides and other chemicals***

**Action:** Compliance with the Clean Water Act, the Federal Insecticide, Fungicide and Rodenticide Act, DoD Directives and Army Regulations protect against chemical contamination. These laws and regulations provide protection for Topeka shiners.

Aerial spraying is conducted to control sericea lespedeza and brush/trees and to reduce the number of annual forbs growing around targets on firing ranges.

***Prescription: Control construction of permanent, water impounding dams on streams of Fort Riley***

**Action.** Follow prescriptions outlined in the Biological Opinion from 2002 for construction of water impounding structures on any stream identified in Appendix C, Figure 2 and as outlined in this plan.

***Prescription: Protect Topeka shiners from bait-fish seining***

**Action.** Prohibit bait-fish collection in Fort Riley Regulation 210-15 (Fort Riley Hunting and Fishing Regulations). Enforcement will be conducted by MP staff and Fort Riley's Conservation Law Enforcement Officers. Provide educational materials to Fort Riley anglers of the prohibition, and post in fishing brochures and on the Fort Riley Internet Page.

***Protect, maintain, and restore small stream habitat***

**Action.** Topeka shiners require streams with high water quality to meet all of their needs throughout the life cycle (USFWS 1993). High water quality requires minimal disturbance to the streambed. Stream quality also is directly related to maintaining a vegetative filter strip along the streambed to capture soil runoff before it reaches the stream. Protection and maintenance of high quality water in all streams will be a priority.

***Prescription. Prevent degradation of existing streams***

**Action.** All streams shown in Appendix C, Figure 2 that have recent documentation of Topeka shiners (currently Wind, Wildcat, Sevenmile, Honey, Silver and Little Arkansas) will be protected from adverse impacts. Adverse impacts include activities that result in channel destruction or alteration, increase water turbidity or eutrophication, or destroy vegetation filter strips. The following activities will be controlled within 50 feet on either side of the streams shown in Appendix C, Figure 2: construction, operations and maintenance activities, demolition, operation of vehicles, timber harvest, detonation of explosives, and recreational pursuits. Vehicle traffic on improved stream crossings and bridges are not subject to this action. Actions affecting all other streams shown in

Appendix C, Figure 2 (currently Threemile, Fourmile, and Forsyth) will not require consultation with the USFWS if the Conservation Branch deems the action is not likely to adversely affect Topeka shiners.

***Prescription. Educate Fort Riley personnel about the requirement to protect Topeka shiner habitat***

**Action.** A brochure describing Threatened and Endangered (T&E) species on Fort Riley has been developed. In the summer of 2003, Conservation Branch became permitted by the USFWS to display live Topeka shiners. Fish were acquired from a long-term experiment at the University of Kansas and a sign explaining the display and an informative bookmark were part of the display. This project has been temporarily suspended due to complications at the research station and will hopefully return in the future. Information regarding the Topeka shiners has been placed on the Fort Riley web page.

The prohibition of bait-fish collection has been posted in fishing brochures and on the Fort Riley Internet Page. Additional programs will be developed, as needed, to publicize the requirements of Topeka shiner habitat conservation to all Department of Army personnel and contractors who work or train on Fort Riley.

The streams on Fort Riley identified as providing apparently suitable habitat for Topeka shiners have been incorporated into the GIS database. This information will be consulted when planning actions for the operation and maintenance of the installation and tactical training events.

Provide Soldier Field Cards through the Sustainable Range Awareness program.

***Prescription. Restore degraded stream habitat***

**Action.** Streams shown in Appendix C, Figure 2 will be restored, as needed, by reshaping damaged banks or channels, establishing revetments, or reestablishing vegetative filter strips. When applicable, restoration projects will incorporate Natural Channel Design and identify reference reaches.

***Prescription: Implement USFWS non-discretionary terms and conditions***

**Action.** Fort Riley consulted with the USFWS in 2002 concerning road maintenance actions that may occur in or nearby streams that contain, or potentially contain, Topeka shiners. Because the USFWS made a determination that those actions may adversely affect the Topeka shiner, the USFWS provided in a Biological Opinion non-discretionary terms and conditions that implement the reasonable and prudent measures that are necessary and appropriate to minimize the take of Topeka shiners. Those non-discretionary terms and conditions are:

- During any activities utilizing a rock translocation option in a known Topeka shiner stream, extreme caution should be exercised to avoid damage to the natural stream channel and its habitat. If rock retrieval from the downstream channel using a motor grader blade is determined likely to adversely impact habitat within the

stream channel, this option should be avoided. In such a case, the rock that has migrated off the hardened ford by streamflow should be left in the downstream channel, and new rock used to rehabilitate the ford.

- During installation and/or maintenance of either a culvert or a hardened low water ford, the streambed gradient should be unaltered. The finished installation should not back water upstream of the structure, create any measurable plunge pool on the downstream side, nor create a ponded or pooled situation over the face of the crossing.
- Construction activities below the water's surface shall not be permitted in Topeka shiner streams during the spawning period of May 15 to July 31, inclusive. This prohibition includes any known Topeka shiner stream. If ongoing surveys discover Topeka shiners in other streams on Fort Riley, notification shall be made to the USFWS and these streams shall be added to the prohibited list. The lone exception to this condition is if a documented emergency situation exists, where inactivity during this time period would result in a verifiable jeopardy to human safety.
- The USFWS Manhattan Field Office should be notified in writing in advance of any activities which have the potential to affect Topeka shiner habitat that are not already addressed in this plan.
- Only clean, uncontaminated rock or broken concrete (no rebar, asphalt, or soil) shall be used for temporary or permanent within all stream channels of any known Topeka shiner stream.
- Long-term degradation to stream banks shall be avoided by keeping road and ramp building and channel reshaping to the absolute minimum necessary to complete the work, and downstream sedimentation shall be minimized during all activities. Downstream silt screens or fences may be appropriate in some circumstances, at the Army's discretion.
- Best management practices for erosion control shall be implemented and maintained throughout the duration of all project activities located in runoff areas to streams.
- Seeding and/or mulching shall occur within all stream runoff areas as soon as grading allows, following the end of construction or maintenance activities at any site.
- Storage facilities for petroleum products, fuels and other chemicals shall be located so that discharge and runoff into the streams is not possible.

***Prescription: Continue development of hardened, low water fords***

**Action.** Construction and maintenance of hardened, low water fords will precisely follow protocol approved by the USFWS (below) in the 2002 road maintenance consultation. Important components of this protocol are: constructing hardened, low water fords level with the natural streambed, limiting ford width to approximately 30 feet, and using best management practices to control silt entering streams from construction actions. Deviation from this protocol will degrade, rather than improve, stream quality.

- Direct adverse impacts to Topeka shiner reproduction will be minimized because no construction activity will take place at crossing sites with flowing water between the dates of May 15 and July 31, inclusive, except in emergency situations.
- Approaches on each side of the crossing will be cut where necessary such that a grade of ten percent is not exceeded. The approaches will be a minimum of eighteen feet wide (thirty feet on tank trails) and extend from the ford a minimum of one hundred feet.
- A layer of geotextile fabric will be laid down on the surface of the graded approaches. A one-foot layer of 8-12 inch diameter rock will be applied to the geotextile. An additional six-inch layer of 3-4 inch diameter top rock will be used on approaches that occur on tank trails to serve as a wearing surface. Top rock used during construction shall contain a minimal amount of fines.
- V-ditches will be constructed on both sides of the approaches to provide drainage for them. The side slopes of the V-ditches will not be less than 3:1. A layer of riprap will be applied to the drainage ditches of approaches with grades that exceed five percent.
- Methods used to construct low water fords will be dependent upon the typical water-flow conditions expected for each site.
  - Construction will occur during no flow conditions at ephemeral stream crossing sites. Soil in the stream at the ford site will be excavated to a minimum depth of two feet or until bedrock or a clay pan is reached. The minimum width of the excavation will be eighteen feet. The length of the excavation will equal the width of the stream channel plus ten feet. A geotextile fabric will be laid down to cover the surface of the excavated area. The excavated area will then be filled with 8-12 inch diameter rock. Rock will be added and compacted until the original streambed elevation is reached. A layer of 3-4 inch top rock will be used on fords that occur on tank trails to fill voids in the larger rock. Materials used shall be free from excessive amounts of fines.
  - A backhoe will be used to excavate a hole in streams with perennial water flow. The holes that are created will have riprap of 24-inch diameter or larger emptied into them. Large vehicles will drive across this material forcing it into the ground. The large riprap will be emptied into the site until the vehicles are no longer able to force the rocks deeper, i.e., the riprap is at bedrock or a clay pan.
- Soil removed during construction that is suitable for reuse may be utilized to build berms and diversion ditches. Soil removed during construction that is not used for berm or diversion ditch construction shall be spread over a relatively level area outside of the construction area and at least 50 feet from a stream channel.
- A motor grader will improve or develop a trail in locations where trails leading to stream crossings are inadequate for travel by construction vehicles. All transport

roads created during construction shall be tilled and planted to grass after ford construction is complete.

- Best management practices for erosion control (e.g., hay bales, silt fences, etc.) will be implemented and maintained throughout the duration of all project activities located in runoff areas to streams. Temporary seeding and/or mulching will occur within all stream runoff areas as soon as grading allows, followed by permanent seeding of native or brome grasses as soon as practical.
- Additional stream crossing sites that were created by military maneuvers but will no longer be needed with the availability of hardened stream crossings will be reclaimed and remediated, or protected from further use and allowed to naturally recover.
- Grubbing and stream channelization will be minimized.

### **Topeka Shiner Monitoring Plan**

#### ***Determine Topeka shiner status in Fort Riley streams.***

Surveys will be conducted in all streams that have, or apparently have, suitable Topeka shiner habitat. Biennial surveys will be conducted in streams in which Topeka shiners have been found. These are Wildcat, Wind, Little Arkansas, Silver, Honey and Sevenmile creeks. Surveys will be conducted one out of every five years in streams in which Topeka shiners have not been documented. This will include Threemile, Fourmile, Timber, Madison, Rush, and Forsyth creeks. Surveys will concentrate on pools and runs in these streams. Topeka shiner capture sites will be maintained in the GIS database.

#### ***Long-term monitoring of small-stream fish populations.***

Fish assemblages present at each sample location will be recorded to document any changes in community structure over time. Numbers of each species captured will provide estimates of the density of Topeka shiner and other fish populations on the installation.

### **Literature Cited**

- Cross, F.B., and J.T. Collins. 1975. Fishes in Kansas. Univ. Kansas Mus. Nat. Hist. Public Educ. Series No. 3.
- Drilling, N.E. 1986. Topeka shiner, *Notropis topeka*, element stewardship abstract. TNC Midwest Reg. Office, Minneapolis, MN. 6 pp.
- Minckley, W.L. and F.B. Cross. 1959. Distribution, habitat, and abundance of the Topeka shiner *Notropis topeka* Gilbert in Kansas. Am. Midl. Nat. 61:210-217.
- Quist, M.C. 1999. Structure and function of fish communities in streams on Fort Riley Military Reservation. M.S. Thesis, Kansas State University, Manhattan, Kansas.
- USFWS. 1993. Status report on Topeka shiner (*Notropis topeka*). USFWS, Manhattan, KS. 22 pp.

\_\_\_\_\_. 1998. Federal Register. Endangered and Threatened Wildlife and Plants; Final Rule To List the Topeka Shiner as Endangered. 63(240): 69008-69021.

Tabor, V. Personal communication, 22 December 1997.

Winston, M.R., C.M. Taylor, and J. Pigg. 1991. Upstream extirpation of four minnow species due to damming of a prairie stream. *Trans. Am. Fisheries Soc.* 120:98-105.

## **HENSLOW'S SPARROW MANAGEMENT PLAN**

The purpose of this management plan is to present information on the Henslow's sparrow (*Centronyx henslowii*), define conservation goals, and describe actions that will enable achievement of those conservation goals.

### **Henslow's Sparrow Species Information**

#### ***Description:***

***Size and Plumage.*** The Henslow's sparrow is a small grassland passerine, typically 13 cm in length and having a mass of 10-15 grams (Herkert et al 2020). Characteristic plumage traits include thin, dark brown streaking across upper breast, sides, and flanks, which are all a buffy tan. The belly remains clean with a color ranging from light gray to white. The legs and bill of the Henslow's sparrow are both mostly pink in color, with a darker streak of black across the top of the bill. The face contains dark, bold patterning, across otherwise tan plumage and a white eye-ring. This distinct, dark brown face patterning includes two strips across the crown mediated by white, a post-ocular line, sub-auricular stripe ("moustache"), and a lateral throat stripe. Other facial characteristics include a yellow supraloral (area between eye and beak) spot and sometimes olive to yellow wash overall on head. It should be noted that each of these characteristics and colors could vary in intensity depending on the age of the bird and the individual itself. Lastly, the Henslow's sparrow has chestnut colored wings with bold, dark brown scaling thinly outlined in tan to white across the back. The tail of the Henslow's sparrow is also chestnut with dark brown centers.

***Vocalizations.*** The most well-known vocalization of the Henslow's sparrow is a short "tse-zlik" call that is often repeated a number of times. This sparrow typically begins its call 30 minutes to an hour before sunrise. The peak number of songs occurs during early morning but steadily continues until midday before substantially dropping off (Heller and Hughes 1997). The Henslow's sparrow continues its song throughout the day until about an hour after sunset, and has even been recorded calling throughout the night during the breeding months (May-July) (Herkert et al 2020). Vocalizations tend to occur atop grass heads, either at the canopy of the grassland or just below (Herkert et al 2020).

#### ***Henslow's Sparrow Life History***

Henslow's sparrows begin nesting upon their arrival to their breeding range, starting at the end of April and beginning of May. Nests are an open cup, made primarily of grasses in the nesting area, lack any signs of greenery, and are most commonly placed among a thick litter layer (Robin 1971). The first clutch, ranging around four to five eggs, is laid in late-May and nest clutches may continue to be initiated from June until August (Robins 1971, Reinking et al 2000). The incubation period of the Henslow's sparrow lasts 11 days on average, with only the female developing a visible brood patch (Robins 1971, Pyle 1997). After hatching, nestlings mature to fledglings and leave the nest around 8-10 days post-hatch (Baicich, and Harrison 1997). Once fledged, fledgling sparrows tend to stay within a radius of 40-240 m from the nest (Young et al 2019).



Following maturation, parents and newly recruited young begin migration to their wintering ground in September and October (Thompson and Ely 1992). The first arrivals to the wintering grounds have been observed as early as late-October (Turcotte and Watts 1999, Stevenson and Anderson 1994). Henslow's sparrows begin to leave their winter ground for their return to the breeding range at the beginning of March,

### ***Henslow's Sparrow Range***

During the breeding season Henslow's sparrows occur in a limited number of states in the eastern United States including Missouri, eastern Kansas, southern Wisconsin, southern Michigan, western New York, Pennsylvania, Illinois, Indiana, Ohio, northern Kentucky, and northern West Virginia. In each of these states, Henslow's sparrow occurrence is strictly limited to what remains of tallgrass prairie expanses. Previously, the Henslow's sparrow was a common breeder along the northeast U.S. coast until its decline and disappearance from most eastern, coastal U.S. states around the mid- to late-1900s (Knapton 1984, Stone 1937, Eaton 1988). The wintering range of the Henslow's sparrow is not well defined, but described as including eastern Texas, Louisiana, Georgia, Alabama, South Carolina, and Florida (Johnson et al 2011).

### ***Henslow's Sparrow Habitat:***

***Nesting and Fledgling Habitat.*** Henslow's sparrows require a diverse prairie landscape to complete each of their breeding stages, i.e. finding a mate, nesting, and fledging. However, nest success and nesting attempts significantly decrease when nests are located close to shrub and forest edges, specifically within a 50-m threshold (Winter et al 2000, Herkert et al 2003, Ellison et al 2013), and Henslow's sparrow density and nest locations were found to significantly increase in a 50-m radius of previously standing windbreaks following complete tree removal (Ellison 2013). Many nest failures facilitated by fragmented prairie are due to increased nest predation rather than environmental variables or diet (Herkert et al 2003). This includes within tracts fragmented by intermittent tree rows such as farmstead windbreaks that often occur within Kansas prairie. In addition to large tracts of open prairie, Henslow's sparrows require a thick litter layer for nesting habitat and avoid nesting in recently burned or hayed areas (Herkert 1994, Stauffer et al 2011). However, increasingly deep litter around the nest can cause higher chances of nest mortality (Stauffer et al 2011) even though nests that are well concealed have a high probability of success.

Fledgling survival is negatively associated with the presence of shrub cover, such as sumac (*Rhus spp.*) (Young et al 2019). Newly independent Henslow's sparrows also use habitat with more forbs and less litter compared to the adults within a 240-m radius of the nest, meaning that a heterogeneous prairie landscape on the 100-200 m landscape scale is required for successful recruitment (Young et al 2019). In summary, Henslow's sparrows require expansive grassland tracts with limited intermittent woody encroachment in order to maintain successful recruitment and ultimately a stable or increasing population.

***Winter Habitat.*** Henslow's sparrows overwinter in the longleaf pine (*Pinus palustris*) savannahs and forests of the southeastern U.S. (Johnson et al 2011). Investigations of

winter habitat selection of Henslow's sparrows determined that although the highest densities of the sparrows are in savannahs in their first winter post-fire, selection had no effect on body condition (Johnson et al 2011). However, the same study found that the post-fire savannahs did support greater concentrations of nutrient-dense seeds compared to those in their second or third year post fire (Johnson et al 2011).

**Diet and Foraging.** From late-spring until early-fall, insects, specifically orthopterans, comprise the majority of adult Henslow's sparrows' diet at their summer breeding range (Hyde 1939). Contrasting with the diet of adults, the primary food of nestlings is lepidopteran larvae (Hyde 1939, Robins 1971, Kopal et al 1998). In the fall, seeds from plants such as grasses and sedges are the main component of the sparrow's diet. Specifically, Henslow's sparrows rely on seeds from the buckwheat family (*Polygonaceae spp.*) and ragweed (*Ambrosia elatior*) in late-September and October, which is immediately before their migration south (Hyde 1939).

On the winter breeding ground along the southeast coast of the U.S., Henslow's sparrows forage for fine grass seeds that are most abundant after a recent burn, such as cutover muhly (*Muhlenbergia expansa*), needleleaf rosette grass (*Dichanthelium angustifolium*), and whipgrass (*Scleria spp.*) (DiMiceli et al 2007, Johnson et al 2011).

#### **Henslow's Sparrow Status:**

The U.S. Migratory Bird Treaty Act grants the Henslow's sparrow a standard level of protection from harassment or illegal take within the United States. Due to its consistent decline and loss of nesting habitat in recent years, the U.S. Fish and Wildlife Service has designated the Henslow's sparrow as a Focal Species and Bird of Management Concern (Cooper 2012). Furthermore, the Henslow's sparrow is designated a Watch List and Mission Sensitive species by the DoD Partner's in Flight organization. Habitat loss has been cited as the primary cause of population decline, however, restoration efforts such as the Conservation Reserve Program have provided a promising avenue to reestablishing Henslow's sparrow populations in areas such as Illinois (Hands et al. 1989, Herkert 2007a, Herkert 2007b).

#### **Comparative Literature:**

**Nest success.** Apparent nest success is the ratio of the number of nests that successfully fledged at least one chick to all nest attempts within a breeding season. Across reclaimed surface mines in Pennsylvania, apparent nest success of Henslow's sparrows ranges from 0.142 to 0.532 (Stauffer et al 2011). A similar study investigating reclaimed coal mines in Kentucky from 2000 to 2001 observed apparent nest success of 74.2% and 31.3%, and a Mayfield estimated success of 32.1% and 18.8%, respectively (Mayfield 1975, Monroe and Ritchison 2005). During a study in northeast Oklahoma, average nest success for a limited sample of Henslow's sparrow nests was 0.45 (Reinking et al 2000). Nest success of Henslow's sparrows on Fort Riley is yet to be determined.

**Density.** In northwest Missouri, Henslow's sparrow densities estimates, which stemmed from relative counts, ranged from 0.9 to 2.6 sparrows/ha depending on the grassland type (cool-season Conservation Reserve Program fields, grazed cool-season grasses and

forbs, hayed cool-season grasses and forbs, grazed native prairie, hayed native prairie, warm-season Conservation Reserve Program fields). The highest Henslow's sparrow observations were in hayed native prairie and hayed cool-season grasses and forbs, while the lowest was in grazed native prairie (Jacobs et al. 2012). Comparatively, a Kentucky population of Henslow's sparrows had a density of 0.81 to 1.20 breeding pairs/ha based upon color banding data and the relative density of an Illinois population ranged from 0.62 to 6.67 breeding pairs/ha, with the highest densities occurring in areas with a minimum of three years since burn (Monroe and Ritchison 2005). The density of Henslow's sparrows on Fort Riley is yet to be determined but is currently being assessed.

### ***Henslow's Sparrow on Fort Riley:***

Previous surveys on Fort Riley indicate that Henslow's sparrows are most abundant in Maneuver Areas H, K and O. They also have been observed in Maneuver Areas A-F, J, L, M, and N, and Training Areas 12, 14, 20, and 22-24. The majority of the Fort Riley Henslow's sparrow observations have occurred in areas that are native tallgrass prairie, rather than "go-back", and in areas that receive a longer fire-return burn interval. These areas include the Maneuver Areas of H, K, and O, all of which area interiorly located within the installation where prescribed burning occurs less frequently due to the decreased risk of wildfire to surrounding private properties.

### **Henslow's Sparrow Management Prescriptions and Actions**

#### ***Prescription: Protect, Maintain, and Improve Habitat***

**Action.** According to the assessment completed by the Kansas Biological Survey in 2012, Fort Riley is composed of 11,940 hectares of Flint Hills Tallgrass Prairie (39%) and 11,764 hectares of altered grassland (38%) which has transitioned into "go-back" or low-grade prairie, creating an estimated total of 23,704 hectares of grassland. This grassland is managed and altered by a variety of means, including prescribed burns, wildfires, haying, track vehicle training, and woody removal via mulching, chain sawing, or mowing. Henslow's sparrow conservation is aided by reducing tallgrass prairie fragmentation (Herse et al 2017a, Herse et al 2017b, Herse et al 2020). Overall, the management tools used by Fort Riley accomplish this.

**Prescribed Fire** – Prescribed burning occurs across thousands of hectares of the Fort Riley Installation for safety and habitat management purposes. The peripheral maneuver areas of Fort Riley tend to receive shorter fire return intervals ranging from 1-3 years compared to the interior maneuver areas, which may be prescribed burned every 4-5 years. This is primarily due to the privately owned properties around the installation that require large buffers of protection from any wildfires that may occur due to the military training that occurs throughout the installation. Because of this burn pattern, the largest abundance of Henslow's sparrow nesting habitat is suspected to occur within these interior training areas, as Henslow's sparrows tend to select against areas that are heavily burned, or burned at a return interval of less than 5 years (Herkert 1994, Stauffer et al 2011). Prescribed fire is fueled by the dry litter layer of grasslands, removing the resources and structure required for Henslow's sparrow nest sites and nest survival (Herkert 1994, Stauffer et al

2011). Although negatively correlated with prescribed fire on a large landscape scale, Henslow's sparrow recruitment does benefit from fire at a smaller scale when patchy by increasing fledgling survival (Young et al. 2019). After successful fledging of a nest located within a sufficient litter layer, fledglings have a higher chance of survival in areas containing forbs and little to no litter layer, both of which are factors associated with fire presence (Young et al 2019). Lastly, Henslow's sparrows also benefit from prescribed fires due to its potential to remove shrub islands and control woody encroachment (Young et. al 2019). Fledgling survival is negatively associated with the presence of shrub cover, such as sumac (*Ruhs* spp.) (Young et al 2019). This leads us to support the management practice of completing less intense prescribed fires at a medium (3-5 years) fire return interval, creating a patchily burned landscape rather than one that is burned completely through, to support Henslow's sparrow nesting and fledgling habitat.

*Haying* – Haying is an essential function of Fort Riley, aiding in control of woody encroachment as well as wildfire suppression. Approximately 14,870 hectares are leased for haying on the Fort Riley installation during the years of 2021 through 2025. Hay leases are in the form of 21 individual lease units, which are further divided into sections that are placed into rest rotations to, in part, support Henslow's sparrow nesting within them. To further protect the Henslow's sparrow, each hay unit is not available to be hayed until after the majority of the nesting season has been completed (July 15) to prevent the decimation of Henslow's sparrow nests and fledglings. Completion of haying in each lease unit ranges from 12-95%, with the southern area of Fort Riley near cantonment experiencing higher hay completion rates and the area north of Rubio Road experiencing lower haying completion ratios due to uneven terrain from track-vehicle training. Currently, Fort Riley does not have an accurate estimate or record of the area that is successfully hayed each year. Due to the reported (Jacobs et al. 2012) positive association between nesting Henslow's sparrow density and hayed native prairie, the current status of area available to hay is viewed as satisfactory by Fort Riley biologists. However, observations of high population densities within an area does not always equal population health or stability due to the isodar theory and latency in movement of individuals (Shochat et. al 2005, Johnson et al 2011). The previously mentioned long-term monitoring program begun in 2021 may further elucidate the relationship between haying and Henslow's sparrow conservation specifically to our locale. This monitoring will be distinct to the Fort Riley Henslow's sparrow population and will have the potential to either support or cause reason to adapt our current hay lease program. Future efforts of the Fort Riley's Conservation Branch will include accurately delineating the area that is successfully hayed across the installation each year, specifically in areas where Henslow's sparrows have been observed.

*Mechanical Removal* – Henslow's sparrows greatly benefit from the removal of woody vegetation, as it expands the amount of area available for nesting pairs to colonize within a grassland and decreases nest mortality rates (Winter et al 2000, Herkert et al 2003, Ellison et al 2013, Herse et al 2018). Because of this,

the Fort Riley Conservation Branch will continue mechanical removal of woody vegetation, using methods including mulching, chain sawing, and mowing. Specifically, the Conservation Branch will focus mechanical removal efforts on woody vegetation surrounding areas of high Henslow's sparrow observations in an effort to promote nest survival in addition to increasing area available for nest site colonization.

**Chemical Application** – The Fort Riley Conservation Branch often utilizes various herbicides for removing invasive species and weed control on food plots. These herbicides include chemicals such as Encore (Dicamba), Roundup (glyphosate), Dual Magnum (S-metolachlor), and Select Max (clethodim). Application of herbicides not toxic to avians does not appear to directly affect songbird fitness or nest success, however, it indirectly affects songbirds by altering vegetation structure and composition (Santillo et al 1989, Rivers et al 2019). The herbicides, besides glyphosate, used by Fort Riley where Henslow's sparrows occur do not have current evidence of implications on songbird physiology but do have a negative impact on other vertebrates (Chen et al 2017, Gill et al 2018, Wang et al 2019). Glyphosate is toxic to birds and has the potential to cause issues such as hormonal disruption and poor embryonic development (Gill et al 2018, Ruuskanen et al 2020). Despite that, when used against large areas of fescue, glyphosate can have a positive impact on grassland bird communities by aiding in the return of native grass species and tallgrass prairie restoration (Osborne and Sparling 2013). However, it should be noted that the use of glyphosate initially creates negative implications on Henslow's sparrow populations due to the complete removal of standing dead vegetation that they require (Osborne and Sparling 2013). The Fort Riley Conservation Branch will avoid glyphosate application in areas that have had Henslow's sparrow observations within the last two years.

### ***Prescription. Initiate Conservation Partnerships***

**Action.** With ~98% of the land in Kansas held in private ownership, relationships with these landowners is imperative to ensure the persistence of the Henslow's sparrow in the state. The surrounding private lands are a mosaic of development, agricultural ground, and non-agricultural grassland in various states of succession. The private lands surrounding Fort Riley serve as an opportunity to provide additional quality prairie to support both the local and regional populations of Henslow's sparrow. Fort Riley partners with the Kansas Land Trust and other non-governmental and governmental organizations to promote grassland stewardship in the region and will continue to seek opportunities to do so.

### **Henslow's Sparrow Monitoring Plan**

***Action.*** Continue to estimate the density of Henslow's sparrows within the installation's boundaries utilizing distance sampling. Fort Riley had from the 1980s – 2020 utilized relative abundance, which we now understand provides unrepresentative estimates of local population statuses and trends (Thompson and La Sorte 2008, Rigby and Johnson 2019, Kissling and Garton 2006), to estimate densities of Henslow's sparrows. By

employing the distance sampling method, it is expected that we will be able to detect changes in Henslow's sparrow populations more accurately and sooner than the previously used relative abundance measures (Diefenbach et al. 2003). Distance sampling is a method in which the biologist records the distance and species of each bird observed from the center of the radial point count. The biologist then uses the distances along with their associated variables such as vegetation structure or weather in an algorithm, resulting in unique detection probabilities and density estimates. When used properly, distance sampling accounts for the varying levels of detection probability based on an array of environmental and species-specific variables, resulting in higher accuracy in estimating species abundances (Thompson and La Sorte 2008).

Henslow's sparrow point count surveys will be located across the entire Fort Riley Military Installation, excluding the cantonment, Douthit Range Complex, and Impact Area. The survey contains 101 points, with each point being a sufficient distance from the next to avoid the double recording of birdcalls and reduce chances of recorded birds' movement between points (Ralph et al 1995). The number of survey points was determined based upon the size of Fort Riley, as well as the amount of labor hours previously dedicated by the Conservation Branch to breeding bird surveys. Additionally, literature states that a minimum of 50, 5-minute surveys is required to begin capturing differences between rare and common species, and a minimum of 30, 5-minute surveys per habitat type are required to investigate community differences (DeSante 1986, Ralph et al 1995). To account for the change in detection probability across years, each location will be surveyed a minimum of three times within each breeding season to collect an adequate number of observations for most species (Kissling and Garton 2006, Reidy et al. 2011). We will conduct the first survey effort starting by May 15 and ending in mid-June, the second survey effort mid-June through mid-July, and the third effort from mid-July into mid-August (Ralph et al 1995). Additional surveys, such as a survey between April and May, may be added as well in attempt to observe the arrival dates of Henslow's sparrow to the Fort Riley breeding grounds. Surveys will take place between 0600-hrs and 1030-hrs, when weather conditions are appropriate (Ralph et al. 1995). Surveys will not occur during high winds (greater than 12 mph), precipitation, or fog (Ralph et al. 1995).

We have chosen the radial point-count method of distance sampling rather than the line-transect approach due to the goal of monitoring multiple species, including the Henslow's sparrow, at once as well as being the modern standard for breeding bird monitoring (Buckland et al. 2008, Matsuoka et al. 2014). Additionally, the radial point method will allow for clearer assessment of changes in population density and habitat structure over time compared to the line-transect method (Buckland et al. 2008). Upon arrival to the survey site, the wildlife biologist will record observer name, temperature, time, cloud cover, and date. The biologist will then allow a silent 2-minute adjustment period to account for the human disturbance created upon arrival to the site. Each survey will then last 5 minutes, and the biologist will record the species and detection distance, determined to the nearest meter using a rangefinder, of every bird seen or heard within 200-m during the survey period (Kissling and Garton 2006, Reidy et al 2011). We selected a survey duration of 5 minutes due to the standards set in previous literature, and because travel time between most survey points in a given morning is estimated to be equal to or

less than 15 minutes (Ralph et al. 1995). The 5-minute survey period also allows a long enough period to detect inconspicuous bird species, such as the Henslow's sparrow, while limiting the time for movement among common species (Fuller and Langslow 1984). We define detection distance as the distance of the bird from the center of the radial point count at first detection, whether flying or stationary. Prior to the collection of any avian survey data, all biologists will train on the identification of Kansas bird species, proper steps of the point count survey, and detection distance estimation (Kepler and Scott 1981, Kissling and Garton 2006).

Each of these methods is subject to change following the influx of new information to allow proper adjustment of length of survey, distance of fixed-width radius, survey locations, and the introduction of new information (Efford and Dawson 2009, Hutto 2016)

### **Literature Cited**

- Baichich, P. J., and C. Harrison 1997. A Guide to the Nests, Eggs, and Nestlings of North American Birds. 2nd edition. Academic Press, San Diego, CA, USA.
- Billerman, S. M., B. K. Keeney, P. G. Rodewald, and T. S. Schulenberg (Editors). 2020. Birds of the World. Cornell Laboratory of Ornithology, Ithaca, NY, USA. <https://birdsoftheworld.org/bow/home>
- Chen, L., D. Wang, Z. Tian, S. Di, W. Zhang, F. Wang, Z. Zhou, J. Diao. Comparative toxic responses of male and female lizards (*Eremias argus*) exposed to (S)-metolachlor-contaminated soil. *Environmental Pollution*. 227: 476e483
- Cooper, T. R.. 2012. Status Assessment and Conservation Plan for the Henslow's Sparrow (*Ammodramus henslowii*). Version 1.0. U.S. Fish and Wildlife Service, Bloomington, Minnesota, U.S..
- Diefenbach, D.R., D.W. Brauning, and J.A. Mattice. 2003. Variability in Grassland Bird Counts Related to Observer Differences and Species Detection Rates. *The Auk*. 120:1168-1179.
- DiMiceli, J.K., P.C. Stouffer, E.I. Johnson, C. Leonardi, and E.B. Moser. 2007. Seed preferences of wintering Henslow's Sparrows. *The Condor*, 109: 595-604.
- Eaton, S. W. 1988. "Henslow's Sparrow." In *Atlas of breeding birds in New York State.*, edited by R. F. Andrle and J. L. Carroll, 450-451. Ithaca, NY: Cornell Univ. Press.
- Ellison, K.S., C.A. Ribic, D.W. Sample, M.J. Fawcett, and J.D. Dadisman. 2013. Impacts of Tree Rows on Grassland Birds and Potential Nest Predators: A Removal Experiment. *PLOS ONE* 8: e59151.
- Gill, J.P.K., N. Sethi, A. Mohan, S. Datta, and M. Girdhar. 2018. Glyphosate toxicity for animals. *Environmental Chemistry Letters*. 16: 401-426.

- Hands, H.M., R.D. Drobney, and M.R. Ryan. 1989. Status of the Henslow's Sparrow in the northcentral United States. Missouri Cooperative Fish and Wildlife Research Unit, U.S. Geographical Survey. Columbia, MO, USA.
- Heller, S. and K. Hughes. 1997. Song activity of Henslow's Sparrow and Grasshopper Sparrow over a 24-hour period. *Indiana Audubon Quarterly* 75:61-67.
- Herkert, J. 1994. Status and Habitat Selection of the Henslow's Sparrow in Illinois. *The Wilson Bulletin*, 106:35-45.
- Herkert, J.R., D.L Reinking, D.A. Wiedenfeld, M. Winter, J.L Zimmerman, W.E. Jensen, E.J. Finck, R.R. Koford, D.H. Wolfe, S.K. Sherrod, and M.A. Jenkins. 2003. Effects of prairie fragmentation on the nest success of breeding birds in the midcontinental United States. *Conservation Biology*, 17:587-594.
- Herkert, J.R., 2007a. Conservation reserve program benefits on Henslow's sparrows within the United States. *The Journal of Wildlife Management*, 71:2749-2751.
- Herkert, J.R., 2007b. Evidence for a recent Henslow's sparrow population increase in Illinois. *The Journal of wildlife management*, 71:1229-1233.
- Herkert, J.R., P. D. Vickery, and D. E. Kroodsman. 2020. *Birds of the World: Henslow's Sparrow (Centronyx henslowii)*. Cornell Laboratory of Ornithology, Ithaca, NY, USA
- Herse, M. R., K. A. With, and W. A. Boyle. 2017a. The importance of core habitat for a threatened species in changing landscapes. *Journal of Applied Ecology*. 55:2241–2252.
- Herse, M. R., M. E. Estey, P.J. Moore, B. K. Sandercock, and W. A. Boyle. 2017b. Landscape context drives breeding habitat selection by an enigmatic grassland songbird. *Landscape Ecology*. 32:2351-2364.
- Herse, M. R., K. A. With, and W. A. Boyle. 2020. Grassland fragmentation affects declining tallgrass prairie birds most where large amounts of grassland remain. *Landscape Ecology*.
- Hyde, A.S. 1939. The Life History of Henslow's Sparrow *Passerherbulus henslowii* (Audubon). Miscellaneous Publications 41. University of Michigan Museum of Zoology, University of Michigan Press, Ann Arbor, Michigan.
- Johnson, E.I., DiMiceli, J.K., Stouffer, P.C. and Brooks, M.E., 2011. Habitat use does not reflect habitat quality for Henslow's Sparrows (*Ammodramus henslowii*) wintering in fire-managed longleaf pine savannas. *The Auk*, 128: 564-576.
- Knapton, R. W. 1984. The Henslow's Sparrow in Ontario: a historical perspective. *Ontario Birds* 2:70-74.



- Kobal, S. N., N. F. Payne and D. R. Ludwig. 1998. Nestling food habits of seven grassland bird species and insect abundance in grassland habitats in northern Illinois. *Trans. Ill. Acad. Sci.* 91:69-75.
- Osborne, D. C., and D.W. Sparling. 2013. Multi-Scale Associations of Grassland Birds in Responses to Cost-Share Management of Conservation Reserve Program Fields in Illinois. *The Journal of Wildlife Management.* 77:920-930.
- Pyle, P. 1997. *Identification Guide to North American Birds, Part I: Columbidae to Ploceidae.* Slate Creek Press, Bolinas, CA, USA.
- Reinking, D.L., D.A. Wiedenfeld, D.H. Wolfe, and R.W. Rohrbaugh. 2000. Distribution, habitat use, and nesting success of Henslow's Sparrow in Oklahoma. *Prairie naturalist*, 32:219-232.
- Rivers, J.W., J. Verschuyt, C.J. Schwarz, A.J. Kroll, and M.G. Betts, 2019. No evidence of a demographic response to experimental herbicide treatments by the White-crowned Sparrow, an early successional forest songbird. *The Condor*, 121: duz004.
- Robins, J. D. 1971. A Study of Henslow's Sparrow in Michigan. *The Wilson Bulletin.* 83:39:48.
- Ruuskanen, S., M. J. Rainio, M. Uusitalo, K. Saikkonen, and M. Helander. 2020. Effects of parental exposure to glyphosate-based herbicides on embryonic development and oxidative status: a long-term experiment in a bird model. *Scientific Reports.* 10: 6349.
- Santillo, D.J., P.W. Brown, and D.M. Leslie Jr. 1989. Response of songbirds to glyphosate-induced habitat changes on clearcuts. *The Journal of Wildlife Management*, 53:64-71.
- Shochat, E., M.A. Patten, D.W. Morris, D.L. Reinking, D.H. Wolfe, and S.K. Sherrod. 2005. Ecological traps in isodars: effects of tallgrass prairie management on bird nest success. *Oikos*, 111:159-169.
- Stauffer, G.E., D.R Diefenbach., M.R Marshall, and D.W. Brauning, 2011. Nest success of grassland sparrows on reclaimed surface mines. *The Journal of Wildlife Management*, 75: 548-557.
- Stevenson, H. M. and B. A. Anderson. 1994. "Ammodramus henslowii (Audubon): Henslow's Sparrow." In *Birdlife of Florida, 1500-1502.* Gainesville: Univ. Presses of Florida.
- Stone, W. 1937. *Bird studies at old Cape May: an ornithology of coastal New Jersey.* Philadelphia, PA: Delaware Valley Ornithol. Club.

- Thompson, M. C., and C. Ely 1992. Birds in Kansas, Volume II. University of Kansas Museum of Natural History 12, Lawrence, KS, USA.
- Turcotte, W. H., and D. L. Watts. 1999. Birds of Mississippi. University Press of Mississippi, Jackson, MS, USA.
- Wang, H., L. Zhou, Z. Meng, M. Su, S. Zhang, P. Huang, F. Jiang, X. Liao, Z. Cao, and H. Lu. 2017. Clethodim exposure induced development toxicity and behavior alteration in early stages of zebrafish life. *Environmental Pollution*. 255: 113218.
- Winter, M., D.H. Johnson and, J. Faaborg. 2000. Evidence for edge effects on multiple levels in tallgrass prairie. *The Condor*, 102: 256-266.
- Young, A. C., W. Cox, J. P. McCarty, and L. Wolfenbarger. 2019. Postfledging habitat selection and survival of Henslow's Sparrow: management implications for a critical life stage. *Avian Conservation and Ecology* 14:10

## **TEXAS HORNED LIZARD MANAGEMENT PLAN**

The purposes of this management plan are to present information on the Texas horned lizard, define conservation goals, and describe actions that will enable achievement of those conservation goals.

### **Texas Horned Lizard Species Information**

#### ***Description***

The Texas horned lizard is a small lizard, ranging 2-4 inches in length. Its appearance differs from any other lizard on Fort Riley, as it has rough raised scales all over its body. These scales appear as ragged points along each side and down the short tail, down the chin, and especially large spines resembling horns protruding from the back of its head. Its coloration is basically some shade of brown with a dark brown blotch on each side of the neck and a series of dark spots or blotches on each side of the back, separated by a light-colored median line. Its belly is white with small gray spots.

#### ***Habitat/Ecology***

The Texas horned lizard occurs in dry, flat areas with a sandy, loamy, or rocky surface with little vegetation, where its diurnal activities include basking in the sun, foraging for ants, or hiding just below the soil surface (Collins 1982).

On Fort Riley, Texas horned lizards are observed in areas with little vegetation, such as well-drained upland slopes, gravelly ridges, road cuts, active or abandoned quarry sites, and other eroded areas (Busby et al. 1996). While these types of areas occur throughout the installation, Texas horned lizards have most often been observed south of Rubio Road and east of the Impact Area in Maneuver Areas C and I.

There has been no systematic attempt to quantify the population of Texas horned lizards on Fort Riley. This species has been surveyed for only as part of installation wide surveys that seek all reptile, amphibian and turtle species. Incidental sightings of individuals are reported from Training Areas 12, 14, 15, 17, 22, 23, 25, 26, 27, 29, 33, 35, 45, 46, 51, 91, 92, 102, 103, and in the Custer Hill Cantonment area. The species is not believed to be abundant, but occurs in small numbers at a variety of locations.

### **Texas Horned Lizard Management Prescriptions and Actions**

#### ***Document Texas Horned Lizard Occurrences***

Because of its status as a declining species and subsequent designation as an Army Species At Risk, the Conservation Branch will document any sighting of a Texas horned lizard.

#### ***Prescription. Improve detection and reporting of Texas horned lizards***

**Action.** All Conservation Branch personnel will be made aware of the importance of recording encounters with this lizard in the field. All observations, including verified

sighting reports from non-affiliated personnel, will be maintained on maps, so specific habitats utilized by the species can be tracked and identified.

Action. Locations of reported sightings of Texas horned lizards will be visited to obtain a habitat description of the sighting location. A log of habitats from which sightings are recorded will be maintained to create more specific description of actual habitats used by this species on Fort Riley. Such information can then be referenced when considering future actions that require NEPA documents.

***Minimize the Risk of Injury and Mortality to Texas Horned Lizards***

Because it is insectivorous, pesticide use may adversely affect its invertebrate food supply, and should be restricted in most terrestrial habitats.

***Prescription. Protect Texas horned lizards from chemical impacts***

Action. The storage and use of all insecticides on Fort Riley shall be conducted in strict accordance with label directions and restrictions. All general use and military chemicals on Fort Riley shall be used, stored, and disposed of in accordance with directions, restrictions and/or guidelines established by the manufacturer and/or Department of the Army.

Action. Refrain from using insecticide control measures in settings away from cantonment areas.

**Texas Horned Lizard Monitoring Plan**

Other than maintaining sighting records, there is no need for additional monitoring of this species at this time. Habitat use will be characterized at any sighting location.

**Literature Cited**

Busby, W.H., J.T. Collins & J.R. Parmelee. 1996. The Reptiles and Amphibians of Fort Riley and Vicinity. Univ. of Kansas Printing Service.

Collins, J.T. Amphibians and reptiles in Kansas. Univ. Kansas Mus. Nat. Hist. Public Educ. Series No. 8.

## **REGAL FRITILLARY MANAGEMENT PLAN**

The purpose of this management plan is to present information on the regal fritillary (*Speyeria idalia*), define conservation goals, and detail actions that will facilitate achievement of those conservation goals.

### **Regal Fritillary Species Information**

#### ***Description***

**Adult:** The regal fritillary is a relatively large butterfly that is similar in size and overall coloration to the familiar monarch (*Danaus plexippus*). Their wingspan ranges from 6.8 cm to 11 cm (Opler and Malikul 1992, Opler and Wright 1999, Williams 2001) and females are slightly larger than males. The dorsal surface of the forewings is primarily burnt orange with irregular black markings. The dorsal surface of the hindwings is a rich velvety, blue-black color with two bands of spots. In females both bands of spots are creamy white, however in males the outermost band is burnt orange. The ventral wing surface is described as olive brown to black with bold silvery white spots (Klots 1951, Royer and Marrone 1992, NatureServe 2005, Selby 2007).

**Larvae:** Regal fritillary larvae are approximately 2.03 mm long when they hatch, and they reach a length of 44.45 mm when they are fully developed (Edwards 1879). Scott (1986) describes regal fritillary larvae as “yellow to orangish, yellow on the rear, with a black mid-dorsal line, black blotches in front of the dorsal and sub-dorsal spines, two black transverse lines on each segment behind the spines, and yellowish mid-dorsal and lateral stripes, the dorsal spines are silvery at the base, the sub-dorsal and lateral spines are orange at the base; head black, orangish on top rear”.

#### ***Life History***

Regal fritillaries are univoltine and non-migratory. Adult flight begins with the emergence of males in late-May and continues through September when females begin to oviposit (Klots 1951, Tilden and Smith 1986, Wagner et al. 1997). Regal fritillaries mate shortly after they emerge in late-May to early-June, however, females enter a period of post reproductive diapause and delay oviposition until late-August to early-September (Wagner et al. 1997, Kopper et al. 2001, Zercher et al. 2002). Regal fritillary eggs hatch in ~25 days and the 1<sup>st</sup> instar larvae emerge, consume the chorion, and enter a winter diapause. Larval development resumes in early spring with the emergence of host plants and lasts ~6-7 weeks. There are six larval instars followed by pupation in late-spring and a pupal stage that lasts 2.5-4 weeks (Edwards 1879, Hammond 1974, Wagner et al. 1997).

**Range:** The historic range of the regal fritillary extended from eastern Colorado eastward to the Atlantic coast, and as far north as southern Canada and southward into Oklahoma (NatureServe 2005, Selby 2007). Unfortunately, populations of this once common butterfly have suffered sharp declines in abundance and marked range contraction (NatureServe 2005, Selby 2007, Sims 2017). In the eastern portion of its range the species has been nearly extirpated, and western populations have experienced dramatic

declines as well (NatureServe 2005). Nonetheless western populations can be “locally abundant” and the species has been described as stable in Kansas (Ely et al. 1986, Marrone 2002, Selby 2007).

### **Habitat**

The regal fritillary is associated with the Upper Austral and Transition Life Zone of the eastern United States, and the Prairie Grassland Zone of the Great Plains (Hammond 1974, Scott 1986). Generally, habitats are described as tallgrass prairie, wet meadows, and marshy areas (Klots 1951, Scott 1986, Tilden and Smith 1986, Opler and Malikul 1992, Opler and Wright 1999, Brock and Kaufman 2003). Specifically, habitats in the Great Plains are described as relatively non-degraded native tallgrass prairie, wet fields, meadows, and, to a lesser extent, shortgrass prairie (Hammond and McCorkle 1983, Glassberg 2001, Dole et al. 2004).

**Food Habits-Nectar Plants:** The availability of appropriate nectar sources during adult flight is perhaps as important as the presence of larval host plants for an area to support a population of a particular butterfly species (Opler and Krizek 1984). This habitat requirement is especially important for long-lived butterflies such as the regal fritillary (Selby 2007). While most butterflies use nectar resources to meet energy needs, long-lived butterflies also use these resources for egg production (Opler and Krizek 1984). Studies have found regal fritillary populations’ sizes positively correlated with number of flower ramets (Vogel et al. 2010), diversity of known nectar resources (Huebschman 1998), and even flower color (Swengel 1993), primarily pink and purple. Although regal fritillaries utilize a variety of forb species as nectar resources to meet the demanding nutritional requirements of their extended adult lifespan, they appear to exhibit strong selection for specific nectar plants (Heitzman and Heitzman 1987, Nagel et al. 1991, Swengel, 1993, Huebschman 1998, Royer 2004). Some of the most important nectar resources include milkweeds (*Asclepias*), thistles (*Cirsium*), coneflowers (*Echinacea*), blazing-stars (*Liatris*), bergamots (*Monarda*), goldenrods (*Solidago*), clovers (*Trifolium*), and ironweeds (*Vernonia*; Selby 2007).

**Larval Host Plants:** Violets (*Viola* spp.) are the larval food plants for all members of the genus *Speyeria* (Klots 1951, Hammond 1974, Ferris and Brown 1981). While regal fritillary larvae are oligophagous and can feed on a variety of violet species, specific violet species tend to dominate within different populations of the plant (Selby 2007). In the Midwest and Great Plains, larvae are reported to predominately feed on bird’s foot (*Viola pedata*) and prairie violet (*Viola pedatifida*; Swengel 1997, Kelly and Debinski 1998, Dole et al. 2004, McCullough et al. 2017), however, larvae have also been documented using wild pansy (*Viola tricolor*; Shuey et al. 2016) and common blue violet (*Viola sororia*; Caven et al. 2017, McCullough et al. 2017).

### **Status**

Despite its historically broad geographic distribution, populations of this once common butterfly have declined considerably (~99%; NatureServe 2005). The exact causes of regal fritillary declines remain unclear, but it is generally suspected that habitat loss, fragmentation, and degradation of remaining habitat are the primary drivers for the range

Year	95% CI Upper	Density Estimate	95% CI Lower	95% CI Upper	Abundance Estimate	95% CI Lower	Raw No. Regals
2014	2.60	1.13	0.49	107,088	46,542	20,182	131
2015	1.63	0.71	0.31	67,136	29,243	12,768	210
2016	0.35	0.14	0.06	14,415	5,766	2,471	19
2017	0.31	0.13	0.05	12,768	5,354	2,059	29
2018	0.61	0.24	0.09	25,124	9,885	3,706	22
2019	3.10	1.34	0.58	127,682	55,191	23,889	120
2020	1.58	0.75	0.35	65,077	30,891	14,415	166
2021	0.40	0.20	0.10	11,460	5,847	2,983	108

wide declines (Hammond and McCorkle 1983, NatureServe 2005, Selby 2007, Sims 2017, Henderson et al. 2018). Additionally climate change (Boggs and Inouye 2012, Breed et al. 2013, Sims 2017, Swengel and Swengel, 2017) are also thought to be threats to remaining populations. Furthermore, the inability of many studies to attribute declines to any particular cause suggests that their continued declines may be due to several compounding factors and/or factors that have yet to be explored such as disease or pesticide use (Henderson et al. 2018). Previously, the regal fritillary was listed as a Category II species under the U.S. Endangered Species Act (ESA) of 1973 until this category was eliminated in 1996 (USFWS 1996). Continued range-wide declines and persistent threats to remaining populations from habitat loss and degradation prompted the U.S. Fish and Wildlife Service to initiate a status review of the regal fritillary in September 2015 in response to a petition to list the species as threatened under the USA (USFWS 2015).

### ***Regal Fritillary on Fort Riley***

Regal fritillaries remain a common sight in the remnant tallgrass prairie tracts that occur throughout the Fort Riley Military Reservation. They have been detected in 56 out of 90 training areas that have at least one regal fritillary sampling transect. There are a total of 104 total training areas on the installation. . Additionally, data from distance sampling surveys conducted on the installation since 2014 suggest an average density of 0.60 regal fritillary/ha across the 90 training areas that have regal fritillary transects.

Year	95% CI Upper	Density Estimate	95% CI Lower	95% CI Upper	Abundance Estimate	95% CI Lower	Raw No. Regals
2014	2.06	1.57	1.20	58,468	44,561	34,059	131
2015	0.67	0.52	0.41	19,016	14,759	11,637	210
2016	0.10	0.06	0.03	2,838	1,702	851	19
2017	0.31	0.13	0.05	12,768	5,354	2,059	29
2018	0.61	0.24	0.09	25,124	9,885	3,706	22
2019	3.10	1.34	0.58	127,682	55,191	23,889	120
2020	1.58	0.75	0.35	65,077	30,891	14,415	166
2021	0.40	0.20	0.10	11,460	5,847	2,983	108

Density (no. /ha) estimates and relative abundance estimates of regal fritillary (*Argynnis idalia*) from surveys during 2014 – 2021 conducted in northeastern Kansas, USA at the Fort Riley Military Reserve (FRMR). Density and abundance estimates along with their respective 95% confidence intervals were calculated using a distance sampling approach in program R.

### **Previous Research Projects**

In 2013, Fort Riley funded a research project that provided the following information: spatially explicit estimates of the current distribution and relative abundance patterns of the regal fritillary and its larval host plants, *Viola* spp., baseline population estimates of the regal fritillary, models that identified habitat features and management practices that influence the density of adult regal fritillary, models that identified habitat features and management practices that influence the occurrence of late instar larvae; and finally information products on the effectiveness of current and potential management strategies for the conservation of regal fritillary populations within Fort Riley.



## **Regal Fritillary Management Prescriptions and Associated Actions**

### ***Prescription: Protect, Maintain, and Enhance Habitat***

**Action.** Tracts of prairie that currently support the regal fritillary, along with those that aren't known to currently support the species but contain both an abundance and diverse array of native forbs, especially those recognized as primary food plants for the regal fritillary, will be identified. Their identification will facilitate the protection and maintenance through focused restoration, site enhancement and other efforts. It is largely accepted that North American grassland ecosystems were historically shaped and maintained by disturbances such as fire and grazing by large native ungulates (Fuhlendorf and Engle 2001). In turn, modern grassland management practices such as prescribed fire, livestock grazing, and haying/mowing play important roles in maintaining and preserving native prairie remnants today (Samson et al. 1998, Fuhlendorf and Engle 2004, Toombs et al. 2010). Moreover, the loss or infrequent occurrence of these practices has been shown to negatively affect tallgrass prairie ecosystems and disturbance-dependent flora and fauna (Collins 1992, Briggs and Knapp 1995, Fuhlendorf and Engle 2004). In order to preserve, maintain, and enhance regal fritillary habitat on Fort Riley a variety of grassland management techniques will be employed to maintain the open structure of the prairie, thwart woody encroachment, depress invasive species spread, and promote overall productivity (Vogel 1974, Shuey 1997).

- *Prescribed Fire* - Although previous studies have indicated that prescribed fire may be harmful to regal fritillary populations (Swengel 1996, Swengel 1998, Powell et al. 2007, Vogel et al. 2010), there is a growing body of evidence that indicates application of prescribed fire, particularly patch burning, at a moderate fire-return interval is not necessarily unfavorable (Moranz et al. 2014, Henderson et al. 2018, McCullough et al. 2019). In fact, recent research has suggested that a lack of fire may be more damaging to regal fritillaries and their habitat (Henderson et al. 2018, McCullough et al. 2019). Grassland tracts on Fort Riley may be best managed and maintained by patch-burning at a moderate fire-return interval (burning two out of five years; Moranz et al. 2014, Henderson et al. 2018, McCullough et al. 2019).
- *Haying* - In the absence of prescribed fire, management practices such as haying and grazing have helped preserve prairie remnants by preventing excessive litter accumulation and woody encroachment (Selby 2007, Begay et al. 2011). These management practices have also been shown to be suitable management strategies for sites that contain regal fritillary (Swengel 1996, Swengel 1998, Swengel et al. 2011, Moranz et al. 2014). In part, to help maintain the openness, structure, and integrity of the native tallgrass prairie tracts, haying occurs on Fort Riley from 15 July to 30 August each year. Most hayed sites are largely dominated by native, warm-season grasses, which may be hayed during even-numbered years only, odd-numbered years only, or annually.
- *Woody Plants Removal* - Recent research has indicated that delaying fire-return intervals greater than three years can lead to transitions from grasslands to shrublands and fire-return intervals greater than ten years, or complete fire suppression, can lead to the invasion of woody species and conversion from

grasslands to woodlands (Ratajczak et al. 2016). Once woody species are established, conversion back to grasslands is difficult and more intensive fires or extensive use of mechanical or herbicide practices may be required to remove invaded woody species (Ratajczak et al. 2016).

Consequently, in sites with heavy woody species encroachment mechanical (e.g., chainsaw, mulcher, tree saw, and clipper) and/or targeted spot chemical treatment methods will be utilized to reduce and eliminate woody vegetation spread on Fort Riley.

- ***Sericea Lespedeza*** - *Sericea lespedeza* (*Lespedeza cuneate*) is one of seven invasive forbs listed as a noxious weed in Kansas (Natural Resources Conservation Service 2016). *Sericea lespedeza* was intentionally introduced to the United States from central and eastern Asia for erosion control, forage, and wildlife cover (Eddy and Moore 1998). Unfortunately, the species has become widespread throughout the eastern half of the United States, has invaded nearly 15% of the remaining tallgrass prairie, and is continuing to expand its range at a rate of approximately 2% per year (Cummings et al. 2007). *Sericea lespedeza* is able to outcompete native grasses and forbs by depositing an extensive seed bank and producing phytochemicals that stunt the growth of neighboring plants (Koger et al. 2002). Because of *sericea lespedeza*'s allelopathic properties, fecundity, and canopy dominance, it is capable of reducing the abundance of native grasses and forbs in tallgrass prairie by up to 92% (Eddy and Moore 1998). Although there is little empirical evidence to draw on with respect to the effects of *sericea lespedeza* on native grassland fauna, it is surmised that heavily infested grasslands with dense monoculture stands of *sericea lespedeza* support diminished invertebrate communities including the regal fritillary and provide lower quality habitat for grassland-obligate wildlife species (Eddy and Moore 1998, Ogden et al. 2019). Therefore, the presence, abundance, and extent of *sericea lespedeza* will be monitored throughout Fort Riley. Infestations in tracts of native tallgrass prairie will predominantly be controlled through late growing season fires which have been shown to cause comparatively more damage to this aggressive forb than to native grasses and forbs (Howe 1994, Knapp et al. 2009, Alexander 2018). Broad-spectrum herbicides can be effective at controlling *sericea lespedeza* and aerial spraying is often the most efficient method. However, repeat applications are often necessary and typically result in damage to sensitive, non-target forbs (Blocksome 2006, Gatson et al. 2018). Consequently, in areas that harbor regal fritillary or sites considered feasible habitat, targeted spot chemical treatments normally will be used in combination with late growing season prescribed burns to aid in the control of *sericea lespedeza* spread when chemical treatments are warranted.

***Prescription: Reduce and Minimize Exposure to Chemical Applications***

**Action:** Little empirical evidence exists regarding the direct and/or indirect effects of pesticide and herbicide applications on regal fritillary specifically. Nonetheless, a number of studies have inferred their use to be threats to regal fritillary populations by directly causing mortality to adults and larvae or through the broadcast spraying of herbicides, which generally target dicots, indirectly affecting populations by eliminating larval food plants and vital nectar resources (Royer and Marrone 1992, Iftner et al. 1992, Selby

2007). Likewise, there is a growing amount of evidence that suggests the application of such chemicals pose both direct and indirect risks to Lepidopterans at large (Sinha et al. 1990, NatureServe 2005, Selby 2007; Bohnenblust et al. 2013, Gilburn et al. 2015, among others). Despite the lack of direct biological effects of herbicides' and other pesticides' use on the regal fritillary from which to draw informed conclusions, the most responsible course of action is to proceed under the assumption their application in sites that harbor this species is harmful. In order to reduce and minimize exposure to chemicals, the storage and usage of all pesticides and herbicides on Fort Riley will be done so in strict accordance established by label instructions and/or the Department of Army guidelines. Generally, other than targeted, spot spraying will be restricted to sites that do not harbor regal fritillary and to sites identified as "go-back" or brome by Freeman and Delisle (2004). The use of pesticides outside of the cantonment area will be limited.

***Prescription: Establish Cooperative Partnerships***

**Action.** Vast expanses of native tallgrass prairie once covered approximately 67 million ha, but native tallgrass prairie communities in the United States have been reduced to less than 4% of their former range (Samson and Knopf 1994). Native tallgrass communities have succumbed to urban development, conversion to cropland, plant community succession, and invasion by herbaceous and woody plant species (Samson and Knopf 1994). While much of the remaining tallgrass prairie exists in isolated fragments, the Flint Hills ecoregion of Kansas contains the largest contiguous extent of remaining tallgrass prairie (Reichman 1987). Nevertheless, the Flint Hills has also suffered drastic losses with tallgrass prairie retaining as little as 37% of its historic extent in the Flint Hills/Osage Plains region (Samson et al. 2004). Despite the regal fritillary's strong flight capabilities and ability to disperse relatively great distances (Nagel et al. 1991, Zercher et al. 2002), the species has a strong propensity to remain in native prairie and is sensitive to habitat edges such as tree lines, roads, and agricultural fields (Ries and Debinski 2001, Caven et al. 2017). This likely explains why recolonization occurs in some contexts such as the relatively contiguous grasslands within the Flint Hills but not others (McCullough et al. 2019). The aforementioned information elucidates the importance of maintaining and creating connectedness within and among remnant patches of native prairie for the persistence of regal fritillary populations. With ~98% of the land in Kansas held in private ownership, relationships with these landowners is imperative to ensure the persistence of the regal fritillary in the state. The surrounding private lands are a mosaic of development, agricultural ground, and non-agricultural grassland in various states of succession. The private lands surrounding Fort Riley serve as an opportunity to provide additional quality prairie to support both the local and regional populations of the regal fritillary. Fort Riley partners with the Kansas Land Trust and other non-governmental and governmental organizations to promote grassland stewardship in the region and will continue to seek opportunities to do so.

**Regal Fritillary Monitoring Plan**

**Action:** Determine approximate population size and extent of the regal fritillary on Fort Riley. Information pertaining to population size estimates will provide conservation land managers with a baseline that can be utilized to assess population trends both spatially

and temporally. Likewise, knowledge of occurrences and presence/absence data may help guide land management decisions and focus efforts for targeted habitat/prairie restoration projects. In order to estimate population size and extent of regal fritillary on Fort Riley, we utilize a distance sampling approach (Buckland et al. 1993, Brown and Boyce 1998, Moranz et al. 2014). With this approach, transects are established across the installation and surveyed during the regal fritillary's annual flight period (late-May to early-August). Line transects are 500 m to ~1km in length. Successive survey bouts do not begin until all transects for the current bout have been surveyed. All surveys are conducted between 0930 hrs. and 1630 hrs., preferably under sunny and warm conditions and when temperatures are  $\geq 17^{\circ}\text{C}$  if the sky is overcast, and winds  $< 20$  km/h on the Beaufort scale (Pollard and Yates 1993). Surveys are conducted by traversing transect centerlines and recording the perpendicular distance from the centerline to each regal fritillary detected within  $\leq 30$  m of each side of the transect centerline. The distance at which each regal fritillary is first detected from the transect centerline is recorded within intervals of 0-5 m, >5-10 m, >10-20 m, and >20-30 m. To estimate regal fritillary density we use function 'distsamp' in package Unmarked (Fiske and Chandler 2011) in R (R Core Team, Version 3.2.2, 2018). Due to the variation in transect length, regal fritillary density estimates are weighted by transect length in the models. To identify which models best explain observed patterns in density, we use an information-theoretic framework to compare, rank, and select the best-fitting models (Burnham and Anderson, 2002). We use the second-order variant of Akaike's information criterion adjusted for small sample sizes ( $\text{AIC}_c$ ) to compare the relative fit of alternative models. We compare  $\text{AIC}_c$  values from models using the key functions uniform, half-normal, and hazard rate to determine the best-fitting detection function. We then calculate delta  $\text{AIC}_c$  ( $\Delta\text{AIC}_c$ ) and Akaike weights ( $w_i$ ), to evaluate support for each model (Burnham and Anderson 2002). We use  $\text{AIC}_c$  to rank models and select the best-fitting models as those with the lowest  $\text{AIC}_c$  scores (Buckland et al. 2001). We consider all models with a  $\Delta\text{AIC}_c < 2$  from the top-ranked model to have support. All spatially explicit data are maintained in a geographic information systems (GIS) database which is updated annually.

### **Literature Cited**

- Alexander, J.A. 2018. Effects of prescribed fire timing on vigor of sericea lespedeza in the Kansas Flint Hills. M.S. Thesis. Kansas State University, Manhattan. 68 p.
- Begay, B., H. M. Alexander, and E. Questad. 2011. Effect of mid-summer haying on growth and reproduction in prairie forbs. Transactions of the Kansas Academy of Science 114:108–114.
- Blocksome, C.B. 2006. Sericea lespedeza (*Lespedeza cuneata*): seed dispersal, monitoring, and effect on species richness. Dissertation. Kansas State University, Manhattan.
- Boggs, C.L. and D.W. Inouye. 2012. A single climate driver has direct and indirect effects on insect population dynamics. Ecological Letter 15:502-508.

- Bohnenblust, E., J.F. Egan, D. Mortensen, and J. Tooker. 2013. Direct and indirect effects of the synthetic-auxin herbicide dicamba on two lepidopteran species. *Physiological Ecology* 42:586-594.
- Breed, G.A., S. Stichter, and E.E. Crone. 2013. Climate-driven changes in northeastern US butterfly communities. *Natural Climate Change* 3:142-145.
- Briggs, J. M., and A. K. Knapp. 1995. Interannual variability in primary production in tallgrass prairie: climate, soil moisture, topographic position, and fire as determinants of aboveground biomass. *American Journal of Botany* 82:1024–1030.
- Brock, J.P. and K. Kaufman. 2003. *Butterflies of North America*. Houghton Mifflin, New York, New York, USA.
- Brown, J.A. and M.S. Boyce. 1998. Line transect sampling of karner blue butterflies (*Lycaeides melissa samuelis*) *Environmental and Ecological Statistics* 5:81-91.
- Buckland, S. T., D. R. Anderson, K. P. Burnham, J. L. Laake. 1993. *Distance sampling: estimating abundance of biological populations*. Chapman and Hall, London, UK.
- Buckland, S. T., D. R. Anderson, K. P. Burnham, J. L. Laake, D. L. Borchers, and L. Thomas. 2001. *Introduction to distance sampling: estimating abundance of wildlife populations*. Oxford University Press, Oxford, UK.
- Burnham, K. P., and D. R. Anderson. 2002. *Model selection and multimodel inference: a practical information-theoretic approach*. Springer Science and Business Media, New York, New York, USA.
- Caven, A.J., K.C. King, J.D. Wiese, and E. M. B. Buckley. 2017. A descriptive analysis of regal fritillary (*Speyeria idalia*) habitat utilizing biological monitoring data along the big bend of the Platte River, NE. *Journal of Insect Conservation* 21:183-205.
- Collins, S. L. 1992. Fire frequency and community heterogeneity in tallgrass prairie: a field experiment. *Ecology* 73:2001–2006.
- Cummings, D.C., T.G. Bidwell, C.R. Medlin, S.D. Fuhlendorf, R.D. Elmore, and J.R. Weir. 2007. Ecology and management of sericea lespedeza. Publication No. NREM-2874. Oklahoma Cooperative Extension Service, Stillwater. Available at <http://www.okrangelandswest.okstate.edu/files/invasive%20species%20pdfs/NREM-2874.pdf>
- Davies, J. D., D. M. Debinski, and B. J. Danielson. 2007. Local and landscape effects on the butterfly community in fragmented Midwest USA prairie habitats. *Landscape Ecology* 22:1341–1354.

- Dole, J. M., W. B. Gerard, and J. M. Nelson. 2004. Butterflies of Oklahoma, Kansas, and North Texas. University of Oklahoma Press, Norman, Oklahoma, USA.
- Eddy, T.A. and C.M. Moore. 1998. Effects of sericea lespedeza (*Lespedeza cuneata*) invasion on oak savannas in Kansas. Transactions of the Wisconsin Academy of Sciences, Arts and Letters, 86: 57–62.
- Edwards, W.H. 1879. Description of the preparatory stages of *Argynnis idalia* Drury. Canadian Entomologist. 11:217-219.
- Ely, C. A., M. D. Schwilling, and M. E. Rolfs. 1986. An annotated list of the butterflies of Kansas. Fort Hays Studies (Science) 7. Fort Hayes State University, Fort Hays, Kansas, USA.
- Ferris, C. D., and F. M. Brown. 1981. Butterflies of the Rocky Mountain States. University of Oklahoma Press, Norman, Oklahoma, USA.
- Fiske, I. J., and R. B. Chandler. 2011. Unmarked: an R package for fitting hierarchical models of wildlife occurrence and abundance. Journal of Statistical Software 43:1–23.
- Freeman, C. C., and J. M. Delisle. 2004. Vegetation of the Fort Riley Military Reservation, Kansas. Open-file Report No. 119. Kansas Biological Survey. Lawrence, KS. 110 p.
- Fuhlendorf, S. D., and D. M. Engle. 2001. Restoring heterogeneity on rangelands: ecosystem management based on evolutionary grazing patterns: We propose a paradigm that enhances heterogeneity instead of homogeneity to promote biological diversity and wildlife habitat on rangelands grazed by livestock. BioScience 51:625–632.
- Fuhlendorf, S. D., and D. M. Engle. 2004. Application of the fire-grazing interaction to restore a shifting mosaic on tallgrass prairie. Journal of Applied Ecology 41:604–614.
- Gatson, G.A., W.H. Fick, and K.C. Olson. 2018. Effects of late-summer prescribed fire and early-fall herbicide application on tallgrass prairie degraded by sericea lespedeza. Rangeland Ecology and Management.
- Gilburn, A.S., N. Bunnefeld, J.M. Wilson, M.S. Botham, T.M. Brereton, R. Fox, and D. Goulson. 2015. Are neonicotinoid insecticides driving declines of widespread butterflies? PeerJ 3:e1402.
- Glassberg, J. 2001. Butterflies through binoculars: the West: a field guide to the butterflies of western North America. Oxford University Press, New York, New York, USA.
- Hammond, P. C. 1974. An ecological survey of the nymphalid butterfly genus *Speyeria*. Thesis. University of Nebraska, Lincoln, Nebraska, USA.

- Hammond, P.C. and D.V. McCorkle. 1983. The decline and extinction of *Speyeria* populations resulting from human environmental disturbances (Nymphalidae: Argynninae). *Journal of Research on the Lepidoptera* 22: 217-224.
- Heitzman, J. R., and J. E. Heitzman. 1987. Butterflies and moths of Missouri. Missouri Department of Conservation, Jefferson City, Missouri, USA.
- Henderson, R. A., J. Meunier, and N. S. Holoubek. 2018. Disentangling effects of fire, habitat, and climate on an endangered prairie-specialist butterfly. *Biological Conservation* 218:41–48.
- Howe, H.F. 1994. Response of early- and late-flowering plants to fire season in experimental prairies. *Ecological Applications* 4: 121–133.
- Huebschman, J. J. 1998. The relationship between nectar sources and regal fritillary (*Speyeria idalia* Drury) butterfly populations. Thesis. University of Nebraska at Omaha, Omaha, Nebraska, USA.
- Iftner, D.C., J.A. Shuey, and J.V. Calhoun. 1992. Butterflies and skippers of Ohio. *Bulletin of the Ohio Biological Survey. (New Series)* 9:1-212.
- Kelly, L., and D. M. Debinski. 1998. Relationship of host plant density to size and abundance of the regal fritillary butterfly, *Speyeria idalia* Drury (Nymphalidae). *Journal of the Lepidopterists' Society* 52:262–276.
- Klots, A. B. 1951. A field guide to the butterflies of North America, east of the Great Plains. Houghton Mifflin Company, Boston, Massachusetts, USA.
- Knapp, E.E., B.L. Estes, and C.N. Skinner. 2009. Ecological effects of prescribed fire season: a literature review and synthesis for managers. U.S. Department of Agriculture, Forest Service General Technical Report no. PSW-GTR-224., Pacific Southwest Research Station. Albany, California.
- Kopper, B.J. S. Shu, R.E. Charlton, and S.B. Ramaswamy. 2001. Evidence for reproductive diapause in the fritillary *Speyeria idalia* (Lepidoptera: Nymphalidae). *Physiology, Biochemistry and Toxicology* 94:427-432.
- Marrone, G.M. 2002. Field Guide to Butterflies of South Dakota. South Dakota Dept. of Game, Fish, and Parks, Pierre, South Dakota, USA.
- McCullough, K., G. Albanese, and D. A. Haukos. 2017. Novel observation of larval fire survival, feeding behavior, and host plant use in the regal fritillary, *Speyeria idalia* (Drury) (Nymphalidae). *Journal of the Lepidopterists' Society* 71:146–152.
- McCullough, K., G. Albanese, D.A. Haukos, A.M. Ricketts, and S. Stratton. 2019. Management regime and habitat response influence abundance of regal fritillary (*Speyeria idalia*) in tallgrass prairie. *Ecosphere* 10(8):e02845.

- Moranz, R. A., S. D. Fuhlendorf, and D. M. Engle. 2014. Making sense of a prairie butterfly paradox: the effects of grazing, time since fire, and sampling period on regal fritillary abundance. *Biological Conservation* 173:32–41.
- Nagel, H. G., T. Nightengale, and N. Dankert. 1991. Regal fritillary butterfly population estimation and natural history on Rowe Sanctuary, Nebraska. *Prairie Naturalist* 23:145–152.
- Natural Resources Conservation Service. 2016. Introduced, Invasive, and Noxious Plants. <https://plants.usda.gov/java/noxiousDriver>.
- NatureServe. 2005. NatureServe Explorer: an online encyclopedia of life. Version 7.0. Arlington, Virginia, USA. <http://www.natureserve.org/explorer>.
- Ogden, S., D.A. Haukos, K.C. Olson, J. Lemmon, J. Alexander, G.A. Gatson, W.H. Fick. 2019. Grassland bird and butterfly response to sericea lespedeza control via late-season grazing pressure. *The American Midland Naturalist* 181:147-169.
- Opler, P. A., and G. O. Krizek. 1984. Butterflies east of the Great Plains. Johns Hopkins University Press, Baltimore, Maryland, USA.
- Opler, P.A. and V. Malikul. 1992. Peterson field guide to eastern butterflies. Houghton Mifflin Co., Boston, Massachusetts, USA.
- Opler, P.A. and A.B Wright. 1999. Peterson field guide to western butterflies, revised edition. Houghton Mifflin Co., Boston, Massachusetts, USA.
- Pollard, E. and T.J. Yates. 1993. Monitoring butterflies for ecology and conservation: the British butterfly monitoring scheme. Chapman and Hall, London, UK.
- Powell, A. F. L. A., W. H. Busby, and K. Kindscher. 2007. Status of the regal fritillary (*Speyeria idalia*) and effects of fire management on its abundance in northeastern Kansas, USA. *Journal of Insect Conservation* 11:299–308.
- R Development Core Team. 2018. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. <https://www.R-project.org/>.
- Ratajczak, Z., J. M. Briggs, D. G. Goodin, L. Lei, R. L. Mohler, J. B. Nippert, and B. Obermeyer. 2016. Assessing the potential for transitions from tall-grass prairie to woodlands: Are we operating beyond critical fire thresholds? *Rangeland Ecology and Management* 69:280–287.
- Reichman, O. J. 1987. Konza prairie: a tallgrass natural history. University of Kansas Press, Lawrence, Kansas, USA.
- Ries, L., and D. M. Debinski. 2001. Butterfly responses to habitat edges in the highly fragmented prairies of central Iowa. *Journal of Animal Ecology* 70:840–852.



- Royer, R. A., and G. M. Marrone. 1992. Conservation status of the regal fritillary (*Speyeria idalia*) in North and South Dakota. U.S. Fish and Wildlife Service, Denver, Colorado, USA.
- Royer, R. A. 2004. Atlas of North Dakota butterflies. Northern Prairie Wildlife Research Center Online, Jamestown, North Dakota, USA. Version 29. <http://www.npwrc.usgs.gov/resource/distr/lepid/bflynd/bflynd.html>.
- Samson, F., and F. Knopf. 1994. Prairie conservation in North America. *BioScience* 44:418–421.
- Samson, F. B., F. L. Knopf, and W. R. Ostlie. 2004. Great Plains ecosystems: past, present, and future. *Wildlife Society Bulletin* 32:6–15.
- Samson, F. B., F. L. Knopf, and W. R. Ostlie. 1998. Grasslands. Pages 437–445 in M. J. Mac, P. A. Opler, C. E. Puckett Haecker, and P. D. Doran, editors. Status and trends of the nation's biological resources. Biological Resources Division, U.S. Geo-logical Survey, Reston, Virginia, USA.
- Scott, J.A. 1986. The butterflies of North America. Stanford University Press, Stanford, California, USA.
- Selby, G. L. 2007. Regal fritillary (*Speyeria idalia* Drury):  
A technical conservation assessment. USDA Forest Service, Rocky Mountain Region. <http://www.fs.fed.us/r2/projects/scp/assessments/regalfritillary.pdf>.
- Shuey, J. A. 1997. Dancing with fire: ecosystem dynamics, management, and the karner blue (*Lycaeides melissa samuelis* Nabokov) (Lycaenidae). *Journal of the Lepidopterists' Society* 51:263–269.
- Shuey, J., E. Jacquart, S. Orr, F. Becker, A. Nyberg, R. Littiken, T. Anchor, and D. Luchik. 2016. Landscape-scale response to local habitat restoration in the regal fritillary butterfly (*Speyeria idalia*) (Lepidoptera: Nymphalidae). *Journal of Insect Conservation* 20:773–780.
- Sims, S.R. 2017. *Speyeria* (Lepidoptera: Nymphalidae) conservation. *Insects* 8:45.
- Sinha, S.N., K.H. Lakhani, and B.N.K. Davis. 1990. Studies on the toxicity of insecticidal drift to the first instar larvae of the large white butterfly *Pieris brassicae* (Lepidoptera: Pieridae). *Annals of Applied Biology* 116:27-41.
- Swengel, A. B. 1993. Regal fritillary: prairie royalty. *American Butterflies* 1:4–9.
- Swengel, A.B. 1996. Effects of fire and hay management on abundance of prairie butterflies. *Biological Conservation* 76:73-85.

- Swengel, A.B. 1997. Habitat associations of sympatric violet-feeding fritillaries (*Euptoieta*, *Speyeria*, *Boloria*) (Lepidoptera: Nymphalidae) in tallgrass prairie. *Great Lakes Entomologist* 30(1-2):1-18.
- Swengel, A.B. 1998. Effects of management on butterfly abundance in tallgrass prairie and pine barrens. *Biological Conservation* 83:77-89.
- Swengel, A. B. and S. R. Swengel. 2001. Effects of prairie and barrens management on butterfly faunal composition. *Biodiversity Conservation* 10:1757–1785.
- Swengel, A. B., and S. R. Swengel. 2007. Benefit of permanent non-fire refugia for Lepidoptera conservation in fire managed sites. *Journal of Insect Conservation* 11:263–279.
- Swengel, S. R., D. Schlicht, F. Olsen, and A. B. Swengel. 2011. Declines of prairie butterflies in the Midwestern USA. *Journal of Insect Conservation* 15:327–339.
- Tilden, J. W., and A. C. Smith. 1986. *A field guide to western butterflies*. Houghton Mifflin Company, Boston, Massachusetts, USA.
- Toombs, T. P., J. D. Derner, D. J. Augustine, B. Krueger, and S. Gallagher. 2010. Managing for biodiversity and livestock. *Rangelands* 32:10–15.
- USFWS (U.S. Fish and Wildlife Service). 2015. Status review for four Midwestern species. [www.fws.gov/midwest/es/soc/Batch90daySept2015.html](http://www.fws.gov/midwest/es/soc/Batch90daySept2015.html).
- USFWS (U.S. Fish and Wildlife Service). 1996. 50 CFR Part 17, Endangered and threatened wildlife and plants; review of plant and animal taxa that are candidates for listing as endangered or threatened. *Federal Register* 1:7596.
- Vogel, R. J. 1974. Effects of fire on grasslands. Pages 139–194 in T. T. Kozlowski and C. E. Ahlgren, editors. *Fire and ecosystems*. Academic Press, New York, New York, USA.
- Vogel, J. A., D. M. Debinski, R. R. Koford, and J. R. Miller. 2007. Butterfly responses to prairie restoration through fire and grazing. *Biological Conservation* 140:78–90.
- Vogel, J. A., R. R. Koford, and D. M. Debinski. 2010. Direct and indirect responses of tallgrass prairie butterflies to prescribed burning. *Journal of Insect Conservation* 14:663–677.
- Wagner, D. L., M. S. Wallace, G. H. Boettner, and J. S. Elkington. 1997. Status update and life history studies on the regal fritillary (Lepidoptera: Nymphalidae). Pages 261–275 in P. D. Vickery and P. W. Dunwiddie, editors. *Grasslands of northeastern North America ecology and conservation of native and agricultural landscapes*. Massachusetts Audubon, Lincoln, Massachusetts, USA.

Williams, B.L. 2001. Recognition of western populations of *Speyeria idalia* (Nymphalidae) as a new subspecies. *Journal of the Lepidopterists' Society* 55:144–149.

Zercher, D., P. McElhenny, and P. Mooreside. 2002. Habitat management plan for the regal fritillary (*Speyeria idalia*) at the Fort Indiantown Gap National Guard Training Center, Annville, Pennsylvania. 5-year implementation period: 2002–2006. Final plan prepared for the Pennsylvania Department of Military and Veterans Affairs, Fort Indiantown Gap, Environmental Section, Annville, Pennsylvania, USA.

## **RUSTY BLACKBIRD MANAGEMENT PLAN**

The purposes of this management plan are to present information on the Rusty blackbird, define conservation goals, and describe actions that will enable achievement of those conservation goals.

### **Rusty Blackbird Information**

#### ***Description***

In fall and winter plumage, rusty blackbirds are characterized by rust-tipped edges on otherwise black feathers. All adult birds have conspicuous yellow irises. Immature birds resemble adults except for having brown irises, which become pale yellow during the first winter. During breeding season, adult males become uniformly black above with a blue-green to greenish gloss, and adult females are slate gray, darker above with a bluish green gloss.

#### ***Habitat***

The Rusty Blackbird breeds in northern boreal forests along bogs, muskeg swamps, beaver ponds, and streams. It occurs on Fort Riley during winter. In winter, the rusty blackbird is often located in woodlands associated with water, such as hardwood bottomlands, stream and pond borders, and their adjacent open fields (Avery 1995).

In winter and during migration, vegetative foods consist mainly of crops (corn, oats, wheat) and weed seeds, as well as grape and oak mast. Throughout the year, a variety of invertebrates also are eaten, including aquatic beetles and their larvae, grasshoppers, spiders, snails and crawfish. Rusty blackbirds feed mostly on the ground, particularly along edges of ponds and streams, but also in open pasture and agricultural fields (Avery 1995).

Expected habitat for this species on the installation occurs in riparian woodlands of rivers and streams, woodlands near ponds, as well as food plot and firebreak agricultural fields that occur adjacent to the woodlands.

#### ***Rusty Blackbird on Fort Riley***

There has been no systematic attempt to quantify the occurrence of rusty blackbirds on Fort Riley. This species has been documented only as part of other winter-time surveys that have occurred (e.g., raptor and eagle surveys, Christmas Bird Count). Incidental sightings of individuals and small groups of rusty blackbirds are reported from Training Areas 3, 19, 20, 25, 27, 28, 53, 75, 91, 92, 103, and along the Kansas River. The species is not believed to be abundant, but occurs in small numbers at a variety of locations.

### **Rusty Blackbird Management Prescriptions and Actions**

#### ***Prescription: Improve detection and reporting of rusty blackbirds***

**Action.** All wildlife biologists learn to recognize rusty blackbirds and be made aware of the importance of recording encounters with this bird in the field. All observations,

including verified sighting reports from non-affiliated personnel, will be maintained on maps, so specific habitats utilized by the species can be tracked and identified.

**Action.** Visit locations of reported sightings to obtain habitat description of sighting location. Maintain log of habitats from which sightings are recorded in order to create more specific description of actual habitats used by this species on Fort Riley. Such information can then be referenced when considering future actions that require NEPA documents.

***Prescription: Protect and Maintain Existing Habitat***

**Action.** Invasive plants that diminish the quality of riparian woodlands and compete with trees that may provide mast and structure in woodlands adversely affect the rusty blackbirds. Agricultural practices that allow grain seed to be available throughout the winter may benefit the species by providing feeding areas for migrating and wintering birds. Fort Riley will achieve this goal by maintaining cropped food plots and treating invasive plants.

***Prescription. Investigate and address Tartarian honeysuckle infestations***

**Action.** Fort Riley woodlands are experiencing invasion by the exotic Tartarian honeysuckle; in some tracts this invasive is achieving nearly 90% dominance of the understory vegetation, outcompeting growth of shade intolerant trees such as oaks. The woodlands experiencing the greatest Tartarian honeysuckle invasion are in the southern portion of the installation, and generally along the Kansas and Republican rivers. Continue to aeri ally spray infested woodlands with rotary wing aircraft. Mechanically remove Tartarian honeysuckle and increase use of fire to control this species where appropriate.

***Prescription. Maintain agricultural crop fields***

**Action.** Rusty blackbirds are known to forage in agricultural fields during migration and on their wintering grounds. Activities that establish agricultural crops and maintain available grain throughout the winter may benefit rusty blackbirds by providing a winter food source while this species is present on the installation. Fort Riley will achieve this goal by maintaining cropped fields to serve as firebreaks around the installation's perimeter.

**Rusty Blackbird Monitoring Plan**

***Document Rusty Blackbird Occurrences***

The Rusty Blackbird has suffered population declines of 90–98% since 1966 (Greenberg and Droege 1999, Greenberg et al. in review). Due to its decline, this once abundant bird has been identified as a high priority for conservation by several groups, including the DoD Partner's in Flight organization (Rich et al. 2005) and the USFWS (USFWS 2007), and has been designated as a Fort Riley Species At Risk. The Conservation Branch will document any sighting of a rusty blackbird.

**Literature Cited**

- Avery, Michael L. 1995. Rusty Blackbird (*Euphagus carolinus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/200>.
- Greenberg, R., and S. Droege. 1999. On the decline of the Rusty Blackbird and the use of ornithological literature to document long-term population trends. *Conservation Biology* 13-553–559.
- Greenberg, R., D. W. Demarest, S. Droege, D. Evers, P. B. Hamel, T. H. Hodgman, J. Lusnier, S. M. Matsuoka, C. Mettke-Hofmann, L. L. Powell, D. Shaw, M. A. Avery, K. A. Hobson, P. J. Blancher, D. K. Niven, S. L. Van Wilgenburg. In review. Understanding declines in Rusty Blackbirds. *Studies in Avian Biology*.
- Rich, T. D., C. J. Beardmore, H. Berlanga, P. J. Blancher, M. S. W. Bradstreet, G. S. Butcher, D. W. Demarest, E. H. Dunn, W. C. Hunter, E. E. Inigo-Elias, J. A. Kennedy, A. M. Martell, A. O. Panjabi, D. N. Pashley, K. V. Rosenberg, C. M. Rustay, J. S. Wendt, T. C. Will. 2004. Partners in Flight North American Landbird Conservation Plan. Cornell Lab of Ornithology, Ithaca, NY.
- USFWS. 2007. Birds of Conservation Concern 2007. Division of Migratory Bird Management, Arlington, VA.

## **NORTHERN LONG-EARED BAT MANAGEMENT PLAN**

On April 2, 2015, the USFWS published in the Federal Register a final rule to list the northern long-eared bat (*Myotis septentrionalis*) as a threatened species throughout its range under the ESA. It was determined that critical habitat for this species is not determinable, and therefore none was listed. Additionally, an interim rule under section 4(d) of the Act was described to provide exceptions to the prohibitions for some activities with threat factors that may cause cumulative effects to the species, but are deemed necessary and advisable for the conservation of the species. (Federal Register 2015). However, this interim rule does not remove or alter in any way the consultation requirements of federal agencies with the USFWS under Section 7 of the Act if an action may affect a northern long-eared bat.

To fulfill its Section 7 consultation obligations, the U.S. Army Installation Management Command submitted a Biological Evaluation (USAEC 2015) with its request for informal consultation concerning northern long-eared bats with the USFWS on April 24, 2015. In its concurrence response letter dated May 04, 2015, the USFWS wrote “The Service was part of, and worked to help construct the biological evaluation, including all analysis and design of conservation measures.” Table 1 of that evaluation lists the status of northern long-eared bats at Fort Riley as verified absence. Section XI of that evaluation lists in summary form Activities/ Areas not subject to conservation measures, which include ‘any area where northern long-eared bat absence has been verified’ and ‘all activities involving the use of aircraft’. Therefore, unless the presence of northern long-eared bats is verified on Fort Riley, the implementation of conservation measures to protect this species is not deemed necessary within installation boundaries. Aircraft outside of installation boundaries do not perform low level flights or other operations that would adversely affect bats in a manner not described already in the biological evaluation, so will continue without additional consultation.

This management plan is based on and is consistent with the Endangered Species Act of 1973, the Kansas Endangered Species and Nongame Conservation Act of 1975, and Army Regulations. Any action that may directly or indirectly affect the northern long-eared bat, or its known habitat, must be coordinated with the USFWS by the Conservation Branch that is not otherwise outlined in this plan.

### **Northern Long-eared Bat Information**

#### ***Description***

The northern long-eared bat (*Myotis septentrionalis*) has also been known as the northern myotis and Keen’s myotis. It is a medium-sized bat about 3 to 3.7 inches in length with a wingspan of 9 to 10 inches. Its fur color is medium to dark brown on the back and tawny to pale-brown on the underside. Northern long-eared bats are similar in color to big brown and little myotis bats. As its name suggests, however, this bat can be distinguished by its long ears, particularly as compared to other bats in its genus, which are bats noted for their small ears (USFWS 2013).

#### ***Habitat***

**Summer Habitat.** The northern long-eared bat is associated with mature, interior-forest environments. On the western edge of its range in which Fort Riley lies, this species is found in wooded riparian zones within prairie habitats. At summering sites, the presence of northern long-eared bats is correlated with the availability of features most often found in older forests, e.g., uneven forest age, a multi-layered canopy, single and multiple tree-fall gaps, standing snags and abundant woody debris (CBD undated).

**Winter Habitat:**

Northern long-eared bats across most of their range overwinter in caves, abandoned/inactive mines or other such structures in multi-species hibernacula and generally comprise a small proportion (generally less than 25 percent) of the total number of animals hibernating at each site. The bat seems to favor deep crevices for hibernation, often with only the nose and ears visible (CBD undated). Some suspect that in Kansas, northern long-eared bats may hibernate in rock crevices of rocky outcrops (Sparks et al. 2011).

**Diet and Foraging.** Northern long-eared bats emerge about half an hour after sunset. They tend to forage in forested areas, even if the woodlands are only a few acres in size, flying through the understory of forested hillsides and ridges (Sparks et al. 2011). Like other *Myotis* species, the northern long-eared bat feeds opportunistically on insects, using both “hawking” and “gleaning” to obtain prey (CBD undated). Some animals occupy a night roost and re-emerge to forage a second time immediately before dawn (Sparks et al. 2011).

**Range**

The northern long-eared bat ranges widely across much of the eastern and north central United States, and all Canadian provinces, but it is patchily distributed and rarely found in groups of more than 100. Within the United States, this includes the area from Maine through Florida, and west to Montana, Wyoming, Kansas and Oklahoma (USFWS 2013). In Kansas, this bat is documented from eight counties (Ellis, Graham, Leavenworth, Marshall, Osborne, Phillips, Rooks, Russell, Washington), but may occur in other riparian woodlands throughout the northern half of the state. More thorough sampling is needed (Sparks et al. 2011).

**Life History**

**Breeding.** Mating takes place in late-summer or early-fall and females store sperm until they emerge from hibernation in the spring, when ovulation and fertilization occur. After fertilization, pregnant females migrate to summer areas where they roost in small colonies and give birth to a single pup. Maternity colonies, with young, generally have 30 to 60 bats (USFWS 2013).

**Migration.** The migratory status of the northern long-eared bat is unclear. Some consider the species to not be migratory, with individuals traveling no more than 35 miles between winter hibernacula and summer roosting sites (CBD undated). Others assume in Kansas the species is present primarily as a migrant, with some small breeding populations also being present. However, this bat is one of the species most often captured along riparian



corridors in north central Kansas during summer sampling. Thus, some suspect that the species may be increasing in Kansas in both range and numbers, and that northern long-eared bats may migrate long distances in order to reach summer areas (Sparks et al. 2011).

**Conservation Issues.** No other threat is as severe and immediate as the disease white-nose syndrome. If this disease had not emerged, it is unlikely the northern long-eared population would be declining so dramatically (USFWS 2013). Of the seven species known to be affected by this deadly bat-disease to date, the northern long-eared bat is among the hardest hit (CBD undated).

### **Northern Long-eared Bat Management Prescriptions and Actions**

#### ***Prescription: Document northern long-eared bat occurrences***

Fort Riley has conducted bat surveys since 2011 using the Anabat SD2 bat detector paired with a directional broad spectrum microphone. Bat echolocation calls are recorded by the detector. Several software programs are used to analyze the calls, beginning with Echoclass and BCID. These programs automatically analyze each call recorded, identify which species the call most closely resembles, and assign a probability that the classification is correct. After this automated process is complete, the program AnalookW can be used to manually view any calls of interest. AnalookW generates a spectrogram of the call, allowing the user to visually compare the call in question to known spectrograms for the species, and therefore determine if the classification was correct. Several call files collected on Fort Riley were classified as northern long-eared bats using both Echoclass and BCID. However, upon examination of spectrograms produced by AnalookW, it was determined that these calls were of eastern red bats. The presence of the northern long-eared bat has not been confirmed on the installation. The Conservation Branch will continue surveys for northern long-eared bats.

#### ***Prescription: Improve detection and reporting of northern long-eared bats***

**Action.** Expand Anabat-enhanced bat surveys across the installation; see Section 8.5, Monitoring Plan, for details.

**Action.** Conservation Branch personnel will be educated in identification of northern long-eared bats, and be made aware of the importance of encounters with this bat in the field. All observations, including verified sighting reports from non-affiliated personnel, will be maintained on maps, so specific habitats utilized by the species can be tracked and identified.

#### ***Prescription: Assess northern long-eared bat populations that occur on Fort Riley***

**Action.** If the presence of northern long-eared bats is confirmed on Fort Riley, more intensive surveys for this species will be conducted, both to further delineate where this species occurs on the installation, and to better understand when, where and how this species is using Fort Riley habitats. The surveys may include Anabat technology, drift nets, visual inspections of potential roost sites, or other survey technologies that may come available.

**Action.** Locations with suspected northern long-eared bat detections and any future confirmed sightings will be mapped and incorporated into GIS programs. This information will be consulted when planning actions for the operation and maintenance of the installation and tactical training events.

**Action.** Locations of suspected and documented sightings of northern long-eared bats will be visited to obtain a habitat description of the sighting location. A log of habitats from which sightings are recorded will be maintained to create more specific description of actual habitats used by this species on Fort Riley. Such information can then be referenced when considering future actions that require NEPA documentation.

***Prescription: Protect and conserve northern long-eared bat habitat***

**Action.** Northern long-eared bats' presence and activity levels are highest in forest stands with old-growth characteristics, which the species may favor for the large, partially dead or decaying trees in which this bat roosts (CBD undated). During summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees. Males and non-reproductive females seem opportunistic in selecting roosts, using tree species based on suitability to retain bark or provide cavities or crevices. They have also been found, rarely, roosting in structures like bridges, bat boxes, and abandoned buildings (USFWS 2013). Maternity colonies usually form in hollow trees, although exfoliating bark may also be used. Females exhibit high site fidelity to maternity roosts, returning annually to their natal sites. Because of the species' strong association with large blocks of older forests, forest fragmentation and conversion (such as clearing trees for agriculture or development) will be avoided (CBD undated). Potential nest trees that are not a safety hazard will be left standing as a routine silviculture practice.

***Prescription: Protect known northern long-eared bat roost trees***

**Action.** Any tree which is confirmed to be used as a roost site by northern long-eared bats will be marked to protect that tree from harvest, fuelwood-cutting, deer tree stands, firefighter training, or any other activity that may damage or down the tree. If deemed appropriate, firebreaks may be maintained to slow the advance of fire into the area containing the tree.

**Action.** Where possible and not a safety hazard, dead and dying trees will be left standing within woodlands that appear to meet the appropriate habitat requirements for providing potential roost sites for northern long-eared bats.

**Action.** Where it is not possible to leave dead and dying trees standing, and in locations where trees suitable for bat roosting are in short supply, bat boxes will be established to provide additional roost sites.

***Prescription: Protect northern long-eared bat hibernacula***

**Action.** A "no disturbance" buffer zone will be established around any known northern long-eared bat hibernacula. The size, duration and limitations of the zone will be determined after consultation with the USFWS.

***Prescription: Protect habitat areas used by northern long-eared bats***

**Action.** Once a northern long-eared bat is documented on Fort Riley, all conservation practices described in Section VI of the Biological Evaluation (USAEC 2015) will be fully implemented on the installation. In instances where a desired action is not described in the Biological Evaluation, or effects are anticipated that are different from those described, the installation will consult with USFWS prior to initiating that action.

**Action.** Tracts of woodland *documented as used by this species* will be designated Northern Long-Eared Bat Habitat.

**Action.** All areas designated as Northern Long-Eared Bat Habitat will be protected from adverse impacts. Adverse impacts include activities that result in destruction or removal of large, mature trees. The following activities shall be controlled within a woodlot designated as Northern Long-Eared Bat Habitat: construction; operations and maintenance activities; demolition; and detonation of explosives.

***Prescription: Educate Fort Riley personnel of any requirement to protect Northern Long-Eared Bat Habitat.***

**Action.** Inform pilots if “no disturbance” buffer zones are in effect around hibernacula. Information will be provided to aviators through Local NOTAMs (Notices to AirMen) regarding “no disturbance” zones to minimize aircraft conflicts with roosting bats.

**Action.** Programs will be developed, *if needed*, to publicize the requirements of northern long-eared bat conservation to all Department of Army personnel and contractors, and outdoor enthusiasts, who work, train or recreate on Fort Riley.

***Prescription: Protect northern long-eared bats from human-induced injury and mortality***

**Action.** Since first observed in New York in 2006, white-nose syndrome has spread rapidly from the Northeast to the Midwest and Southeast; an area that includes the core of the northern long-eared bat’s range and where it was most common before this disease. Northern long-eared bat numbers have declined by 99 percent in the Northeast. Although there is uncertainty about the rate that white-nose syndrome will spread, it is expected to spread throughout the United States (USFWS 2013).

Although significant population declines have not been observed due to human-induced sources of mortality, those may now be important factors after the declines caused by white-nose syndrome. Northern long-eared bats are unlikely to be disturbed by routine uses of roads, homes, and other facilities where such use pre-dates the initial finding of activity in a given area. Therefore, in most cases *ongoing*, existing uses may proceed with the same intensity with little risk of disturbing the species.

***Prescription: Protect against the spread of white-nose syndrome***

**Action.** A national plan was prepared by the USFWS and other agencies that details actions needed to investigate, manage, and slow the spread of white-nose syndrome through human transmission (USFWS 2011). Fort Riley managers will adhere to protocol

within that plan when conducting actions for the northern long-eared bat. Under no circumstances will clothing, footwear, or equipment that was used in bat hibernacula from a white-nose-syndrome-affected region be used on Fort Riley.

***Prescription: Ensure northern long-eared bats are not affected during irregularly scheduled activities***

**Action.** Once a northern long-eared bat is documented on Fort Riley, all conservation practices described in Section VI of the Biological Evaluation (USAEC 2015) concerning construction, forest management, prescribed burning, and tree removal will be fully implemented on the installation. In instances where a desired action is not described in the Biological Evaluation, or effects are anticipated that are different from those described, the installation will consult with USFWS prior to initiating that action.

***Prescription: Protect northern long-eared bats from pesticides and other chemicals***

**Action.** Once a northern long-eared bat is documented on Fort Riley, all conservation practices described in Section VI of the Biological Evaluation (USAEC 2015) concerning construction, forest management, prescribed burning, and tree removal will be fully implemented on the installation. In instances where a desired action is not described in the Biological Evaluation, or effects are anticipated that are different from those described, the installation will consult with USFWS prior to initiating that action.

***Prescription: Protect from disturbance roosting northern long-eared bats, if they occur on Fort Riley***

**Action.** If a northern long-eared bat roost is located on Fort Riley, a "no disturbance" buffer zone will be established around the roost if required to protect the species. The size, duration and limitations of the zone will be determined after consultation with the USFWS.

**Action.** If hibernating northern long-eared bats are discovered on Fort Riley, they will not be disturbed by human intrusion into hibernacula without prior consultation with the USFWS.

### **Northern Long-eared Bat Monitoring Plan**

These surveys are intended to determine presence or probable absence of northern long-eared bats on Fort Riley during the summer. There are no protocols currently available to survey during migration. Summer presence/absence surveys will be conducted following guidance<sup>8</sup>. Supplemental survey efforts, if any, will be coordinated with USFWS if any northern long-eared bats are encountered to further evaluate use of the area.

Fort Riley will use a tiered survey plan. Type 1 surveys will be performed to search for northern long-eared bats across Fort Riley. Type 2 surveys will be performed only after

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<sup>8</sup> The northern long-eared bat Interim Conference and Planning Guidance (<http://www.fws.gov/midwest/ endangered/mammals/nlba/index.html>) states surveys should follow guidance for Indiana Bat Summer Survey. It is expected USFWS will inform Fort Riley if changes to this guidance occurs.

Type 1 surveys document presence of northern long-eared bats. Type 2 surveys will evaluate presence or probable absence of northern long-eared bats when future actions on Fort Riley may affect potential habitat when northern long-eared bats are expected to occupy such habitat. Negative presence results from Type 2 surveys obtained following this protocol will be considered valid for a minimum of two years.

The following provides a step-by-step outline of how Fort Riley will conduct northern long-eared bat summer surveys. The summer survey period will be from May 15 through August 15. The presence or probable absence of northern long-eared bats may be determined by conducting either acoustic or mist-netting surveys, as outlined below. Surveys will be conducted in the best suitable habitat possible to increase the likelihood of detection.

### ***Acoustic surveys for northern long-eared bat breeding on Fort Riley***

The acoustic sampling period begins at sunset and ends at sunrise each night of sampling.

***Personnel.*** Acoustic surveyors will have a working knowledge of the equipment, acoustic analysis programs and northern long-eared bat ecology. Surveyors will be able to identify appropriate detector placement sites and establish those sites in the areas that are most suitable for recording high-quality calls.

### ***Acoustic Survey Types***

#### **➤ Type 1 Surveys**

- Stationary surveys will consist of at least two detector nights in a minimum of eight locations.
- Mobile surveys will consist of at least two nights each of vehicle-mounted detectors driven along two established monitoring routes. Survey speed is not to exceed 20 mph.

#### **➤ Type 2 Surveys (performed as needed)**

- In linear habitats, surveys will consist of a minimum of two detector nights per km of suitable summer habitat potentially affected by the project.
- In non-linear habitats, surveys will consist of a minimum of 4 detector nights per 50 ha of suitable summer habitat potentially affected by the project. Two detector locations per 50 ha site shall be sampled until at least 4 detector nights have been completed over the course of at least 2 calendar nights (may be consecutive). For example:
  - Two detectors for 2 nights each (can sample same location or move within site).
  - One detector for 4 nights (must sample at least 2 locations).

### ***Acoustic Sampling Protocol***

***Detector and Microphone Required Characteristics.*** Several factors were considered when selecting hardware for the acoustic monitoring program. A suitable detector must work with both stationary and mobile monitoring, must have the ability to detect Fort Riley's bat species, and should collect/process data that can be managed easily. A general literature search revealed that Anabat detectors are commonly used by researchers to detect many species of bats all around the world. Species with relatively quiet calls, such as the northern long-eared bat, can be difficult to detect. Peer reviewed journal articles are published detailing the detection of this species using Anabat (Ford et al. 2011; Jachowski et al. 2014). Kim Livengood from Titley Scientific stated that Anabat detectors will readily detect northern long-eared bats provided that proper techniques are used and suitable habitat is sampled (personal communication).

Anabat uses a zero crossing algorithm to extract the primary frequency of a bat call. One benefit of zero crossing is that a small file is created for each bat call. This allows the user to collect a large amount of data in the field without concern for data storage limitations. Conversely, full spectrum detectors capture more details of the call, but require more data storage space and time for processing. Allen et al. (2011) found that it took 200 hours to process a batch of full spectrum files and only 2 hours to process a similar batch of zero crossing files.

After comparing features of multiple brands and types of bat detectors, the Anabat SD2 bat detector from Titley Scientific was selected because it best met Fort Riley's general research needs and is sufficient for difficult to detect species such as the northern long-eared bat.

Directional microphones, including omni-directional microphones that have been converted to directional, are one of two types accepted for acoustic surveys at this time. Microphones attached to detectors via a cable are acceptable.

***Detector/Microphone Placement.*** Suitable set-up of the equipment should result in high-quality call sequences that are adequate for species identification. Individual sites that produce no bat calls during the initial night they are sampled may need to be re-sampled. Modifications of the equipment (e.g., changing the orientation) at the same location on subsequent nights may improve quantity and quality of call sequences recorded, which can be determined through daily data downloads. If modifications to the equipment do not improve call identification, then the detectors should be moved to a new location.

Suitable sites for detectors at stationary surveys are forest-canopy openings, water sources, wooded fence lines adjacent to large openings or that connect two larger blocks of suitable habitat, road or stream corridors with open tree canopies or canopy height of more than 10 meters, and woodland edges (Britzke et al. 2010). When selecting acoustic sites, detectors should be: at least 1.5 meters in any direction from vegetation or other obstruction (Hayes 2000; Weller and Zabel 2002); in areas without, or with minimal<sup>9</sup>

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<sup>9</sup> Surveyors can remove small amounts of vegetation (e.g., small limbs, saplings) from the estimated detection cone at a site, as is done while setting up mist-nets. Deployment of detectors in closed-canopy

vegetation within 10 meters in front of the microphone; parallel to woodland edges; and at least 15 meters from known or suitable roosts (e.g., trees/snags, buildings, bridges, or bat houses). Elevating a detector greater than 1.5 meters above ground level vegetation can improve recording quality.

Once acoustic sites are identified, photographs documenting the orientation, detection cone and relative position of the microphone should be taken.

Surveyors should distribute acoustic sites throughout the area. In most cases, acoustic sites should be at least 200 meters apart.

**Orientation.** Detectors deployed near the ground (e.g., on a tripod) should be aimed 45 degrees or more above horizontal. Microphones deployed higher within the flight path/zone (e.g., on a pole) should be oriented horizontally. In some circumstances (e.g., forest openings), it might be desirable to aim a detector's microphone vertically.

**Verification of Deployment Location.** GPS units will record accurate location coordinates for each acoustic site that is paired with the acoustic data files.

**Verification of Proper Functioning.** Surveyors will ensure equipment is working during set-up in the field. This can be done by producing ultrasound (e.g., finger rubs) in front of the microphone at survey start and survey finish. This documents that the equipment was working when deployed and when picked up (and by assumption throughout the period).

Detector field settings (e.g., sensitivity, frequency, etc.) should follow the recommendations provided by the manufacturer. Surveyors should also save files produced by detectors (e.g., log files, status files, sensor files) to provide documentation when equipment was functioning within the survey period.

**Weather Conditions.** At a minimum, nightly weather conditions for survey sites should be checked. If any of the following weather conditions existed during acoustic sampling, repeat the acoustic sampling effort for that night.

- Temperatures fall below 50°F during the first 5 hours of survey period.
- Precipitation, including fog, exceeds 30 minutes or occurs intermittently during the first 5 hours of the survey period.
- Sustained wind speeds greater than 9 miles/hour (3 on Beaufort scale) during the first 5 hours of the survey period.

**Weatherproofing.** The decision to use weatherproofing will be based on the likelihood of precipitation. The corded microphone allows the user to detach the microphone from the

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locations that typically are good for mist-netting are acceptable as long as the area sampled below the canopy does not restrict the ability of the equipment's detection cone to record high-quality calls (i.e., the vegetation is outside of the detection cone).

detector so that the detector is placed in a weatherproof container while the microphone remains unobstructed.

### ***Analysis of Recorded Echolocation Calls***

***Acoustic Analysis.*** The number of bat calls recorded in a single survey night can be in the hundreds, and it is not feasible to identify all of the calls manually. The USFWS approved BCID East, EchoClass, Kaleidoscope Pro and SonoBat for acoustic analyses.

- Acoustic analysis will be conducted on all data collected from Type 1 and Type 2 surveys using the acoustic ID programs 'EchoClass' and 'BCID'.
- If northern long-eared bat presence is considered unlikely by both programs, then no further summer surveys of that area will be conducted and it will be assumed none are present.
- If northern long-eared bat presence is considered likely at least once, then proceed to Qualitative Analysis.

### ***Qualitative Analysis.***

- For each site/night a program considered northern long-eared bat presence likely, review all files from that site/night. A program such as AnalookW will be used to create spectrograms of the calls. These spectrograms will be visually compared to species-specific spectrograms from a known call library.
- Qualitative analysis will compare the results of each acoustic ID program by site and night, including: the number of call files flagged as probable northern long-eared bat by each program; an evaluation of other species identified; individual file level agreements and disagreements on northern long-eared bat between programs; a qualitative analysis of all probable northern long-eared bat call sequences to further evaluate whether the correct ID has been made by the program(s) used.
- If no visual confirmation of probable northern long-eared bat is detected during qualitative analysis, then no further summer surveys of that area will be conducted and it will be assumed no northern long-eared bats are present.
- If visual confirmation of probable northern long-eared bat is detected during qualitative analysis, then assume presence and coordinate with the USFWS.

### ***Mist-netting surveys for northern long-eared bat breeding on Fort Riley***

Mist-netting can be used as a presence or probable absence method or it can be conducted for the purpose of attempting to capture northern long-eared bats after detection during acoustic surveys. The same protocol applies for both uses of mist-netting surveys. Capture of reproductive adult females (i.e., pregnant, lactating, or post-lactating) and/or young of the year confirms the presence of a maternity colony in the area. The survey period for each net shall begin at sunset and continue for at least five hours.

### ***Mist-Netting as Type 2 presence/probable absence surveys***



- In linear habitats, surveys will consist of a minimum of 4 net nights per km of suitable summer habitat
- In non-linear habitats, surveys will consist of a minimum of 9 net nights per 50 ha of suitable summer habitat. For example:
  - 3 sites<sup>10</sup>, 1 net<sup>11</sup>/site for 3 calendar nights = 9 net nights
  - 1 sites, 3 nets/site for 3 calendar nights = 9 net nights
- There is a maximum of 3 nights of consecutive netting at any given net location. After 3 consecutive nights of netting at the same location, surveyors must change net locations or wait at least 2 calendar nights before resuming netting at the same location.
- If there is no capture of northern long-eared bat, then no further summer surveys are necessary and it will be assumed none are present.
- If a northern long-eared bat is captured, then Fort Riley will notify USFWS and stop mist-netting.

**Mist-netting After Positive Acoustic Finding.** If mist-netting was not conducted as the presence or probable absence method, then it may be conducted to capture and characterize (e.g., sex, age, reproductive condition) the northern long-eared bat presence in an area. Fort Riley will work with the USFWS to develop mist-netting plans. There are no minimum requirements for this phase as this is not a presence or probable absence survey.

**Personnel.** A qualified biologist<sup>12</sup> will select or approve mist-net set-ups in areas that are most suitable, be physically present at each mist-net site throughout the survey period, confirm all bat species' identifications, and oversee and manage mist-net set-ups in close proximity to one another if the net-check timing (i.e., every 10 - 15 minutes) can be maintained while walking between nets. All personnel handling captured bats will be --- whatever the right words are for immunized against rabies ----.

**Equipment.** Surveys will use the finest, lowest visibility mesh mist-nets as practical. The preferred mesh size available is approximately 1½ inches (38 millimeters). There are many suitable systems of ropes and/or poles to hold nets. The system of Gardner et al. (1989) has been widely used.

To minimize potential for disease transmission, any equipment that comes in contact with bats will be cleaned and disinfected, following approved protocols; this is particularly a concern in white-nose syndrome areas. Protocols are posted at <http://www.whitenosesyndrome.org/>.

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<sup>10</sup> A site is defined as a geographic area to be sampled. It can include one or more nets.

<sup>11</sup> A net is defined as any combination of individual panels and poles (e.g., single, double, triple high) to fill the area (e.g., corridor) being sampled.

<sup>12</sup> A qualified biologist is an individual who holds a USFWS Recovery Permit for NLEB in Kansas and/or has been authorized by the KDWP to net and handle NLEB.

**Net Placement.** Potential travel corridors (e.g., streams, trails) typically are the most effective places to net (although other places may also be productive; see Carroll et al. 2002). Place nets approximately perpendicular across the corridor, filling the corridor from side to side, extending beyond the corridor boundaries when possible, and from stream (or ground) level up to the overhanging canopy. Nets of varying widths and heights may be used as the situation dictates. If over water, there is to be enough space between the net and the water so that captured bats will not get wet.

Occasionally it may be necessary or desirable to net where a suitable corridor is lacking. In these situations, the surveyors will use their experience and best judgment to employ an alternative net design, such as in Humphrey et al. (1968) and Kiser and MacGregor (2005).

Surveyors will distribute net set-ups throughout suitable habitat. Net set-ups may be repeatedly sampled throughout the project, but generally no more than 2-3 nights at a single location. Photos to document placement of nets will be taken.

#### **Checking Nets.**

- Each net should be checked every 10 minutes, never exceeding 15 minutes.
- Surveyors will minimize noise, lights and movement near the nets.
- Monitoring the nets with a bat detector can be beneficial.
- Biologists should be prepared to cut the net if a bat is severely entangled and cannot be safely extracted within 3 - 4 minutes.

**Handling Bats.** Capture and handling are stressful for bats. Northern long-eared bats will not be held for more than 30 minutes after capture. See Kunz and Kurta (1988) for general recommendations.

**Weather and Light Conditions.** Negative surveys combined with any of the following weather conditions throughout all or most of a sampling period may require an additional night of mist-netting:

- Temperatures that fall below 50°F.
- Precipitation, including heavy fog, which exceeds 30 minutes or continues intermittently during the survey period.
- Sustained wind speeds greater than 9 miles/hour (3 on Beaufort scale).

It is best to place net set-ups under the canopy where they are out of moonlight, particularly when the moon is half-full or greater. Net set-ups illuminated by artificial light sources should also be avoided.

**Documentation of NLEB Captures.** Species of bats from the genus *Myotis* share common physical characteristics, making identification difficult. Therefore, photo-

documentation of all bats identified as northern long-eared bats and the first 10 little brown myotis captured per area will verify the identifications made in the field. Photo-documentation should include; a  $\frac{3}{4}$ -view of face showing ear, tragus and muzzle, a view of calcar showing presence/absence of keel, and a transverse view of toes showing extent of toe hairs.

If a bat from the genus *Myotis* is captured that cannot be readily identified to the species level, then species verification may be attempted through fecal DNA analysis.

- Collect fecal pellets from the bat in question by placing it temporarily in a holding bag (no more than 30 minutes).
- Place pellets collected in a small vial with silica gel desiccant.
- Store pellets from individual bats in separate vials and out of direct light.
- A list of available laboratories that analyze fecal pellets is at (<http://www.fws.gov/midwest/Endangered/mammals/inba/index.html>).

If a northern long-eared bat is captured, the USFWS and KDWP offices will be notified of the capture within two business days (or in accordance with permit conditions).

**Submission of survey results.** Fort Riley will provide results of acoustic and mist-netting surveys to the USFWS.

### **Literature Cited**

- Allen, C.R., S.E. Romeling, L.W. Robbins. 2011. Bats: Proceedings of Protecting Threatened Bats at Coal Mines.
- Arndt, R.J. and B.A. Schaetz. 2009. A tale of two deniers: nylon versus polyester mist-nets. *Bat Research News* 50(3):57.
- Britzke, E.R, B.A. Slack, M.P. Armstrong, and S.C. Loeb. 2010. Effects of orientation and weatherproofing on the detection of bat echolocation calls. *J. Fish and Wildl. Mgmt* 1:136-141.
- Carroll, S.K., T.C. Carter, and G.A. Feldhamer. 2002. Placement of nets for bats: effects on perceived fauna. *Southeastern Naturalist* 1:193-198.
- CBD. undated (Center for Biological Diversity). Saving the Northern Long-eared Bat. [http://www.biologicaldiversity.org/species/mammals/northern\\_long-eared\\_bat/index.html](http://www.biologicaldiversity.org/species/mammals/northern_long-eared_bat/index.html)
- Federal Register. April 2, 2015. 50 CFR Part 17. Endangered and Threatened Wildlife and Plants; Threatened Species Status for the Northern Long-Eared Bat With 4(d) Rule; Final Rule and Interim Rule. Vol. 80(63): 17974-18033.
- Ford, Mark W., Eric Britzke, Christopher Dobony, Jane Rodrigue, Joshua Johnson. 2011. Patterns of Acoustical Activity of Bats Prior to and Following White-Nose

- Syndrome Occurrence. Fort Drum, New York. Hayes, J. P. 2000. Assumption and practical considerations in the design and interpretation of echolocation-monitoring studies. *Acta Chiropterologica* 2:225-236.
- Hayes, J. P. 2000. Assumption and practical considerations in the design and interpretation of echolocation-monitoring studies. *Acta Chiropterologica* 2:225-236.
- Humphrey, P.S., D. Bridge, and T.E. Lovejoy. 1968. A technique for mist-netting in the forest canopy. *Bird-Banding* 39(1): 43-50.
- Jachowski, D.S., Johnson, J.B., Dobony, C.A., Edwards, J.W. & Ford, W.M. (2014) Space use and resource selection by foraging Indiana bats at the northern edge of their distribution. *Endangered Species Research*, doi:10.3354/esr00594.
- Kiser, J.D. and J.R. MacGregor. 2005. Indiana bat mist-net surveys for coal mining activities. Pp. 169-172 *in* Vories and Harrington, The Proceedings of the Indiana bat and coal mining: a technical interactive forum Office of Surface Mining, US Dept of Int, Alton, IL. At: [http://www.mcrc.org/MCR/Resources/bats/pdf/Indiana\\_Bat\\_and\\_Coal\\_Mining.pdf](http://www.mcrc.org/MCR/Resources/bats/pdf/Indiana_Bat_and_Coal_Mining.pdf). (Accessed 10/06/2011).
- Kunz, T.H. and A. Kurta. 1988. Capture methods and holding devices. Pp. 1-29 *in* T.H. Kunz (ed.), *Ecological and behavioral methods for the study of bats*. Smithsonian Inst. Press, Washington, DC
- Sparks, D.W., C.J. Schmidt, J.R. Choate. 2011. *Bats of Kansas*. ISU Center for North American Bat Research and Conservation.
- Weller, T. J., and C. J. Zabel. 2002. Variation in bat detections due to detector orientation in a forest. *Wildlife Society Bulletin* 30:922-930.
- U.S. Army Environmental Command. May 2015. Informal Conference & Management Guidelines on the Northern Long-eared Bat (*Myotis septentrionalis*) for Ongoing Operations on Installations Management Command Installations.
- U.S. Fish & Wildlife Service. 2011. A National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats.
- U.S. Fish & Wildlife Service. 2013. Northern Long-Eared Bat Fact Sheet. <http://www.fws.gov/midwest/endangered/mammals/nlba/pdf/NLBAFactSheet27Sept2013.pdf>

## **WHOOPING CRANE MANAGEMENT PLAN**

This management plan is based on and is consistent with the ESA, the Kansas Nongame and Endangered Species Conservation Act of 1975, and Army Regulations. Any action that may directly or indirectly affect the whooping crane must be coordinated with the USFWS by the Conservation Branch that is not otherwise outlined in this plan.

### **Whooping Crane Information**

#### ***Description***

The whooping crane (*Grus americanus*) is the tallest bird in North America, standing five feet tall. An adult's snow-white plumage contrasts with its black wing tips, black legs, black facial "mustache", and a crimson patch on the crown of the head. Flying snow geese (*Chen caerulescens*) and American white pelicans (*Pelicanus erythrorhynchos*) resemble whooping cranes as all exhibit white plumage with black wing tips. Whooping cranes are readily distinguished from these species in flight by their long extended neck and legs and greater overall size. Standing whooping cranes may be confused with the great egret (*Casmerodius albus*), another large, white wading bird. Great egrets lack the black moustache and crimson crown patch. Adult Sandhill cranes (*Grus canadensis*) have a similar crimson crown patch, but are uniformly gray in color. Juvenile whooping cranes are light cinnamon brown with a white belly, but will be accompanied by adult birds in adult plumage.

#### ***Habitat/Ecology***

The only natural wild flock of whooping cranes breeds in marshes at Wood Buffalo National Park in Canada, and winters along the Texas coast on salt flats and islands in and around Aransas National Wildlife Refuge (Armbruster 1990). Its birds make biannual, migratory flights between their breeding and wintering grounds. The spring and fall migration paths tend to follow a narrow route that is nearly a straight line between the two areas (Johnson and Temple 1980; USFWS 2007), passing over central Kansas.

Whooping cranes stop during migration to feed and roost. Stopover sites may be used for one or more nights. Sites are selected opportunistically from habitat available when cranes are ready to land. Whooping cranes feed on a variety of aquatic and terrestrial plants and animals. They select wetland habitat for roosting, using rivers and marsh complexes. Preferred riverine roost habitat has a wide channel with low, exposed, barren sandbars, shallow water, low flow velocity, low banks, no riparian timber and isolation from human disturbance (Johnson and Temple 1980, USFWS 1981, Howe 1987, Armbruster 1990).

#### ***Distribution and Range***

Whooping cranes historically ranged east of the Rocky Mountains in North America. This species apparently was not abundant prior to the Europeans' arrival into North America. The pre-1870 population estimate is 1,300-1,400 birds (Armbruster 1990). Non-migratory populations existed along the Louisiana and Florida coasts, and migratory populations followed four different routes. The two most important routes travelled between the upper

Midwestern United States and Louisiana, and between central Canada and the Texas coast (USFWS 2007). Currently, the only self-sustaining population is the population migrating between Canada and Texas, where surveys in March 2015 counted 314 whooping cranes (USFWS 2015a). A migratory flock of whoopers has been established that travels between Wisconsin and the Florida Gulf Coast (USFWS 2007), which numbers around 100 birds (WCEP 2015). A non-migratory flock is being reestablished in Louisiana and currently numbers around 46 cranes (Masson 2015). Approximately 160 birds are housed in captivity (USFWS 2015b).

Whooping cranes occur in Kansas only during migratory stopover periods. These stopover sites occur both within and outside of the primary flight corridor. The species has been recorded in Kansas from February 10 through April 28, and from October 5 through December 6 (Thompson and Ely 1989; KSBIRD-L).

Fort Riley is located approximately 80 miles east of the whooping crane's primary flight corridor. Whooping cranes have been sighted in Geary and Riley counties (Thompson and Ely 1989), with one report of a group of 3 whooping cranes observed flying at low altitude over Maneuver Area O during November 2021 during a period when the species is confirmed to have been present in Kansas. However the observed birds were not photographed and the observer's identification of the species is not considered certain.

There are six documented records of whooping cranes near Fort Riley since 1991; two from Riley County (Rocky Ford, 3 birds 1998; Zeandale, 5 birds, 2009), one from Wabaunsee County (Kansas River at St. Mary's, 2 birds, 1991), and three from Clay County (Smith Bottoms, 1 bird, 2000; Milford Lake, 1 bird, 2008; Steve Lloyd Wetland, 3 birds, 2015).

USFWS evaluated FRK for whooping crane habitat using habitat variables described in Carlson et al. (1990). The majority of habitat was determined to be of suboptimal quality for use by roosting cranes (USFWS 1992). Poor lateral visibility due to woody riverbank vegetation and lack of isolation from human activity were the two most important criteria resulting in the suboptimal rating.

### **Status**

The number of free-ranging whooping cranes within the Aransas population had fallen to 16 birds by 1942 (USFWS 2007). The loss of nesting and wintering habitat due to human development and agricultural expansion were the primary factors involved in the population decline (Johnson and Temple, 1980). Other factors involved were the increased hazards of migration resulting from human activities, winter storms, the cranes low reproductive rate, and their inability to recolonize suitable habitat within their former range. The whooping crane was listed as endangered in 1970, and was grandfathered into the ESA when it was ratified in 1973 (USFWS 2007).

**Conservation Measures.** A captive breeding flock of whooping cranes has been developed from eggs taken from the wild and hatched in captivity. These hand-reared birds have been supplemented by birds permanently injured and captured from the wild.

Young produced from these captive birds are released back into the wild in attempts to establish additional breeding populations.

### **Whooping Crane Management Prescriptions and Actions**

#### ***Prescription: Protect individual whooping cranes from human-induced injury***

**Action.** Disruption, intrusion, or obstruction of roosting and foraging areas can negatively affect whooping cranes. Certain activities in or near whooping cranes can interfere with feeding and resting behavior. Airboats, low altitude aircraft, and especially helicopters cause disturbance (USFWS 2007). Where a human activity agitates or bothers whooping cranes to the degree that it interferes with feeding or sheltering behavior, the conduct of that activity constitutes a violation of the ESA prohibition against disturbing an endangered species and may be prosecutable as a taking. While Fort Riley proper does not provide any apparent habitat suitable for whooping cranes, Fort Riley aircraft occasionally have flown over areas that have documented presence of this species. Further, Fort Riley aircraft will continue to fly over areas apparently suitable for whooping cranes into the future.

The presence of unmarked power lines, towers and other structures into which whooping cranes may fly is hazardous. Many transmission lines, poles, and towers exist on Fort Riley. All may pose some degree of threat to this species. However, techniques are available to reduce the hazard.

#### ***Prescription: Protect whooping cranes from disturbance by Fort Riley aircraft***

**Action.** Monitor local bird sighting reports. There are many forums used by bird-watchers to record, report and inform other users of the occurrence of rare or interesting birds. These include eBird, Facebook, and email list-serves. Fort Riley Conservation Staff will monitor these and similar forums to stay apprised of incidents when whooping cranes are present over areas where Fort Riley aircraft may operate. Additionally, Fort Riley staff requests USFWS and KDWP provide similar confidential reports received.

**Action.** Restrict aircraft flight when whooping cranes are present. A "no fly" buffer zone will be established and maintained around the area being used by one or more whooping cranes. An altitude restriction of 2,000 AGL (610 m) will be in effect for the "no fly" zone. The width of the zone will vary, dependent upon the location and expected use of the area by the cranes. Generally, this width will range from 0.5 NM (926 m) to 1.5 NM (2.78 km). The duration of the "no fly" zone will be for as long as any whooping crane is using that area. Biological survey flights and emergency situations, including unusual weather conditions, are the only exceptions to these restrictions.

**Action.** Inform pilots when "no fly" zones are in effect. Information will be provided to aviators through Local NOTAMs (Notices to AirMen) regarding "no fly" zones to minimize aircraft conflicts with whooping cranes. Additional programs will be developed, as needed.

#### ***Prescription: Protect whooping cranes found on Fort Riley***

**Action.** A “no disturbance” buffer zone will be established around any whooping crane that is located on lands controlled by Fort Riley. This buffer zone will be enforced for as long as a whooping crane remains in the area. Initially, the “no disturbance” buffer zone will be the training area(s) in which the whooping crane(s) occur, and will include a “no fly” zone. The size and limitations of the buffer zones may be adjusted after contact with the USFWS. Biological surveys and emergency situations are the only exceptions to these restrictions.

**Prescription: Minimize the risk of whooping crane collisions with aerial structures**

**Action.** Techniques are available to mark or otherwise design aerial structures so that the striking hazard is eliminated or greatly reduced. Line markers, such as aviation balls and colored spiral dampers, and similar markers for towers and guy lines may be used to make these structures more visible to whooping cranes. Any projects to construct new or modify existing aerial structures on Fort Riley will be reviewed by Conservation Branch staff at least 30 days prior to project implementation to determine whether line markers are needed. Areas of particular concern occur within one mile of a river or Milford Lake because these may be used as travel lanes.

**Prescription: Improve detection and reporting of whooping cranes**

**Action.** Fort Riley personnel should learn to recognize whooping cranes, and be made aware of the importance of promptly reporting encounters with this bird in the field. Conservation staff will verify sighting reports from non-affiliated personnel prior to establishing “no fly” zones, as false reports of great egrets or American white pelicans as whooping cranes are expected.

Additional programs will be developed, as needed, to publicize whooping crane identification to other persons who work, train, or are outdoors during daylight hours on Fort Riley.

### **Whooping Crane Monitoring Plan**

Whooping cranes require foraging and roost sites during migration. They forage in agricultural fields, upland pastures and wetlands during daylight hours. The potential for cranes to occur in a large variety of habitats while foraging makes it inefficient to search for feeding cranes outside of traditionally used locations. Few potential roost sites exist on Fort Riley, as the majority of habitat is deemed to possess suboptimal quality for roosting cranes (USFWS 1992). Therefore, no monitoring other than that described in section 9.4.2.1 will occur.

### **Literature Cited**

- Armbruster, M.J. 1990. Characterization of habitat used by whooping cranes during migration. USFWS Biol. Rep. 90(4). 16 pp.
- Carlson, D., D. Holz, and J. Ziewitz. 1990. Whooping crane roosting habitat simulation model for the Platte River in Nebraska. Biology Workshop, Platte River Management Joint Study. 22 pp.



- Howe, M.A. 1987. Habitat use by migrating whooping cranes in the Aransas-Wood Buffalo corridor. pp. 303- 311 in J.C. Lewis, ed. Proc. 1985 Crane Workshop, Platte River Whooping Crane Habitat Maintenance Trust, Grand Island, NE.
- Johnson, K.A., and S.A. Temple. 1980. The migration ecology of the whooping crane. USFWS. 87 pp.
- KS BIRD-L@listserv.ksu.edu. <http://listserv.ksu.edu/archives/ksbird-l.html>. On-line forum for Kansas bird sightings.
- Masson, T. 2015. More whooping cranes released into Louisiana's marshes. The Times-Picayune Greater New Orleans online newspaper, Dec. 7, 2015. [http://www.nola.com/outdoors/index.ssf/2015/12/more\\_whooping\\_cranes\\_released.html](http://www.nola.com/outdoors/index.ssf/2015/12/more_whooping_cranes_released.html).
- Thompson, M.C, and C. Ely. 1989. Birds in Kansas, Volume 1. Lawrence (KS): University Press of Kansas.
- USFWS. 1981. The Platte River ecology study. Northern Prairie Wildlife Res. Center, Jamestown, ND. 197 pp.
- \_\_\_\_\_. 1986. Wood Buffalo whooping crane site evaluation data. Whooping Crane Habitat Suitability Workshop, Grand Island, NE.
- \_\_\_\_\_. 1992. A survey of threatened and endangered species on Fort Riley Military Reservation, Kansas. Summary Report submitted to U.S. Dept. of the Army. 30 pp. + app.
- \_\_\_\_\_. 1994. Endangered Species Technical Bulletin. 19(3):2.
- \_\_\_\_\_. 2007. USFWS. International Recovery Plan Whooping Crane (*Grus americana*), 3<sup>rd</sup> revision.
- \_\_\_\_\_. 2015a. USFWS News Release, SW Region, March 16, 2015. <http://www.fws.gov/uploadedFiles/NR-Aransas%20Crane%20Count-12March2015.pdf>
- \_\_\_\_\_. 2015b. Quivira National Wildlife Refuge, Kansas, Whooping Crane Fact Sheet (as of February 2015). [http://www.fws.gov/refuge/Quivira/wildlife\\_and\\_habitat/whooping\\_crane.html](http://www.fws.gov/refuge/Quivira/wildlife_and_habitat/whooping_crane.html).
- WCEP (Whooping Crane Eastern Partnership). 2015. Whooping Crane Update, November 2015. <http://www.bringbackthecranes.org/technicaldatabase/projectupdates/2015/November2015ProjectUpdate.html>.

## **EASTERN BLACK RAIL MANAGEMENT PLAN**

This management plan is based on and is consistent with the Endangered Species Act of 1973, the Kansas Endangered Species and Nongame Conservation Act of 1975, and Army Regulations.

### **Eastern Black Rail Information**

#### ***Description***

Adult eastern black rails range from 10-15 centimeters in total length and have a wingspan of 22-28 cm. They weigh 35 grams on average. Males and females are similar in size and adults are generally pale to blackish-gray, with a small blackish bill and bright red eyes. The underparts from chin to abdomen are uniformly colored but are lighter on the chin and throat. The nape and upper back are chestnut and the remaining back, upper tail feathers and remiges (wing flight feathers) are dark gray to blackish with small white spots, sometimes washed with chestnut-brown. The lower abdomen, under tail feathers and flanks are streaked with black and have narrow white and dark gray barring washed with chestnut. Overall, males are darker and have pale to medium gray throats, while females are lighter and have pale gray to white throats. The lower legs and toes are a brownish-gray or gray to blackish-brown. Juvenile eastern black rails are similar in appearance to adults, but have duller plumage and fewer and smaller white spots. This bird is very secretive and most often detected by voice, a squeaky kee-kee-krrr. Since it is seldom seen, it may be more common than data indicate.

#### ***Distribution/Habitat/Ecology***

The eastern black rail is one of four subspecies of black rail broadly distributed in the United States, Central America, and South America. The eastern black rail range spans 35 states from Florida to Maine, to Colorado to Texas. In Kansas the eastern black rail is usually found in wet meadows or meadows near marshes of the Cheyenne Bottoms Wildlife Management Area and Quivira National Wildlife Refuge and probably near other wetlands in the state. Apparently, this bird does not require large areas of marshland or wet meadows because several Kansas records are from areas with only a few suitable acres. While it may use cattails and similar habitats, shallow wetland with short dense vegetation is preferred. (Kansas Department of Wildlife, Parks and Tourism 2018). The eastern black rail is currently listed as Threatened under the Endangered Species Act.

Breeding season records for the eastern black rail in Kansas occur in Barton, Stafford, Comanche, Finney, Kingman, Meade, Franklin, and Riley counties. Preferred nesting sites for the eastern black rail in Kansas appear to be marshy areas with stable water levels, a feature not common at most Kansas wetlands. The nest is made of fine-stemmed grasses, rushes, and sedges. Eggs have been reported 6 June – 6 July. Little is known about eastern black rails during migration, including migratory stopover habitat, but individuals seem to appear more frequently in wet prairies, wet meadows, or hay fields during migration than during the breeding and wintering seasons ([www.USFWS.gov/eastern black rail](http://www.USFWS.gov/eastern%20black%20rail)). Wintering eastern black rail are suspected to most likely spend the winter in the southeastern United States, along the Gulf Coast, Mexico, Belize, and portions of the Caribbean Islands and South America (Jackson 1987; Ripley 1977; Eddleman et al. 1994; American Ornithologists' Union 1998).

Expected habitat for this species on the installation occurs in and around impoundments, wetlands, vernal pools, as well as food plot and firebreak agricultural fields. There has been no systematic attempt to quantify the occurrence of eastern black rail on Fort Riley. This species has been documented on Fort Riley as incidental sightings in mid- to late-September and early-October while conservation staff near cropped food plots in Training Areas 34, 39, 42, 45, 53, 54, 75 and on the west edge of the Impact Area. A spring time (late-April) observation occurred in a roadside vernal pool in Training Area 93.

### **Eastern Black Rail Management Prescriptions and Actions**

**Prescription.** Protect eastern black rail habitat on Fort Riley

**Action.** Any activities, projects, or construction that eliminates or greatly degrades impoundments or constructed wetlands on Fort Riley will be reviewed by Conservation Branch staff prior to project implementation to determine effects on potential eastern black rail habitat.

**Prescription.** Maintain and enhance black rail habitat on Fort Riley

**Action.** Provide maintenance and repair for dams and control structures on impoundments and wetlands on Fort Riley.

**Action.** Use mechanical removal and/or prescribed burning to reduce woody plant encroachment and other invasive plant species that will have a negative effect on eastern black rail habitat.

**Action.** Conduct conservation and agricultural practices that provide moderate vegetative disturbance that will benefit eastern black rail during the migration periods.

**Prescription.** Improve detection and reporting of eastern black rails.

**Action.** Conservation Branch field biologists will be trained to recognize eastern black rail, and be made aware of the importance of recording encounters with this bird in the field. All observations, including verified sighting reports from non-affiliated personnel, will be maintained on maps, so specific habitats utilized by the species can be tracked and identified.

**Action.** Visit locations of reported sightings to obtain habitat description of sighting location. Maintain a log of habitats from which sightings are recorded in order to create more specific description of actual habitats used by this species on Fort Riley.

### **Eastern Black Rail Monitoring Plan**

Beginning in April of 2022, the Conservation Branch biologists will begin to routinely monitor the installation's ~60 known wetland areas using a modified version of the Secretive Marsh Bird Monitoring Protocol (Conway 2015). Due to the black rail currently being understood as a rare bird on the Fort Riley Installation, the Conservation Branch will take the approach of monitoring as many wetlands as possible during the 2022 breeding season rather than monitoring only a sample of wetlands multiple times (Conway 2015). Surveys will take place during the two hours before and one hour after

sunrise from April 15 to May 31 (Conway 2015, Davidson 1992). Survey locations will be no less than 400-m apart to avoid double-sampling, and will be randomly placed within each wetland using the ArcMap random point generator (Conway 2015). Surveys will be in a call-playback format (Troutman 2021). The first two minutes ensue a silent listening period, and the following 8 minutes involve a pattern of 30-seconds of solicitation calls being played, followed by 1-minute of silent listening until 10 minutes is reached for the complete survey (Troutman 2021). If possible, the biologist will record the distance to the bird once a detection has been made. Data sheet requirements will include observer initials, water body, point ID, date, time, temperature, barometric pressure, relative humidity, and wind speed. All weather variables will be recorded using a Kestrel weather meter prior to the survey.

In the case that the 2022 field season results in the black rail being identified as more common than previously understood, the wetlands will then begin to be surveyed on a rotational basis coinciding with the Conservation Branch's summer breeding bird surveys. Each year the wetlands to be surveyed will coincide with the breeding bird survey locations of that year, with the wetlands nearest to each point being monitored. If a black rail is not detected after three visits to that location, the wetland will not be surveyed the subsequent year. Instead, the effort that would be given to that wetland will be rotated to a new wetland that did not get surveyed during the previous breeding season. If a black rail is detected during any of the three surveys at a location, that location will continue to be surveyed the following year. This rotation will continue until all known wetland areas have been surveyed. A minimum of three visits to each wetland point within the breeding season will be required to reach the desired 90% accuracy point of determining the occupancy state of each area (Gibbs and Melvin 1993).

The target population of this monitoring plan will be focused on the entire Fort Riley Military Reservation. The initial inventory goal is to determine occupancy (proportion of wetlands occupied by black rails). If the monitoring program detects eastern black rails, the program will continue for at least the next 5 years to attempt to estimate density and population trends over time.

With scientific literature and data being very limited in Kansas and overall, the above monitoring program is subject to change with any influx of new information as time goes on.

### **Literature Cited**

- American Ornithologists' Union. 1998. Check-list of North American Birds. 7<sup>th</sup> Edition. American Ornithologists' Union. Washington D.C.
- Busby, W.H. and J. L. Zimmerman. 2001. Kansas Breeding Bird Atlas. University Press of Kansas. Lawrence, KS.

- Conway, C.J. 2015. National protocol framework for the inventory and monitoring of secretive marsh birds. Inventory and Monitoring, National Wildlife Refuge System, U.S. Fish and Wildlife Service, Fort Collins, Colorado.
- Davidson, L. M. (1992). "Black Rail, *Laterallus jamaicensis*." In Migratory nongame birds of management concern in the Northeast., edited by K. J. Schneider and D. M. Pence, 119-134. Newton Corner, MA: U.S. Fish and Wildl. Serv.
- Eddleman, W.R., R. E. Flores, and M. L. Legare, 1994. Black Rail No. 123, in A. Poole and F. Gill, Eds. The Birds of North America. Academy of Natural Sciences, Philadelphia, Pennsylvania, and American Ornithologists' Union, Washington, D.C.
- Jackson, J. A. 1987. Bird Conservation. University of Wisconsin Press. International Council for Bird Preservation. 3: 51-53.
- Kansas Department of Wildlife, Parks, and Tourism. 2018. Kansas Species in Need of Conservation List. <https://ksoutdoors.com/Services/Threatened-and-Endangered-Wildlife/All-Threatened-and-Endangered-Species/Black-Rail>
- Troutman, L.. 2021. USFWS Eastern Black Rail Survey Protocol Guidance, Version 1. February 2021. Technical Report. South Carolina, United States.
- United States Fish and Wildlife Service. 2018. Wildlife-Birds-Eastern Black Rail. <https://www.fws.gov/southeast/wildlife/birds/eastern-black-rail/>

## **AMERICAN BUMBLE BEE MANAGEMENT PLAN**

### **Description**

The American bumble bee is a relatively large bumble bee with the queen measuring 22-26 mm. Queen and worker heads are long with the cheek (oculo-malar area) just longer than broad. The hair on the head of the queen is always black. Hairs on the thorax metasomal T1-3 are yellow, more dominant at the midline and T4 is black. Worker coloration is similar to the queen, however, workers are smaller than the queen and measure 13-19 mm in length. American bumble bee males differ from females in both size and coloration. Males are slightly smaller than queens measuring 15-20 mm in length. Male coloration is similar to queens and workers except metasomal T7 is often orange, however if T7 is black then T2-3 are entirely yellow. Male faces are mostly black with some yellow hairs intermixed. Male thoraxes are black on the sides and the uppersides often with a black band between the wings occasionally with yellow hairs mixed throughout (Mitchell 1962; Williams et al. 2014).

### **Life Cycle**

The American bumble bee has an annual life cycle. Queen bees that mated the previous fall emerge in the spring from their overwintering shelters and begin building colonies. Once a new queen has chosen a nesting site, she forages for nectar and pollen for herself and combines pollen and nectar together into provisions called “bee bread” within the nest for her offspring. The queen lays an egg on each provision, which hatches and feeds on the provision until entering pupation. Worker bees emerge after they pupate. The colony grows and expands through mid-summer when males are produced. The males leave the colony and go in search of reproductive females from other colonies. Reproductive females are produced at the end of the summer and leave the natal colony, mate, and then find a suitable place to overwinter. The members of the original colony die and the new, mated queens overwinter to begin the cycle the next year (Williams et al. 2014).

### **Phenology**

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
<b>Males</b>												
<b>Workers</b>												
<b>Queens</b>												

*The documented phenology cycle of the American bumble bee colony. This chart was originally published in the USDA report Bumble Bees of Eastern United States (Colla et al. 2011).*

### **Range**

The historic range of the American bumble bee is among the broadest geographic ranges of any bumble bee species in North America; it has been observed in all of the lower 48 United States, except for Washington (Cameron et al. 2011, Williams et al. 2014). The

species is currently found widespread in the Eastern Temperate Forest and Great Plains regions throughout the eastern and central United States and extreme southern Canada. It is absent from much of the Mountain West, but can be found in the Desert West and adjacent areas of California and Oregon (Williams et al. 2014). The American bumble bee is also known to occur in 26 Mexican states (ECOSUR Database 2015).

### **Habitat**

The primary habitat of the American bumble bee is generally described as prairie, grasslands, open farmland and fields (Williams et al. 2014). However, the specific habitat requirements of the American bumble bee have not been well studied or described throughout the species range. The only in-depth study conducted on the specific habitat requirements of the American bumble bee was in southern Ontario, Canada, which is the northern edge of the species range. There, the American bumble bee's habitat was associated with floral and landscape characteristics of open land interspersed with some forest (Liczner and Colla 2020). Additionally, the species has been documented to persist in urbanized areas where floral resources are abundant (Camilo et al. 2017, Evans et al. 2019). Nests are mostly located on the surface of the ground, among long grass, old bird nests, rock piles, or cavities in dead trees (Williams et al. 2014, Hatfield et al. 2015). However, they can occasionally be found underground in abandoned rodent nests (Williams et al. 2014). The species has also been documented utilizing anthropogenic materials such as buckets, old barns, and cinderblocks for nest sites (Rau 1922, Rau 1924).

### **Food Habits-Nectar Plants**

The American bumble bee is a long tongued species that is considered a generalized nectar and pollen gatherer (Williams et al. 2014). Bumble bees forage from a wide array of plants, however bumble bee species in a given area can vary substantially in their food plant preferences, primarily due to differences in tongue length (Hatfield et al. 2015). The American bumble bee relies on flowers throughout the entire growing season, as the amount of nectar and pollen during the early spring and late summer effect the growth of the colony and the production of reproductive females (Westphal et al. 2009, Goulson 2010). Nectar resources utilized by the American bumble bee include milk vetch (*Astragalus canadensis*), thistles (*Cirsium spp.*), bunchberry (*Cornus canadensis*), prairie clovers (*Dalea spp.*), purple coneflowers (*Echinacea spp.*), Joe-pye weeds (*Eupatorium spp.*), sunflowers (*Helianthus spp.*), St. John's wort (*Hypericum perforatum*), *Kallstoemia*, blazing star (*Liatris*), Bird's-foot trefoil (*Lotus corniculata*), *Metzelia*, *Solanum*, goldenrods (*Solidago spp.*), vetches (*Vicia spp.*), and clovers (*Trifolium spp.*; Colla et al. 2011, Williams et al. 2014).

### **Status**

Although the species remains common in parts of its range, primarily in the southern Midwest and the southern United States, particularly Texas, Oklahoma, Missouri and Alabama, numerous studies indicate that both the range, particularly its northern extents, and abundance of this once common bumble bee have precipitously declined (Cameron et al. 2011; Grixiti et al. 2009; Colla et al. 2012). In Kansas specifically, the majority of

bumble bees observed were historically the American bumble bee but the species has suffered >50% decline in relative abundance (Richardson 2020 unpublished database). Surveys referenced by Cameron et al. 2011 and Koch et al. 2015 observed the American bumble bee at a relative abundance of 24.7% in the state.

NatureServe has designated the species status globally as G3/G4 – vulnerable to apparently secure, however its state status for Kansas is not ranked. The International Union for Conservation of Nature (IUCN) has assigned the species a status of vulnerable (IUCN 2022). Due to the precipitous declines in abundance and range contraction as well as persistent threats to remaining populations from habitat loss, pesticide use, and global climate change, the U.S. Fish and Wildlife Service initiated a status review of the American bumble bee in September 2021 in response to a proposal to list the species as threatened under the United States Endangered Species Act (USFWS 2021).

### **Threats**

Given the American bumble bee's broad geographic distribution across the continental United States and parts of southern Canada and Mexico, it is unlikely that a single threat can be attributed to the decline of the species throughout its range (Hatfield et al. 2015). Although the exact causes of the species' decline and range contraction are unclear studies have attributed its decline to pathogen spillover (Colla et al. 2006, Otterstatter and Thomson 2008, Gillespie 2010, Cameron et al. 2011, Cameron et al 2016, McArt et al. 2017), increased pesticide use particularly neonicotinoids (Gels et al. 2002, Marletto et al. 2003, Hatfield et al. 2012), other modern agricultural practices (Grixti et al. 2009), reduced genetic diversity (Goulson 2010, Hatfield et al. 2012, Cameron et al. 2011, Lozier et al. 2011), conversion, loss, and degradation of habitat (Kremen et al. 2002, Greenleaf and Kremen 2006, McFrederick and LeBhun 2006, Hatfield et al. 2012), and fire (Hatfield et al. 2015).

### **American Bumble Bee on Fort Riley**

Currently, there are no known documented observations of American bumble bee occurrences on the installation, however, the Fort Riley Military Reservation is within both the species' historic and current ranges.

### **AMERICAN BUMBLE BEE ACTION PLAN**

**Action:** The three most commonly employed methods for collecting bees are bowl traps, vane traps, and Malaise traps (McCravy 2018). However, each of these methods have drawbacks that hinder their effectiveness for monitoring bees (Portman et al. 2020). Bowl traps are attractive to researchers because they are cheap, simple, repeatable, and reduce individual observer bias (Cane et al. 2000, Westphal et al. 2008). Unfortunately, it is well documented that certain species and genera are over represented using this method, while others are rarely ever captured (Cane et al. 2000, Cane 2001, Roulston et al. 2007, Wilson et al. 2008, Neame et al. 2013). These traps tend to catch an excessive number of bees in the family Halictidae (Portman et al. 2020). Like bowl traps, vane traps



are relatively inexpensive, easy to deploy, and reduce individual observer bias, however, there is substantial evidence that suggests vane traps collect relatively large proportions of larger bees such as *Bombus* (Stephen et al. 2005, Kimoto et al. 2012, Geroff et al. 2014, Buchanan et al. 2017, Gibbs et al. 2017, McCravy et al. 2017). It has been suggested that blue vane traps in particular may attract these bees by mimicking preferred host plants (Joshi et al. 2015, Gibbs et al. 2017). It has been noted in some studies that large quantities of these large-bodied bees have been captured in blue vane traps (Stephen and Rao 2005, Buchanan et al. 2017), suggesting these traps can collect excessive numbers of these bees if not monitored closely (McCravy 2018). Finally, Malaise traps may offer a method that collects a more representative sample of the overall bee fauna because they do not use color, unlike bowl and vane traps, which incorporate color to attract bees (McCravy 2018). Yet, like bowl and vane traps, Malaise traps are subject to a suite of shortcomings. Malaise traps tend to collect an abundance of non-target insects and compared to the other two trapping methods are significantly more costly (>\$200), and set-up is substantially more difficult than bowl or vane traps (McCravy 2018). Furthermore, it has been suggested that the above mentioned sampling methods do not provide reliable estimates of the abundance of populations since it is not clear what proportion of a population of bees are collected or how this proportion varies by bee species and sex (Cane et al. 2000, Toler et al. 2005, Richards et al. 2010, Wood et al. 2015). Thus, year-to-year data collected from these methods provide little information about whether bee populations are increasing or decreasing (Portman et al. 2020). It is also unclear how trap catch is influenced by factors such as the proximity to nest sites (Toler et al. 2005). In addition, it is not known whether these traps catch more bees when there are no flowers or if they catch more bees when there are many flowers (Cane et al. 2000, Mayer and Kuhlmann 2004, Roulston et al. 2007, Baum and Wallen 2011, Wood et al. 2015). Lastly, because these trapping methods are relatively new and were not used by historic collectors comparing captures using these methods to historic net-collected specimens can potentially bias monitoring data (Portman et al. 2020).

Despite the inherent advantages and subsequent limitations of the above mentioned trapping methods, the preponderance of these disadvantages are related to trap under/over sampling of certain species and/or genera and their apparent inability to accurately estimate abundance or annual trends. Given that is unknown whether the American bumble bee is even present on the Fort Riley Military Reservation, our current course of action will be to determine its occurrence on the installation. Subsequently, the disadvantages of the aforementioned methods are arguably inconsequential to our current objectives. Therefore, in order to determine if the American bumble bee is present on the Fort Riley Military Reservation we will employ the use of bowl, vane and Malaise traps. Traps will be randomly distributed across the installation and open for one day during each sampling bout in order to help mitigate excessive capture, which previous studies have revealed could potentially be problematic (Stephen and Rao 2005, Kimoto et al. 2012, Buchanan et al. 2017). Sampling will be conducted throughout the flight period (May - October) on days when weather conditions are clear, warm, and calm. Specimens collected in the traps will be frozen until they can be pinned, labeled, sexed, and accurately identified to species if possible, or morphospecies, if species level identification is not possible. However, due to the inability of these methods to adequately

monitor changes in abundance, should we discover the American bumble bee is present on the Fort Riley Military Reservation through our survey efforts we will make amendments to our monitoring plan. These amendments will include adopting survey methods that are better equipped to inform questions related to population size, changes in abundance and annual trends such as mark-recapture, nest censuses, and targeted sampling (Portman et al. 2020).

## **KANSAS BUMBLE BEE ATLAS**

In addition to the monitoring efforts referenced in the “American Bumble Bee Monitoring Plan” section the FRMR will also be participating in the Kansas Bumble Bee Atlas. The Kansas Bumble Bee Atlas is a collaboration of the USFWS, some states and a number of NGOs. The Kansas Bumble Bee Atlas is a community science project aimed at tracking and conserving Kansas’s native bumble bees. The Kansas Bumble Bee Atlas works by dividing the state into grid cells. Researchers, scientists, land managers, landowners, students, and other members of the community will then be able to “adopt” a grid cell where they will survey for native pollinators. Surveys for the Kansas Bumble Bee Atlas will be conducted twice between June and September. If a single person is surveying, the minimum survey duration is 45 minutes, however, if more people are participating the survey duration can be less. For example, if three surveyors are present then you can divide the survey time by three (3 surveyors/ 45 minutes = 15 minutes). The sampling methods for the survey are all catch and release. Consequently, surveyors will need to have access to a camera to upload high quality photos of each collected bee. Photos from the survey will be submitted through a surveyor’s Bumble Bee Watch account. Therefore, surveyors will need to have a Bumble Bee Watch account where they can adopt a grid cell and upload their data, keep track of observations, and photographs. Other useful equipment for surveys include: an insect net, collection vials, plan identification books and field guides, and the Bumble Bees of North America book.

## **LITERATURE CITED**

- Baum, K.A. and K.E. Wallen. 2011. Potential bias in pan trapping as a function of floral abundance. *Journal of the Kansas Entomological Society* 84:155–159.
- Buchanan A.L., J. Gibbs, L. Komondy and Z. Szendrei. 2017. Bee community of commercial potato fields in Michigan and *Bombus impatiens* visitation to neonicotinoid-treated potato plants. *Insects* 8:30.
- Cameron, S.A., J.D. Lozier, J.P. Strange, J.B. Koch, N. Cordes, L.F. Solter, and T.L. Griswold. 2011. Patterns of widespread decline in North American bumble bees. *Proceedings of the National Academy of Science (USA)* 108:662-667.

- Cameron, S.A., H.C. Lim, J.D. Lozier, M.A. Duennes and R. Thorp. 2016. Test of the invasive pathogen hypothesis of bumble bee decline in North America. *Proceedings of the National Academy of Sciences* 113:4386–4391.
- Camilo, G.R., P.A. Muniz, M.S. Arduser and E.M. Spevak. 2017. A checklist of the bees (Hymenoptera: Apoidea) of St. Louis, Missouri, USA. *Journal of the Kansas Entomological Society* 90:175–188.
- Cane, J.H. 2001. Habitat fragmentation and native bees a premature verdict? *Conservation Ecology* 5.
- Cane, J.H., R.L. Minckley and L.J. Kervin. 2000. Sampling bees (Hymenoptera: Apiformes) for pollinator community studies: pitfalls of pan-trapping. *Journal of the Kansas Entomological Society*. 73:225–231.
- Colla, S.R. M.C. Otterstatter, R.J. Gegear and J.D. Thomson. 2006. Plight of the bumble bee: pathogen spillover from commercial to wild populations. *Biological Conservation* 129:461-467.
- Colla, S.R., F. Gadallah, L. Richardson, D. Wagner and L. Gall. 2012. Assessing the Conservation Status of North American bumble bees using museum records. *Biodiversity and Conservation* 21:3585-3595.
- Droege S., V.J. Tepedino, G. Lebuhn, W. Link, R.L. Minckley, Q. Chen, and C. Conrad. 2010. Spatial patterns of bee captures in North American bowl trapping surveys. *Insect Conservation Diversity* 3:15–23.
- ECOSUR. 2015. Mexican Bumble Bee Database based on ECOSUR (El Colegio de la Frontera Sur) and other Mexican collections.
- Evans, E. M. Boone and D. Cariveau. 2019. Monitoring and habitat assessment of declining bumble bees in roadside in the twin cities metro area of Minnesota. University of Minnesota Center for Transportation Studies.

<https://hdl.handle.net/11299/208533>.

- Gels, J.A., D.W. Held and D.A. Potter. 2002. Hazards of insecticides to the bumble bees *Bombus impatiens* (Hymenoptera: Apidae) foraging on flowering white clover in turf. *Journal of Economic Entomology* 95:722–728.
- Geroff R.K., J. Gibbs, K.W. McCravy. 2014. Assessing bee (Hymenoptera: Apoidea) diversity of an Illinois restored tallgrass prairie: Methodology and conservation considerations. *Journal of Insect Conservation* 18:951–964.
- Gibbs J., N.K. Joshi, J.K. Wilson, N.L. Rothwell, K. Powers, M. Haas, L. Gut, D.J. Biddinge, R. Isaacs. 2017. Does passive sampling accurately reflect the bee (Apoidea: Anthophila) communities pollinating apple and sour cherry orchards? *Environmental Entomology* 46:579–588.
- Gillespie, S. 2010. Factors affecting parasite prevalence among wild bumblebees. *Ecological Entomology* 35:737-747.
- Goulson. D. 2010. *Bumblebees: Behaviour, Ecology, and Conservation*. Oxford University Press.
- Greenleaf S.S. and C. Kremen. 2006. Wild bee species increase tomato production and respond differently to surrounding land use in Northern California. *Biological Conservation* 133:81–87.
- Grixti, J.C., L.T. Wong, S.A. Cameron and C. Favret. 2009. Decline of bumble bees (*Bombus*) in the North American Midwest. *Biological Conservation* 142:75-84.
- 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, Portland, Oregon.
- Hatfield, R. S. Jepsen, R. Thorp, L. Richardson, S. Colla, and S. Foltz Jordan. 2015. *Bombus pensylvanicus*. The IUCN Red List of Threatened Species 2015:

e.T21215172A21215281.

<http://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T21215172A21215281.en>

IUCN. 2022. The IUCN red list of threatened species. Version 2022-3.

<https://www.iucnredlist.org>. Accessed on 13 January 2022.

- Joshi N.K., T. Leslie, E.G. Rajotte, M.A. Kammerer, M. Otieno and D.J. Biddinger. 2015. Comparative trapping efficiency to characterize bee abundance, diversity, and community composition in apple orchards. *Annals of the Entomological Society of America* 108:785–799.
- Kimoto C., S.J. DeBano, R.W. Thorp, S. Rao and W.P. Stephen. 2012. Investigating temporal patterns of a native bee community in a remnant North American bunch grass prairie using blue vane traps. *Journal of Insect Science* 12:108.
- Koch, J.B., J. Lozier, J.P. Strange, H. Ikerd, T. Griswold, N. Cordes, L. Solter, I. Stewart, and S.A. Cameron. USBombus, a database of contemporary survey data for North American Bumble Bees (Hymenoptera, Apidae, Bombus) distributed in the United States. *Biodiversity Data Journal* 3:e6833.
- Kremen, C., N.M. Williams and R.W. Thorp. 2002. Crop pollination from native bees at risk from agricultural intensification. *Proceedings of the National Academy of Sciences of the United States of America* 99:16812–16816.
- Liczner, A.R. and S.R. Colla. 2020. One-size does not fit all: at-risk bumble bee habitat management requires species-specific local and landscape considerations. *Insect Conservation and Diversity* 13:558–570.
- Lozier, J.D., J.P. Strange, I.J. Steward and S.A. Cameron. 2011. Patterns of range-wide genetic variation in six North American bumble bee (Apidae: *Bombus*) species. *Molecular Ecology* 20:4870-4888.
- Marletto, F., A. Patetta and A. Manino. 2003. Laboratory assessment of pesticide toxicity

- to bumblebees. *Bulletin of Insectology* 56:155–158.
- Mayer, C. and M. Kuhlmann. 2004. Synchrony of pollinators and plants in the winter rain fall area of South Africa—observations from a drought year. *Transactions of the Royal Society of South Africa* 59:55–57.
- McArt, S.H. C. Urbanowicz, S. McCoshum, R.E. Irwin and L.S. Adler. 2017. Landscape predictors of pathogen prevalence and range contractions in US bumblebees. *Proceedings of the Royal Society B*:284(1867), p.20172181.
- McCravy, K.W. 2018. A Review of Sampling and Monitoring Methods for Beneficial Arthropods in Agroecosystems. *Insects* 9:170.  
<https://doi.org/10.3390/insects9040170>.
- McCravy K.W., J.D. Ruhoff. 2017. Bee (Hymenoptera: Apoidea) diversity and sampling methodology in a Midwestern USA deciduous forest. *Insects* 8:81.
- McFrederick, Q.S. and G. LeBuhn. 2006. Are urban parks refuges for bumble bees *Bombus* spp. (Hymenoptera: Apoidea)? *Biological Conservation* 129:372–382
- Mitchell, T.B. 1962. Bees of the Eastern United States. North Carolina Agricultural Experiment Station Technical Bulletin No. 152.
- NatureServe. 2022. NatureServe Explorer: an online encyclopedia of life. Version 7.1. Arlington, Virginia, USA. <http://www.natureserve.org/explorer>.
- Neame, L. A., T. Griswold and E. Elle. 2013. Pollinator nesting guilds respond differently to urban habitat fragmentation in an oak-savannah ecosystem. *Insect Conservation Diversity* 6:57–66.
- Otterstatter, M.C. and J.D. Thomson. 2008. Does pathogen spillover from commercially reared bumble bees threaten wild pollinators? *PLoS ONE* 3:e2771.
- Portman, Z.M., B. Bruninga-Socolar and D.P. Cariveau. 2020. The state of Bee monitoring in the United States: A call to refocus away from bowl traps and

- towards more effective methods. *Annals of the Entomological Society of America* 113:337– 342.
- Rau, P. 1922. Ecological and behavior notes on Missouri insects. *Transactions of the Academy of Sciences of St. Louis* 24:1–71
- Rau, P. 1924. Notes on captive colonies and homing of *Bombus pensylvanicus* De Geer. *Annals of the Entomological Society of America* 17:368–381.
- Richards, M. H., J. L. Vickruck and S. M. Rehan. 2010. Colony social organization of *Halictus confusus* in southern Ontario, with comments on sociality in the subgenus *H.(Seladonia)*. *Journal of Hymenoptera Research* 19:144–158.
- Roulston, T. H., S. A. Smith and A. L. Brewster. 2007. A comparison of pan trap and intensive net sampling techniques for documenting a bee (Hymenoptera: Apiformes) fauna. *Journal of the Kansas Entomological Society* 80:179–181.
- Stephen W.P. and S. Rao. 2005. Unscented color traps for non-*Apis* bees (Hymenoptera: Apiformes) *Journal of the Kansas Entomological Society* 78:373–380.
- Toler, T.R., E.W. Evans and V.J. Tependino. 2005. Pan-trapping for bees (Hymenoptera: Apiformes) in Utah's west desert: the importance of color diversity. *Pan-Pacific Entomology* 81:103–113.
- USFWS (U.S. Fish and Wildlife Service) 2021. Endangered and threatened wildlife and Plants: 90-day findings for five species. *Federal Register* 86:53937-53941.
- Westphal, C., R. Bommarco, G. Carre, E. Lamborn, N. Morison, T. Petanidou, S.G. Potts, S.P.M. Roberts, H. Szentgyorgyi, T. Tscheulin, et al. 2008. Measuring bee diversity in different European habitats and biogeographical regions. *Ecological Monographs* 78:653–671.
- Westphal, C., I. Steffan-Dewenter and T. Tschardt. 2009. Mass flowering oilseed rape improves early colony growth but sexual reproduction of bumblebees. *Journal of Applied Ecology* 46:187–193.

Williams, P.H., R.W. Thorp, L.L. Richardson, and S.R. Colla. 2014. *Bumble bees of North America: an identification guide*. Princeton University Press.

Wilson, J.S., T. Griswold and O.J. Messinger. 2008. Sampling bee communities (Hymenoptera: Apiformes) in a desert landscape: are pan traps sufficient? *Journal of the Kansas Entomological Society* 81:288–300.

Wood, T.J., J.M. Holland and D. Goulson. 2015. A comparison of techniques for assessing farmland bumblebee populations. *Oecologia* 177:1093–1102.



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**APPENDIX D: MEMORANDUM OF UNDERSTANDING BETWEEN THE U.S. DEPARTMENT OF DEFENSE AND THE U.S. FISH AND WILDLIFE SERVICE TO PROMOTE THE CONSERVATION OF MIGRATORY BIRDS**

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The following Fort Riley specific plans have been reviewed and incorporated into this INRMP. Conversely, the plans below are reviewed and updated as needed by the DWP Environmental Division.

- Integrated Wildland Fire Management Plan
- Wildlife Air Strike Hazzard Plan
- Fort Riley Master Plan
- Integrated Training Area Management Plan
- Integrated Cultural Resources Management Plan (currently under revision)
- Fort Riley Integrated Pest Management Plan
- Fort Riley Joint Land-Use Study
- Various Installation Restoration Plans
- Fort Riley Environmental Management Plan
- FR 190-1 Privately Owned Weapons.
- FR 200-3 Forest Resources Disposal Program
- FR 210-15 Hunting and Fishing Regulation
- FR 385-12 Range and Safety Regulation

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**APPENDIX E: STAY ANIMAL CONTROL POLICY**

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**Stray Animal Control Policy**

SUMMARY. This policy provides the governing policy for the possession and control of animals onto Fort Riley, Kansas. From the Fort Riley Integrated Pest Management Plan

Ref: (a) DoDI 4150.07, DoD Pest Management Program, 26 December 2019  
(b) AR 40-905/SECNAVINST 6401.1B/AFI 48-131, Veterinary Health Services, 29 August 2006  
(c) Title 18, USC 31 - Definitions  
(d) Title 40, USC 3103 - Admission of Guide Dogs or Other Service Animals Accompanying Individuals with Disabilities

1. Purpose. The purpose of this document is to establish the local policy and procedures governing the possession and control of animals maintained on this installation or brought onto Fort Riley, Kansas. This includes those measures necessary to protect the health, safety, and harmonious coexistence of personnel, their family members, and their animals on this installation.

2. Applicability. This policy is applicable to all persons entering Fort Riley, Kansas.

3. Responsibilities.

a. Garrison Commander will:

(1) Ensure that stray animals are controlled on the installation to protect the health, morale and welfare of installation personnel and their pets; protect wildlife; prevent damage to government property; and effect mission accomplishment.

(2) Ensure that adequate resources (manpower, facilities, equipment and funds) are available to implement an Uncontrolled Cat and Dog Control Program.

(3) Establish an installation policy that prohibits installation personnel from providing food, water or shelter to stray animals or wild animals and provides sanctions for non-compliance.

(4) Establish an installation policy that prohibits personnel from tampering with or releasing captured uncontrolled cats or dogs and wild animals from traps and provides sanctions for non-compliance.

(5) Establish an installation policy outlining the responsibilities of residents for the proper care and maintenance of their pets, with sanctions for non-compliance.

(a) Breeding of stray animals in military family housing is prohibited.

(b) The Commander will determine, in consultation with servicing legal counsel and Veterinarian recommendations, the number of cats or dogs or combination permitted in a set of quarters.

(6) Establish procedures for proper disposal of uncontrolled cat or dog carcasses found on the installation, personal pets, or animals that are euthanized by a Veterinarian or expire while under care at Veterinary Services facilities, in accordance with State and local regulations.

b. Installation Pest Management Coordinator (IPMC) will:

(1) Establish an installation Integrated Pest Management Plan (IPMP) that includes an Uncontrolled Cat and Dog Control Program. The IPMP will:

(a) Define procedures for the humane capture, management and disposition of stray animals.

(b) Identify and delineate responsibilities of installation activities such as, but not limited to, Veterinary Services, military law enforcement, Public Affairs, and Public Works, which are required for the implementation of this program.

(2) Coordinate, as appropriate, with local animal control agencies, shelters or rescue agencies to augment and assist the installation in humanely managing stray animals captured on the installation.

(3) Establish, as appropriate, agreement(s) between the installation and local animal control agencies, shelters and rescue agencies to pick up or receive the transfer of stray animals captured on the installation.

c. Occupational Medicine Services will:

(1) Establish an occupational medicine health program for all installation personnel who are occupationally exposed to uncontrolled and possibly unvaccinated cats or dogs or wild animals.

(2) The Installation Medical Authority will determine program requirements, including, but not be limited to, pre-employment, pre-exposure and post-exposure requirements and periodic monitoring of immunized personnel at a frequency to ensure that protection levels are maintained.

(a) When an immunized person is exposed to or has contact with a known or suspected rabies-infected animal, the Installation Medical Authority or the individual's physician will determine what treatment will be provided to the exposed individual.

(b) When a non-immunized person is exposed to or has contact with a known or suspected rabies-infected animal, a post-exposure treatment should be initiated as soon as possible after exposure unless otherwise directed by the Installation Medical Authority or the exposed individual's physician. Rabies can be a fatal disease if treatment is delayed.

d. Veterinary Services will:

(1) Provide guidance to military and Department of Defense civilian personnel who bring their pets onto the installation. The guidance should emphasize, but not be limited to, pet owner responsibilities and proper care and management of their pets while on the installation.

(2) Examine animals captured by stray animal control personnel that appear to be sick, diseased, or injured.

(a) Treat those animals that would have a reasonable survival rate and whose owners are ascertained or that could be potentially be adoptable if not claimed.

•

(b) Humanely euthanize those animals whose survival is doubtful.

(3) Provide humane treatment of treated animals until they are able to be transferred to the shelter. Transport of said animals will be the responsibility of the stray animal control personnel.

(5) Establish procedures for euthanasia of stray animals or wild animals in accordance with American Veterinary Medical Association recommendations.

e. Military Law Enforcement will:

(1) Respond to reports of stray animals and wild animals in areas such as military family housing, barracks, and administration/office areas to protect personnel from uncontrolled and wild animal contact.

(2) Notify Public Works personnel, as appropriate. If possible, safely restrain the animal until properly trained and equipped personnel arrive to capture and remove it.

(3) Use appropriate force, including lethal force, as necessary, when an animal appears to be sick or its behavior is erratic and not typical, e.g., when it is aggressive or attacks without provocation and cannot be restrained without possible injury to military law enforcement, installation personnel, or stray animal control personnel. If the animal is suspected of being rabid, and lethal force is

necessary, avoid damage to the brain to allow subsequent testing to confirm rabies status.

(4) Provide training and validation qualifications for pest control and other animal control personnel who may be required to shoot animals to ensure that these individuals are proficient in the use of weapons and can accurately hit the target.

(5) Provide oversight when shooting or darting operations are to be conducted to ensure public safety.

f. Public Affairs Office will:

(1) Publicize in installation news media (newspapers, on-installation television) the procedures for reporting and dealing with stray animals until properly trained and equipped personnel arrive, as well as installation policies prohibiting the provision of food, water and shelter to uncontrolled cats, dogs or wild animals, or their release from traps.

(2) Develop and publish articles in installation news media on pet owner responsibilities for the humane treatment of their pets and the sanctions for failure to comply with installation policies.

(3) If appropriate, assist the Integrated Pest Management Coordinator to partner with local animal control agencies, shelters, and rescue agencies to ensure that the installation presents a positive pro-life image to these agencies and the public by the humane handling and disposition of stray animals on the installation.

(4) Publish notifications in installation news media when stray cats or dogs are at the on-site animal facility for adoption.

g. Military Family Housing will:

(1) Provide all personnel owning pets (cats or dogs), at the time they are assigned family housing, the Commander's policy pertaining to the proper care and maintenance of their cat or dog and stray animal control.

(2) Provide all personnel the Commander's stray animal policy. Family housing occupants must notify the Privatized Housing Office if they later obtain a cat or dog. Upon receipt of that notification, the Privatized Housing Office will provide the housing occupants with the Commander's policy for proper care and maintenance of their pet.

(3) Emphasize to pet owners that failure to comply with the Commander's policies may result in a loss of their housing assignment, requiring them to move out of family housing and obtain housing off the installation. Although a loss of

government quarters may present a hardship to the individual and their family, this hardship does not justify noncompliance with established installation policies.

(4) Inform pet owners they are not allowed to breed their cats or dogs without written permission from the Commander.

(5) Provide Veterinary Services a list of personnel owning pets on a routine basis.

h. Public Works will:

(1) Implement the Uncontrolled Cat and Dog Control Program, unless otherwise directed.

(a) Enter into Memorandums of Agreement with appropriate on-post agencies to implement the program.

(b) Provide input to the IPMC on revision to this policy as needed.

(2) Ensure personnel associated with the program receive medical immunizations and monitoring, as appropriate, to protect from exposure to potential rabies-infected animals.

(3) Ensure stray animal control personnel coordinates with DES when lethal shooting is required.

i. Personnel Who Own Animals and Reside on Fort Riley will:

(1) Identify their pet:

(a) Ensure that their pet is micro-chipped or have their pet micro-chipped within 30 days of occupying a residence on the installation.

(b) Ensure that their pet wears a collar with identification and rabies vaccination tags when the animal is outside.

(2) Properly Care and Maintain Pets:

(a) Ensure that pet vaccinations are current and attach rabies vaccination tags to the animal's collar.

(b) Feed pets indoors, whenever possible or practical. If feeding outdoors, remove excess uneaten food to prevent attraction of stray animals and wild animals that can pose a health and/or safety threat to pets.

- (c) Ensure water is provided at all times. Monitor water bowls and refill as needed. Empty water bowls when not in use to prevent mosquito breeding sites.
  - (d) Provide pets shelter when they are left outdoors. The shelter must keep the animal dry and should be adapted to the breed in terms of comfort.
  - (e) Keep only neutered or spayed dogs outside.
- i. Cats must be supervised whenever they are allowed to go outside. Cats can easily escape a fenced yard and become a stray animal.
    - ii. Owners who have American Kennel Club or other recognized registry pedigreed pets, AND HAVE APPROVAL FROM THE GARRISON COMMANDER, may not need to spay or neuter their animals. However, these animals must be closely monitored to ensure they cannot become a stray animal or cause issues with stray animals.
    - iii. Breeding animals for a business (commercial animal) on the installation is not permitted.

### (3) Implement Responsible Pet Ownership:

- (a) If a pet escapes or becomes lost on the installation, the owner should contact the DES for assistance, the local Veterinary Services to determine if the animal has been turned in to the facility, or the local shelters. If the animal has been located but is still loose, the pet owner will be requested to assist in re-capturing their pet.
- (b) If a pet repeatedly escapes and installation animal control is involved in its re-capture, Privatized Housing will be notified by the Stray Animal Control contract COR to take appropriate action to ensure that this problem (lack of pet owner control) does not continue.
- (c) Ensure fence used to contain the animal meets Privatized Housing standards and remains in good repair. It is the owner's responsibility to ensure that the animal remains in its designated area and does not create a nuisance or health concern for other residents.
  - i. Owners of cats will not leave their animals unsupervised outdoors. Fences will not prevent cats from leaving the yard. Do not leave cats outdoors.

ii. With few exceptions, the approved fences will keep dogs confined. However, if the owner has a dog that can escape, an appropriate restraint, such as a chain and collar, must also be used.

j. Supervisors, Facility Managers and Building Custodians will:

(1) Notify installation animal control personnel and request capture and removal of uncontrolled cats or dogs or wild animals that have been observed in or around their facilities.

(a) Uncontrolled cats and dogs should be reported to the DES.

(b) Wild animals should be reported to the DPW SO desk (239-0900)

(2) Ensure that facility personnel do not provide food and/or water to uncontrolled cats, dogs or wild animals, or tamper with traps placed to capture these animals.

(a) Feeding uncontrolled cats, dogs or wild animals, or releasing trapped animals or tripping traps to prevent their capture, is prohibited.

(b) Feeding may appear to be humane treatment but aggravates the installation's stray animal problem.

i. Inform individuals observed providing food and/or water to stray animals, or releasing trapped animals, of installation policy and request them to stop (First Incident).

ii. If the individual persists, notify his/her supervisor and request that appropriate action be taken to stop this behavior (Second Incident).

iii. If the individual continues to disregard the Commander's policy, elevate the issue up the individual's chain of command for appropriate disciplinary action (Third Incident).

#### 4. Privately Owned Animals

a. Animals on Post. All domestic animals brought onto or maintained within the confines of Fort Riley are included within the meaning of this regulation.

b. Withdrawal of privileges. Violations of the requirements of this regulation may result in:

(1) Withdrawal of animal keeping privileges.

(2) Removal of the offending animal.



5. This policy shall be reviewed and revised as needed to meet the current stray animal control program at Fort Riley.

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**APPENDIX F: ITAM INTEGRATION MEMO**

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**DEPARTMENT OF THE ARMY**  
OFFICE OF THE DEPUTY OF STAFF, G-3/5/7  
400 ARMY PENTAGON  
WASHINGTON, DC 20310-4000

DAMO-TRS

MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: Integrated Training Area Management (ITAM) Roles and Responsibilities for Integrated Natural Resource Management Plan (INRMP) Development

1. References:

- a. 16 U.S.C. §670a-§670f, "The Sikes Act"
- b. Army Regulation (AR) 200-1 Environmental Protection and Enhancement
- c. AR 350-19 The Army Sustainable Range Program
- d. Memorandum, DAMO-TRS, Subject: Funding Guidance for Management Decision Package (MDEP) TATM, 4 April 2016

2. This memorandum applies to Army installations that have live military training exercises (i.e. force-on-force and/or force-on-target) supported by an ITAM program.

3. The purpose of this memorandum is to define the roles and responsibilities of installation ITAM programs during INRMP development and review. Guidance is also provided to INRMP proponents for incorporating and integrating with ITAM activities.

4. Discussion:

a. In accordance with references 1.a. and 1.b., the Garrison Commander is responsible for approving an INRMP when significant natural resources are present. The Installation Directorate of Public Works (DPW) Environmental Division is *typically* the office of primary responsibility and proponent for developing INRMPs.

b. One criterion for establishing the presence of significant natural resources is if the installation conducts intensive, live military training exercises (i.e. force-on-force and/or force-on-target) that require conservation measures to minimize impacts and sustain natural resources. Installations designated by the HQDA DCS, G-3/5/7 for management under the ITAM program meet this criterion (reference 1.b.).

c. INRMPs are required, to the extent appropriate and applicable, to provide for no net loss in the capability of installation lands to support the military mission of the installation (reference 1.a.). ITAM maintains the live maneuver training environment and sustains the Army's live training capability by repairing maneuver damage and

DAMO-TRS

SUBJECT: Integrated Training Area Management (ITAM) Roles and Responsibilities for Integrated Natural Resource Management Plan (INRMP) Development

creating a resilient and resistant training land base (reference 1.c. and 1.d.). ITAM fundamentally supports installation compliance with the Sikes Act and is a critical component of installation natural resource management.

d. Installations will ensure that ITAM objectives are incorporated into the INRMP during each update cycle. This will ensure a cohesive union between the training and environmental objectives.

5. The HQDA G-37/TRS Point of Contact for this matter is Mr. Bobby Floyd, 703-692-6411, [robert.h.floyd4.civ@mail.mil](mailto:robert.h.floyd4.civ@mail.mil).

6. The HQDA Office of the Assistant Chief of Staff for Installation Management Point of Contact for this matter is Mr. John Housein, 571-256-9731, [john.g.housein.civ@mail.mil](mailto:john.g.housein.civ@mail.mil).

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Chief, Training Simulations Division

Encl

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SUBJECT: Integrated Training Area Management (ITAM) Roles and Responsibilities for Integrated Natural Resource Management Plan (INRMP) Development

ENCLOSURE

Guidance for integrating ITAM into INRMP Development

1. In support of INRMP development, Integrated Training Area Management (ITAM) shall be responsible for the following during every major INRMP revision:

a. Coordination with the INRMP Proponent, Range Management Authority, and Director of Plans, Training, Mobilization and Security (DPTMS) to establish mutually agreeable timeline for INRMP development and review period;

b. Provide communication, coordination, collaboration, and information to ensure force-on-force and force-on-target live training requirements are integrated throughout the INRMP;

c. Provide information and/or text necessary to develop a dedicated comprehensive chapter for the installation INRMP that details specific ITAM tasks, including, but not limited to:

(1) Land Rehabilitation and Management (LRAM) best management practices (BMPs) for erosion control and environmental compliance

(2) LRAM vegetation management techniques

(3) Project approval, environmental coordination, and compliance procedures

(4) Range and Training Land Assessment (RTLTA) procedures and purpose

(5) Sustainable Range Program (SRP) Geographic Information Systems (GIS) analyses applicable to natural resource management

(6) A description of the sustainable range awareness (SRA) products produced and distributed to improve soldier familiarity with installation specific environmental regulations, BMPs, and relevant installation POC information

(7) Discussion of any other ITAM functions that support or impact natural resource management

d. Assist coordinating INRMP reviews between DPTMS stakeholders and INRMP Proponent; and

e. Provide feedback to INRMP Proponent for each chapter of the INRMP.

2. In support of INRMP development, the ITAM program shall be responsible for the following during every annual INRMP review:

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SUBJECT: Integrated Training Area Management (ITAM) Roles and Responsibilities for Integrated Natural Resource Management Plan (INRMP) Development

a. Provide INRMP Proponent a copy of the most current validated ITAM work plan to be incorporated into the INRMP appendix;

b. Coordinate with INRMP Proponent to identify INRMP updates with potential impacts to installation live force-on-force or force-on-target training. These may include, but are not limited to:

(1) New threatened and endangered species listing/delisting

(2) Updated guidance for environmental compliance

(3) Proposed Critical Habitat

(4) Proposed INRMP implementation projects

3. IAW references 1a and 1b, the INRMP Proponent shall be responsible for the following during annual INRMP reviews and major INRMP revision:

a. Enabling live force-on-force and force-on-target training requiring land use;

b. Be the installation lead for INRMP development to ensure compliance with the Sikes Act and supplemental guidance;

c. Coordinate with ITAM POC to establish mutually agreed upon timeline for INRMP development and review period;

d. Coordinate with ITAM POC to integrate ITAM chapter and ensure training requirements are incorporated throughout the INRMP;

e. Annually append ITAM work plans into the INRMP appendix.

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**APPENDIX H: NATURAL/NEAR-NATURAL VEGETATION TYPES ON FORT RILEY**

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. Detailed summaries of the new vegetation classification the Kansas Biological Survey developed for Fort Riley (Freeman, C. C. and J. M. Delisle. 2004).

**Forest Communities**

Woodland component has 61–100% tree canopy cover, there is usually three distinct canopy layers (overstory trees, understory shrubs, and herbaceous layer), with numerous trees > 5 m tall.

**Green Ash-Elm Species-Northern Hackberry Forest (1)**

Description: This riparian forest community has an open to closed tree canopy dominated by *Fraxinus pennsylvanica*, *Celtis occidentalis*, and *Ulmus americana*. Other tree species that may be present include *Acer saccharinum*, *Juglans nigra*, *Populus deltoides*, and *Tilia americana*. *Ulmus rubra* may be part of the subcanopy. The shrub layer in the western part of the range includes *Cornus drummondii*, *Ribes missouriense*, *Symphoricarpos occidentalis*, and *Zanthoxylum americanum*, as well as woody vines, such as *Parthenocissus vitacea*, *Smilax tamnoides*, *Toxicodendron radicans*, and *Vitis riparia*. The herbaceous layer in the western part of the range includes *Elymus virginicus*, *Festuca subverticillata*, *Galium aparine*, *Geum canadense*, and *Laportea canadensis*. Stands occur along the upper floodplain terraces of rivers and streams, and in upland river bottoms. Soils are moderately well-drained to poorly-drained.

Occurrence on Fort Riley: Widespread on the installation but best represented on the west side along the primary tributaries of Milford Lake, and on the south side along the floodplains of the Republican and Kansas rivers.

**Eastern Cottonwood-Sycamore Forest (2)**

Description: This riparian forest community has an open to closed tree canopy dominated by deciduous trees. Dominant species are *Populus deltoides* and *Platanus occidentalis*, with *Acer negundo*, *Celtis occidentalis*, and *Salix nigra* common associates. The shrub layer may be poorly developed to well developed, depending on flood frequency and duration. Stands occur in level to undulating floodplains of major rivers and large streams. Soils are deep, silty to clayey or less frequently sandy alluvium, and poorly-drained to well-drained.

Occurrence on Fort Riley: Widespread on the installation but best represented on the west side along the primary tributaries of Milford Lake, and on the south side along the floodplains of the Republican and Kansas rivers.

**Eastern Cottonwood-Willow Forest (3)**

Description: This riparian forest community has a closed or nearly closed tree canopy dominated by deciduous trees. *Populus deltoides* and *Salix nigra* are the dominant trees. *Acer negundo*, *Acer saccharinum*, *Fraxinus pennsylvanica*, *Platanus occidentalis*, and *Ulmus americana* are common associates, but tree diversity is limited due to the

dynamics of flooding, scouring, and sediment deposition. The subcanopy usually is dominated by *Salix nigra*. The shrub layer may be conspicuously absent, and herbaceous growth may be lush but often is patchy, again due to flooding. Characteristic species of this layer are *Aster* spp., *Bidens* spp., *Carex* spp., and *Leersia oryzoides*. Stands occur on floodplains of rivers and streams in sites that frequently are flooded and where drainage is poor. Establishment and maintenance of the community is tied closely to flooding events. Soils usually are poorly developed and are moderately well-drained to poorly-drained.

Occurrence on Fort Riley: Widespread on Fort Riley but best represented on the west side along primary tributaries to Milford Lake and on the south side along floodplains of the Republican and Kansas rivers.

### **Woodland Communities**

Woodland component has 26–60% canopy cover and most to all trees < 5 m tall.

#### **Chinquapin Oak-Bur Oak/Big Bluestem Ravine Woodland (4)**

Description: This open-canopy, upland community is dominated by *Quercus muehlenbergii* in the driest stands, with *Quercus macrocarpa* as a subdominant. *Quercus macrocarpa* becomes more important in sites where conditions are more mesic until, eventually, the community grades into a forest with relatively little *Quercus muehlenbergii*. *Ulmus* spp. and *Cercis canadensis* can be abundant. *Ulmus* spp. once may have been an important element of this community, but Dutch Elm disease kills most trees before 40-years of age. Shrub cover varies inversely with tree canopy cover, achieving 50–60% in some of the drier stands (Abrams 1986, 1988). Common shrubs are *Cornus drummondii* and *Symphoricarpos orbiculatus*. *Celtis occidentalis* and *Ulmus* spp. often are in the shrub layer, especially on sites that have not been burned recently. Herbaceous dominants include *Schizachyrium scoparium* and *Panicum virgatum*. Stands occur on moderate to steep south-facing and west-facing slopes of ravines and river valleys. The surface is not saturated or flooded by groundwater at any time during the year, and drought is relatively common. Soils are deep, moderately well-drained to well-drained silts and loams. The parent material is loess, glacial till, cherty shales, or limestones. Drought and fire were common natural disturbances in this community type.

Occurrence on Fort Riley: Widespread on the installation, but best represented along the upper slopes of the Republican and Kansas rivers' drainages, and in the Wildcat Creek drainage.

### **Herbaceous Communities**

Woodland component is < 25% canopy cover, graminoids and/or forbs are >25% canopy cover.

#### **Flint Hills Tallgrass Prairie (5)**

Description: This community is dominated by a dense cover of tall grasses with a moderate to high richness of forbs. Dominant grasses are *Andropogon gerardii*,

*Sorghastrum nutans*, and *Schizachyrium scoparium*. *Bouteloua curtipendula*, *Panicum virgatum*, and *Sporobolus compositus* are common but less abundant. Typical forbs include *Aster ericoides*, *Helianthus grosseserratus*, *Lespedeza capitata*, *Psoraleidum tenuiflorum*, *Solidago* spp., and *Viola pedatifida*. Shrubs, such as *Amorpha canescens*, and trees usually are infrequent but can be common near watercourses or where fires have been suppressed. Stands occur primarily on uplands and slopes but may occur infrequently in well-drained sites on floodplains. Soils are shallow to deep, somewhat poorly-drained to somewhat excessively-drained silts, loams, and clays. The parent material is calcareous clayey shale, limestone, cherty limestone, or interbedded limestone and clayey shale.

Occurrence on Fort Riley: Widespread on uplands and slopes. This is the dominant natural community type on the installation.

### **Sand bluestem-Prairie sandreed Sand Prairie (6)**

Description: This community is dominated by moderately to widely-spaced mid- to tall-grasses. The dominant species are *Andropogon hallii* and *Calamovilfa longifolia*. Other characteristic graminoids include *Bouteloua gracilis*, *Bouteloua hirsuta*, *Cenchrus longispinus*, *Cyperus lupulinus*, *C. schweinitzii*, *Eragrostis trichodes*, *Koeleria macrantha*, *Paspalum setaceum*, and *Schizachyrium scoparium*. Characteristic forbs are *Asclepias amplexicaulis*, *Chamaesyce glyptosperma*, *Chenopodium pratericola*, *Cycloloma atriplicifolium*, *Euphorbia hexagona*, *Helianthus pauciflorus*, *Liatris punctata*, *Lithospermum incisum*, *Oenothera laciniata*, *Physalis heterophylla*, *P. pumila*, *Plantago patagonica*, and *Strophostyles leiosperma*. Representative shrubs and vines are *Cornus drummondii*, *Prunus angustifolia*, *Rhus aromatica*, and *Toxicodendron radicans* (Freeman unpublished data). Stands usually occur on level to undulating sands in valleys of rivers or large streams. Occasionally, the community occurs on uplands immediately adjacent to river valleys. Slopes are gentle to moderate. Soils are sand, loamy-sand, or sandy-loam, and usually are erodible to highly erodible, sometimes with blowouts.

Occurrence on Fort Riley: This community is restricted to the floodplain of the Republican and Kansas rivers, usually immediately adjacent to the rivers. The best remnants occur south and southeast of Camp Forsyth in Training Areas 18 and 19. Most of this community type probably was destroyed long ago as the installation developed along the floodplain of the rivers. Occurrences on Fort Riley are too small to be included in the Kansas Natural Heritage Inventory databases.

### **Sparse Vegetation Communities**

Vegetation scattered or nearly absent; total vegetation cover < 10%.

### **Limestone Butte Sparse Vegetation; Great Plains Limestone Butte (7)**

Description: This community is dominated by drought-tolerant herbaceous species. Representative species include *Agalinis aspera*, *Allium canadense*, *Chamaesyce missurica*, *Coryphantha missouriensis*, *Dalea aurea*, *Hedeoma hispida*, *Hybanthus verticillatus*, *Lomatium foeniculaceum*, *Oenothera macrocarpa*, *Pellaea glabella*, *Stenostiphon linifolius*, *Tomanthera densiflora*, *Tragia ramosa*, and *Yucca glauca*



(Freeman unpublished data). Stands usually occur on the upper slopes of steep valleys along rivers and streams.

Occurrence on Fort Riley: This community is widely distributed on the installation, primarily along bluffs of the Republican and Kansas rivers, and along Wildcat Creek and its tributaries in association with outcrops of the Ft. Riley Limestone. The best examples occur along Backstop Ridge (Training Area 21), Sherman Heights (Training Area 17), east of Campbell Hill (Training Area 7), and in training areas immediately south of Wildcat Creek on the northeast side of the installation (particularly Training Areas 31, 32, 33, 91, and 92). Occurrences on Fort Riley are too small to be included in the Kansas Natural Heritage Inventory databases. They are included within surrounding community types, usually Flint Hills Tallgrass Prairie.

### **Riverine Sand Flats-Bars Sparse Vegetation (8)**

Description: This riverine community supports sparse vegetation and is highly ephemeral due to constantly changing conditions. Representative graminoids are *Cyperus esculentus*, *C. odoratus*, *C. squarrosus*, *C. strigosus*, *Echinochloa muricata*, *Eragrostis pectinacea*, *E. hypnoides*, *Leptochloa fusca*, *L. panicea*, and *Triplasis purpurea*. Characteristic herbaceous species are *Amaranthus tuberculatus*, *Ammannia coccinea*, *A. robusta*, *Aster subulatus*, *Cycloloma atriplicifolium*, *Leucospora multifida*, *Lindernia dubia*, *Polygonum bicorne*, *P. lapathifolium*, *Portulaca oleracea*, *Strophostyles helvula*, and *S. leiosperma*. (Freeman unpublished data). Stands usually occur along sand bars and islands that form as waters recede. Soils usually are undeveloped due to the ephemeral nature of the community and may be poorly drained to excessively drained, depending on the depth to the water table.

Occurrence on Fort Riley: This community is restricted to the floodplains of the Republican and Kansas rivers. Examples typically can be found along the length of these rivers as they pass through Fort Riley. However, the precise locations of occurrences may vary from one year to the next. The Kansas Natural Heritage Inventory has insufficient data about this community type to include examples at Fort Riley in its databases. They are mapped, however.

### **Ruderal Vegetation**

Vegetation has been highly altered by human activities, and is not identifiable to a natural type based on existing composition or structure.

### **Cropland-Abandoned (9)**

Description: This ruderal community is highly variable on the installation, with local physiognomy and species composition depending on length of time since abandonment, ongoing disturbance, and management practices. Most examples are dominated by herbaceous species, but shrubs or trees often are present, and in some cases they dominate.

Occurrence on Fort Riley: Widespread on the installation but concentrated on level uplands, especially in the central part. Because of the amount of natural succession that

has occurred in some areas, Cropland-Abandoned was at times exceedingly difficult to identify in the field. Aerial photos were useful in helping to identify some tracts.

### **Brome Field (10)**

Description: This ruderal community includes areas intentionally planted to non-native, perennial, cool-season grasses, which are or were cut annually for hay. *Bromus japonicus*, a non-native annual, frequently is a co-dominant invader. Abandoned brome fields are difficult to identify in most training areas, but extant examples exist in the south part of Fort Riley. An excellent example of this community type occurs on the level floodplain immediately south of Backstop Ridge. It is hayed annually.

Occurrence on Fort Riley: Sporadic on the installation. Many areas identified as this types in 1985 (as Grassland-Tame) have undergone considerable natural succession and now are classified as other ruderal, invasive, or managed types. Occurrences in the developed parts of Fort Riley were not mapped.

### **Ruderal-Mixed (11)**

Description: This ruderal community captures a wide variety of vegetation conditions represented on the installation. Most examples are characterized by some type of severe, periodic or one-time disturbance, which has resulted in damage to or destruction of native vegetation or seral vegetation. Topsoil disturbance is a characteristic condition, but herbicide use also can create similar conditions. Species composition of the Ruderal-Mixed community is difficult to characterize. Non-native, ruderal herbs and graminoids are common, but native herbs and graminoids also are regular associates. Many associates exhibit a prostrate or spreading habit and are able to survive repeated compaction, such as results from vehicles.

Occurrence on Fort Riley: Widespread on Fort Riley but often highly localized.

### **Invasive Vegetation**

The prevailing vegetation stratum is dominated by species alien to the ecoregion and dominance of this alien species is not likely to give way to native species without active restoration efforts.

### **Sericea lespedeza Herbaceous Vegetation (12)**

Description: This ruderal community was not mapped per se on Fort Riley, but the name may be applied to sites where *Lespedeza cuneata* infestations have become sufficiently dense to warrant special attention. The necessity of identifying occurrences of *Lespedeza cuneata* Herbaceous Vegetation on the vegetation map was moderated by two factors. First, infestations were identified as a separate part of this study. However, before occurrences of the vegetation type can be delimited, thresholds must be set for determining when *Lespedeza cuneata* has achieved dominance. Canopy cover may be the most direct measure of this. Second, DPW probably will continue to pursue aggressive control of *Lespedeza cuneata*. Eradication efforts likely will cause sudden

and dramatic changes in populations of *Lespedeza cuneata*, potentially rendering this component of any vegetation map obsolete.

Occurrence on Fort Riley: *Lespedeza cuneata* was documented in nearly all of the training areas; however, infestations are most severe in formerly cultivated areas. The species has been far less successful invading healthy, native, tallgrass prairies. Estimated mean canopy cover in a majority of five training areas has reached 11–20%; much higher levels of cover, while not uncommon, are exceedingly limited in area.

### **Smooth brome/Japanese brome Herbaceous Vegetation (13)**

Description: This ruderal community was not mapped on Fort Riley, mostly because occurrences are highly localized. While physiognomically similar to the *Bromus inermis/Bromus japonicus-Lolium arundinaceum* Herbaceous Vegetation type, the *Bromus inermis-Bromus japonicus* Herbaceous Vegetation type was not planted intentionally for hay production; it occurs spontaneously in sites with repeated disturbance and appropriate microhabitat conditions.

Occurrence on Fort Riley: Sporadic on the installation and usually highly localized.

### **Modified/Managed Vegetation**

The vegetation community is moderately- to highly-altered by human activities, identifiable to a natural type based on composition or structure, the alteration may be physiognomic or compositional but is beyond the range of variation allowed for corresponding natural type.

### **Yellow Indiangrass-Little bluestem-Oldfield threeawn-Sand dropseed Herbaceous Vegetation, Overgrazed Flint Hills Tallgrass Prairie (14)**

Description: This modified/managed vegetation type represents a disclimax example of the *Andropogon gerardii-Sorghastrum nutans-Schizachyrium scoparium* Flint Hills Herbaceous Vegetation type. Basically, it is overgrazed Flint Hills Tallgrass Prairie. Examples were not mapped, but we discovered numerous areas that appear to have a past history of prolonged and intense grazing by livestock. Suspected examples usually support degraded populations of *Andropogon gerardii*, *Sorghastrum nutans*, and other species characteristic of Flint Hills Tallgrass Prairie; all suspected examples were mapped as Flint Hills Tallgrass Prairie. Sustained grazing appears to have shifted species composition in favor of more grazing-tolerant and drought-adapted species like *Schizachyrium scoparium*, *Aristida oligantha*, and *Sporobolus cryptandrus*. Characteristic forbs are *Ambrosia psilostachya*, *Croton* spp., *Brickellia eupatorioides*, *Physalis* spp., *Verbena stricta*, and *Vernonia baldwinii*. *Juniperus virginiana* is a frequent where fire has been suppressed, invasive tree; other woody species also may be present. Most occurrences are on rocky uplands on gentle to moderate slopes.

Occurrence on Fort Riley: Probably widespread on uplands and slopes, especially in the south, east, and northwest parts of Fort Riley. Natural succession since abandonment of

farms and ranches has made it difficult to identify most examples of this community type. Nomenclature: This community type was not recognized in the 1985 vegetation surveys.

### **Rough-leaf dogwood-Smooth sumac-Elm-Honeylocust Shrubland, Woodland-Brushy (15)**

Description: This modified/managed vegetation type captures sites with widely varying physiognomy and floristic composition. We found it exceedingly difficult to determine what kind of disturbance occurred at many sites supporting this community type, and the type undoubtedly encompasses areas representing varied management and disturbance histories. The Woodland-Brushy type generally is dominated by a moderate to dense cover of shrubs, frequently intermixed with a variety of immature trees. Characteristic woody species generally are *Cornus drummondii*, *Rhus glabra*, *Ulmus americana*, *Ulmus pumila*, and *Gleditsia triacanthos*. *Fraxinus pennsylvanica*, *Juniperus virginiana*, *Maclura pomifera*, *Populus deltoides* are other woody species routinely associated with the type. *Symphoricarpos orbiculatus* is the most common understory shrub. The herbaceous understory is highly variable from site to site. At some sites, it suggests that extreme disturbance of the topsoil occurred. In other places, fire suppression has permitted establishment of the type on formerly cultivated ground or native prairie.

Occurrence on Fort Riley: Encountered throughout the installation. The type is a category of convenience, and occurrences may have dramatically different histories.

### **Planted/Cultivated vegetation types**

#### **Fire Break (16)**

Description: Fire breaks are maintained around the perimeter of most of Fort Riley to help contain wildfires, should they occur. These may consist of bare ground or may be planted with row crops. Regardless of condition, they usually support a mixture of non-native, ruderal species during the growing season.

Occurrence on Fort Riley: Maintained around the perimeter of most of the installation.

#### **Food Plot (17)**

Description: Food plots are planted with a variety of row crops to provide food for wildlife. These may consist of bare ground or may be vegetated with milo, soybeans, or other crop species. Regardless of condition, most support a mixture of non-native, ruderal species during the growing season.

Occurrence on Fort Riley: Maintained throughout the installation.

#### **Cultivated Field (18)**

Description: Cultivated fields are planted with row crops. Most seem to be located around the periphery of the installation, where they also may be functioning as fire breaks. This vegetation type may not be distinct from Fire Break, but it has been carried forward from the 1985 vegetation surveys. Cultivated fields consist of bare ground or may be vegetated

with row crops. Most support a mixture of non-native, ruderal species during the growing season.

Occurrence on Fort Riley: Maintained around the perimeter of most of the installation.

### **Tree Plantation (19)**

Description: A few tree plantations are maintained in training units in the south part of Fort Riley. The largest ones are in Training Areas 2, 18, and 19. All support deciduous tree species. Depending on age, understories may be fairly open, dominated by a mixture of non-native, ruderal species, or dominated by a mixture of native and non-native species during the growing season.

Occurrence on Fort Riley: Maintained mostly in training areas in the south part of the installation.

### **Hedgerow/Windbreak (20)**

Description: Hedgerows/Windbreaks usually are linear tree plantings, mostly with a single species of deciduous tree, which originally provided shelter and shade around farmsteads and along old roads and farm lanes. Some hedgerows also probably served as living fences. *Maclura pomifera* is the species encountered most frequently, but others species used include *Juniperus virginiana*, *Robinia pseudoacacia*, and *Ulmus* spp. Many hedgerows and windbreaks have been damaged due to training exercises, and many had deteriorated due to senescence and death of trees. Most support a varied understory of native and non-native shrubs, herbs, and graminoids.

Occurrence on Fort Riley: Found throughout the installation, mostly in association with old farmsteads and roads.

### **Lawn (21)**

Description: Lawns are areas usually planted to cool-season grasses or rarely warm-season grasses and maintained by periodic and frequent mowing. They also may support a mixture of non-native and native graminoids and herbs.

Occurrence on Fort Riley: Found largely in the developed parts of the installation, especially in the south, in the vicinity of training complexes around the Impact Areas, and around buildings in the northwest part of the MPRC. Mowed roadsides also could be included in this category.

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**APPENDIX I: FLORA AND FAUNA OF FORT RILEY**


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**Appendix I, Table 1.** These tables are updated and provided annually to the USFWS during the INRMP annual review. Plants reported from Fort Riley during the 2012 Kansas Biological Survey study. CoC = Kansas coefficient of conservatism. An asterisk (\*) in the CoC column indicates the species is non-native.

Family	Scientific Name	Common Name	CoC
ACANTHACEAE	<i>Ruellia humilis</i>	fringe-leaf ruellia	3
ACANTHACEAE	<i>Ruellia strepens</i>	limestone ruellia	4
ACERACEAE	<i>Acer negundo</i>	boxelder	1
AGAVACEAE	<i>Yucca glauca</i>	small soapweed	4
ALISMATACEAE	<i>Alisma subcordatum</i>	southern water-plantain	4
ALISMATACEAE	<i>Alisma triviale Pursh</i>	northern water-plantain	4
ALISMATACEAE	<i>Echinodorus berteri</i>	upright burhead	4
ALISMATACEAE	<i>Sagittaria brevirostra</i>	short-beak arrowhead	4
ALISMATACEAE	<i>Sagittaria cuneata</i>	northern arrowhead	4
ALISMATACEAE	<i>Sagittaria montevidensis</i>	giant arrowhead	3
AMARANTHACEAE	<i>Amaranthus albus</i>	tumbleweed amaranth	0
AMARANTHACEAE	<i>Amaranthus palmeri</i>	Palmer's pigweed	0
AMARANTHACEAE	<i>Amaranthus retroflexus</i>	rough pigweed	*
AMARANTHACEAE	<i>Amaranthus tuberculatus</i>	tall water-hemp	0
AMARANTHACEAE	<i>Froelichia gracilis</i>	slender snake-cotton	3
ANACARDIACEAE	<i>Rhus aromatica</i>	aromatic sumac	3
ANACARDIACEAE	<i>Rhus glabra</i>	smooth sumac	1
ANACARDIACEAE	<i>Toxicodendron radicans</i>	poison-ivy	0
APIACEAE	<i>Berula erecta</i>	cut-leaf water-parsnip	6
APIACEAE	<i>Chaerophyllum procumbens</i>	spreading chervil	0
APIACEAE	<i>Chaerophyllum tainturieri</i>	southern chervil	2
APIACEAE	<i>Conium maculatum</i>	poison-hemlock	*
APIACEAE	<i>Daucus carota</i>	Queen-Anne's-lace	*
APIACEAE	<i>Eryngium yuccifolium</i>	button snake-root eryngo	7
APIACEAE	<i>Lomatium foeniculaceum</i>	fennel-leaf desert-parsley	6
APIACEAE	<i>Polytaenia nuttallii A103</i>	Nuttall's prairie-parsley	6
APIACEAE	<i>Sanicula canadensis</i>	Canadian sanicle	2
APIACEAE	<i>Sanicula odorata</i>	fragrant sanicle	2
APIACEAE	<i>Spermolepis inermis</i>	spreading scaleseed	3
APOCYNACEAE	<i>Apocynum cannabinum</i>	hemp dogbane	0
ASCLEPIACEAE	<i>Asclepias amplexicaulis</i>	blunt-leaf milkweed	7
ASCLEPIACEAE	<i>Asclepias incarnata</i>	swamp milkweed	4

ASCLEPIACEAE	<i>Asclepias speciosa</i>	showy milkweed	2
ASCLEPIACEAE	<i>Asclepias stenophylla</i>	narrow-leaf milkweed	7
ASCLEPIACEAE	<i>Asclepias sullivantii</i>	smooth milkweed	5
ASCLEPIACEAE	<i>Asclepias syriaca</i>	common milkweed	1
ASCLEPIACEAE	<i>Asclepias tuberosa</i>	butterfly milkweed	6
ASCLEPIACEAE	<i>Asclepias verticillata</i>	whorled milkweed	1
ASCLEPIACEAE	<i>Asclepias viridiflora</i>	green milkweed	6
ASCLEPIACEAE	<i>Asclepias viridis</i>	spider milkweed	1
ASTERACEAE	<i>Achillea millefolium</i>	western yarrow	1
ASTERACEAE	<i>Ageratina altissima</i>	tall snakeroot	1
ASTERACEAE	<i>Ambrosia artemisiifolia</i>	common ragweed	0
ASTERACEAE	<i>Ambrosia psilostachya</i>	western ragweed	3
ASTERACEAE	<i>Ambrosia trifida</i>	giant ragweed	0
ASTERACEAE	<i>Amphiachyris dracunculoides</i>	common broomweed	2
ASTERACEAE	<i>Antennaria neglecta</i>	field pussy's-toes	2
ASTERACEAE	<i>Arnoglossum plantagineum</i>	tuberous Indian-plantain	6
ASTERACEAE	<i>Artemisia ludoviciana</i>	Louisiana sagewort	2
ASTERACEAE	<i>Aster drummondii</i>	Drummond's aster	2
ASTERACEAE	<i>Aster ericoides</i>	heath aster	5
ASTERACEAE	<i>Aster lanceolatus</i>	lance-leaf aster	3
ASTERACEAE	<i>Aster oblongifolius</i>	aromatic aster	5
ASTERACEAE	<i>Aster pilosus</i>	hairy aster	0
ASTERACEAE	<i>Aster sericeus</i>	silky aster	8
ASTERACEAE	<i>Aster subulatus</i>	saltmarsh aster	0
ASTERACEAE	<i>Bidens bipinnatus</i>	Spanish needles	0
ASTERACEAE	<i>Bidens cernuus</i>	nodding beggar-ticks	3
ASTERACEAE	<i>Bidens frondosus</i>	devil's beggar-ticks	0
ASTERACEAE	<i>Brickellia eupatorioides</i>	eastern brickellbush	2
ASTERACEAE	<i>Carduus nutans</i>	musk plumeless-thistle	*
ASTERACEAE	<i>Cirsium altissimum</i>	tall thistle	2
ASTERACEAE	<i>Conyza canadensis</i>	tall horseweed	0
ASTERACEAE	<i>Conyza ramosissima</i>	spreading horseweed	0
ASTERACEAE	<i>Coreopsis grandiflora</i>	big-flower coreopsis	8
ASTERACEAE	<i>Dyssodia papposa</i>	fetid marigold	0
ASTERACEAE	<i>Echinacea angustifolia</i>	black-Sampson coneflower	purple- 6
ASTERACEAE	<i>Echinacea pallida</i>	pale purple-coneflower	7
ASTERACEAE	<i>Eclipta prostrata</i>	yerba de tajo	3
ASTERACEAE	<i>Erechtites hieracifolia</i>	American burnweed	1
ASTERACEAE	<i>Erigeron annuus</i>	annual fleabane	0
ASTERACEAE	<i>Erigeron strigosus</i>	daisy fleabane	4
ASTERACEAE	<i>Eupatorium altissimum</i>	tall joe-pye-weed	2

ASTERACEAE	<i>Grindelia lanceolata</i>	spiny-tooth gumweed	3
ASTERACEAE	<i>Grindelia squarrosa</i>	curly-top gumweed	0
ASTERACEAE	<i>Helianthus annuus</i>	common sunflower	0
ASTERACEAE	<i>Helianthus grosseserratus</i>	saw-tooth sunflower	4
ASTERACEAE	<i>Helianthus hirsutus</i>	hairy sunflower	6
ASTERACEAE	<i>Helianthus maximiliani</i>	Maximilian's sunflower	3
ASTERACEAE	<i>Helianthus mollis</i>	ashy sunflower	7
ASTERACEAE	<i>Helianthus pauciflorus</i>	stiff sunflower	5
ASTERACEAE	<i>Helianthus petiolaris</i>	plains sunflower	1
ASTERACEAE	<i>Helianthus tuberosus</i>	Jerusalem-artichoke sunflower	2
ASTERACEAE	<i>Heliopsis helianthoides</i>	sunflower heliopsis	6
ASTERACEAE	<i>Heterotheca subaxillaris</i>	broad-leaf golden-aster	2
ASTERACEAE	<i>Heterotheca stenophylla</i>	narrow-leaf golden-aster	4
ASTERACEAE	<i>Hymenopappus scabiosaeus</i>	flat-top white-woolly	4
ASTERACEAE	<i>Krigia cespitosa</i>	weedy dwarf-dandelion	4
ASTERACEAE	<i>Lactuca canadensis</i>	Canadian lettuce	2
ASTERACEAE	<i>Lactuca floridana</i>	Florida lettuce	3
ASTERACEAE	<i>Lactuca saligna</i>	willow-leaf lettuce	*
ASTERACEAE	<i>Lactuca serriola</i>	prickly lettuce	*
ASTERACEAE	<i>Liatis aspera</i>	button gayfeather	6
ASTERACEAE	<i>Liatis mucronata</i>	eastern dotted gayfeather	5
ASTERACEAE	<i>Liatis punctata</i>	western dotted gayfeather	5
ASTERACEAE	<i>Packera plattensis</i>	prairie ragwort	5
ASTERACEAE	<i>Pluchea odorata</i>	purple marsh-fleabane	2
ASTERACEAE	<i>Prenanthes aspera</i>	rough rattlesnake-root	8
ASTERACEAE	<i>Prionopsis ciliata</i>	wax-goldenweed	1
ASTERACEAE	<i>Pseudognaphalium obtusifolium</i>	fragrant false-cudweed	0
ASTERACEAE	<i>Pyrrhopappus grandiflorus</i>	tuberous false-dandelion	4
ASTERACEAE	<i>Ratibida columnifera</i>	upright prairie-coneflower	4
ASTERACEAE	<i>Ratibida pinnata</i>	gray-head prairie-coneflower	3
ASTERACEAE	<i>Rudbeckia hirta</i>	black-eyed-Susan	2
ASTERACEAE	<i>Silphium integrifolium</i>	whole-leaf rosinweed	3
ASTERACEAE	<i>Silphium laciniatum</i>	compassplant	4
ASTERACEAE	<i>Solidago canadensis</i>	Canadian goldenrod	1
ASTERACEAE	<i>Solidago gigantea</i>	late goldenrod	3
ASTERACEAE	<i>Solidago missouriensis</i>	Missouri goldenrod	5
ASTERACEAE	<i>Solidago nemoralis</i>	gray goldenrod	2
ASTERACEAE	<i>Solidago petiolaris</i>	downy goldenrod	7
ASTERACEAE	<i>Solidago rigida</i>	rough goldenrod	3
ASTERACEAE	<i>Solidago speciosa</i>	showy goldenrod	7
ASTERACEAE	<i>Sonchus asper</i>	prickly sow-thistle	*



ASTERACEAE	<i>Taraxacum officinale</i>	common dandelion	*
ASTERACEAE	<i>Thelesperma megapotamicum</i>	Rio Grande greenthread	4
ASTERACEAE	<i>Tragopogon dubius</i>	western salsify	*
ASTERACEAE	<i>Verbesina alternifolia</i>	wing-stem crownbeard	4
ASTERACEAE	<i>Vernonia baldwinii</i>	western ironweed	2
ASTERACEAE	<i>Xanthium strumarium</i>	common cocklebur	0
BIGNONIACEAE	<i>Campsis radicans</i>	common trumpet-creeper	*
BIGNONIACEAE	<i>Catalpa speciosa</i>	northern catalpa	*
BORAGINACEAE	<i>Hackelia virginiana</i>	Virginia bracted-stickseed	3
BORAGINACEAE	<i>Lithospermum arvense</i>	corn gromwell	*
BORAGINACEAE	<i>Lithospermum incisum</i>	plains gromwell	5
BORAGINACEAE	<i>Myosotis verna</i>	spring forget-me-not	2
BORAGINACEAE	<i>Onosmodium bejariense</i>	western false-marbleseed	4
BRASSICACEAE	<i>Alliaria petiolata</i>	common garlic-mustard	*
BRASSICACEAE	<i>Arabis canadensis</i>	Canadian rockcress	4
BRASSICACEAE	<i>Camelina microcarpa</i>	little-pod false-flax	*
BRASSICACEAE	<i>Capsella bursa-pastoris</i>	common shephard's-purse	*
BRASSICACEAE	<i>Diploaxis muralis</i>	stinking wall rocket	*
BRASSICACEAE	<i>Draba reptans</i>	white whitlow-wort	2
BRASSICACEAE	<i>Lepidium densiflorum</i>	prairie pepper-grass	0
BRASSICACEAE	<i>Microthlaspi perfoliatum</i>	perfoliate-pennycress	*
BRASSICACEAE	<i>Rorippa palustris</i>	blunt-leaf yellowcress	2
BRASSICACEAE	<i>Rorippa sessiliflora</i>	stalkless yellowcress	1
CACTACEAE	<i>Coryphantha missouriensis</i>	Missouri River coryphantha	7
CACTACEAE	<i>Opuntia macrorhiza</i>	big-root pricklypear	3
CAMPANULACEAE	<i>Campanula americana</i>	American bellflower	4
CAMPANULACEAE	<i>Lobelia cardinalis</i>	cardinal-flower	6
CAMPANULACEAE	<i>Triodanis leptocarpa</i>	slender-fruit Venus'-looking-glass	3
CAMPANULACEAE	<i>Triodanis perfoliata</i>	clasping-leaf Venus'-looking-glass	2
CANNABACEAE	<i>Cannabis sativa</i>	marijuana	*
CANNABACEAE	<i>Humulus lupulus</i>	common hop	3
CAPRIFOLIACEAE	<i>Lonicera maackii</i>	Amur honeysuckle	*
CAPRIFOLIACEAE	<i>Lonicera tatarica</i>	Tatarian honeysuckle	*
CAPRIFOLIACEAE	<i>Sambucus canadensis</i>	American elder	2
CAPRIFOLIACEAE	<i>Symphoricarpos orbiculatus</i>	coral-berry	1
CAPRIFOLIACEAE	<i>Triosteum perfoliatum</i>	clasping horse-gentian	4
CARYOPHYLLACEAE	<i>Arenaria serpyllifolia</i>	thyme-leaf sandwort	*
CARYOPHYLLACEAE	<i>Dianthus armeria</i>	Deptford pink	*
CARYOPHYLLACEAE	<i>Saponaria officinalis</i>	common soapwort	*
CARYOPHYLLACEAE	<i>Silene antirrhina</i>	sleepy catchfly	0
CARYOPHYLLACEAE	<i>Silene stellata</i>	starry catchfly	4

CARYOPHYLLACEAE	<i>Stellaria pallida</i>	pale chickweed	*
CELASTRACEAE	<i>Celastrus scandens</i>	American bittersweet	4
CELASTRACEAE	<i>Euonymus atropurpureus</i>	eastern wahoo	5
CHENOPODIACEAE	<i>Chenopodium album</i>	lamb's-quarters goosefoot	0
CHENOPODIACEAE	<i>Chenopodium berlandieri</i>	pit-seed goosefoot	0
CHENOPODIACEAE	<i>Chenopodium pallescens</i>	pale goosefoot	1
CHENOPODIACEAE	<i>Chenopodium pratericola</i>	field goosefoot	3
CHENOPODIACEAE	<i>Chenopodium simplex</i>	maple-leaf goosefoot	2
CHENOPODIACEAE	<i>Chenopodium standleyanum</i>	Standley's goosefoot	3
CHENOPODIACEAE	<i>Cycloloma atriplicifolium</i>	tumble ringwing	1
CHENOPODIACEAE	<i>Kochia scoparia</i>	broom kochia	*
CLUSIACEAE	<i>Hypericum perforatum</i>	common St. John's-wort	*
CLUSIACEAE	<i>Hypericum punctatum</i>	spotted St. John's-wort	6
COMMELINACEAE	<i>Commelina erecta</i>	erect dayflower	4
COMMELINACEAE	<i>Tradescantia bracteata</i>	bracted spiderwort	5
COMMELINACEAE	<i>Tradescantia ohiensis</i>	Ohio spiderwort	5
CONVOLVULACEAE	<i>Calystegia sepium</i>	common hedge-bindweed	0
CONVOLVULACEAE	<i>Convolvulus arvensis</i>	field bindweed	*
CONVOLVULACEAE	<i>Evolvulus nuttallianus</i>	Nuttall's evolvulus	6
CONVOLVULACEAE	<i>Ipomoea hederacea</i>	ivy-leaf morning-glory	*
CONVOLVULACEAE	<i>Ipomoea lacunosa</i>	white morning-glory	0
CONVOLVULACEAE	<i>Ipomoea leptophylla</i>	bush morning-glory	5
CONVOLVULACEAE	<i>Ipomoea purpurea</i>	purple morning-glory	*
CORNACEAE	<i>Cornus amomum</i>	pale dogwood	5
CORNACEAE	<i>Cornus drummondii</i>	rough-leaf dogwood	1
CRASSULACEAE	<i>Penthorum sedoides</i>	ditch-stonecrop	3
CUCURBITACEAE	<i>Citrullus lanatus</i>	watermelon	*
CUCURBITACEAE	<i>Cucurbita foetidissima</i>	buffalo gourd	0
CUCURBITACEAE	<i>Sicyos angulatus</i>	wall bur-cucumber	2
CUPRESSACEAE	<i>Chamaecyparis lawsoniana</i>	Port-Orford-cedar	*
CUPRESSACEAE	<i>Juniperus virginiana</i>	eastern red-cedar	
CUSCUTACEAE	<i>Cuscuta glomerata</i>	cluster dodder	3
CYPERACEAE	<i>Bolboschoenus fluviatilis</i>	river tuberous-bulrush	5
CYPERACEAE	<i>Carex aggregata</i>	cluster sedge	6
CYPERACEAE	<i>Carex albicans</i>	white-tinge sedge	7
CYPERACEAE	<i>Carex austrina</i>	southern sedge	2
CYPERACEAE	<i>Carex bicknellii</i>	Bicknell's sedge	8
CYPERACEAE	<i>Carex blanda</i>	woodland sedge	1
CYPERACEAE	<i>Carex brachyglossa</i>	yellow-fruit sedge	5
CYPERACEAE	<i>Carex brevior</i>	short-beak sedge	5
CYPERACEAE	<i>Carex bushii</i>	Bush's sedge	4

CYPERACEAE	<i>Carex davisii</i>	Davis' sedge	4
CYPERACEAE	<i>Carex emoryi</i>	Emory's sedge	5
CYPERACEAE	<i>Carex gravida</i>	heavy sedge	4
CYPERACEAE	<i>Euphorbia spathulata</i>	warty spurge	5
CYPERACEAE	<i>Tragia ramosa</i>	catnip noseburn	6
CYPERACEAE	<i>Carex grisea</i>	narrow-leaf sedge	3
CYPERACEAE	<i>Carex hystericina</i>	bottle-brush sedge	7
CYPERACEAE	<i>Carex inops</i>	sun sedge	8
CYPERACEAE	<i>Carex laeviconica</i>	smooth-cone sedge	8
CYPERACEAE	<i>Carex leavenworthii</i>	Leavenworth's sedge	2
CYPERACEAE	<i>Carex meadii</i>	Mead's sedge	7
CYPERACEAE	<i>Carex oligocarpa</i>	straight-fruit sedge	6
CYPERACEAE	<i>Carex pellita</i>	woolly sedge	5
CYPERACEAE	<i>Carex vulpinoidea</i>	fox sedge	3
CYPERACEAE	<i>Cyperus acuminatus</i>	tape-leaf flat-sedge	0
CYPERACEAE	<i>Cyperus erythrorhizos</i>	red-root flat-sedge	4
CYPERACEAE	<i>Cyperus esculentus</i>	yellow nut-sedge	0
CYPERACEAE	<i>Cyperus lupulinus</i>	slender-stem flat-sedge	3
CYPERACEAE	<i>Cyperus ×mesochorus</i>	intermediate sedge	4
CYPERACEAE	<i>Cyperus odoratus</i>	slender flat-sedge	3
CYPERACEAE	<i>Cyperus schweinitzii</i>	Schwinitz's flat-sedge	6
CYPERACEAE	<i>Cyperus squarrosus</i>	awned flat-sedge	0
CYPERACEAE	<i>Cyperus strigosus</i>	false nut-sedge	4
CYPERACEAE	<i>Eleocharis compressa</i>	flat-stem spike-rush	6
CYPERACEAE	<i>Eleocharis engelmannii</i>	Engelmann's spike-rush	4
CYPERACEAE	<i>Eleocharis erythropoda</i>	bald spike-rush	4
CYPERACEAE	<i>Eleocharis macrostachya</i>	large-spike spike-rush	3
CYPERACEAE	<i>Schoenoplectus tabernaemontani</i>	soft-stem twine-bulrush	4
CYPERACEAE	<i>Scirpus atrovirens</i>	green bulrush	4
CYPERACEAE	<i>Scirpus pallidus</i>	pale bulrush	5
CYPERACEAE	<i>Scirpus pendulus</i>	drooping bulrush	3
EQUISETACEAE	<i>Equisetum laevigatum</i>	smooth scouring-rush	3
EUPHORBIACEAE	<i>Acalypha ostryifolia</i>	rough-pod copperleaf	0
EUPHORBIACEAE	<i>Acalypha rhomboidea</i>	rhombic copperleaf	1
EUPHORBIACEAE	<i>Acalypha virginica</i>	Virginia copperleaf	0
EUPHORBIACEAE	<i>Chamaesyce glyptosperma</i>	ridge-seed mat-spurge	0
EUPHORBIACEAE	<i>Chamaesyce humistrata</i>	spreading mat-spurge	3
EUPHORBIACEAE	<i>Chamaesyce maculata</i>	spotted mat-spurge	0
EUPHORBIACEAE	<i>Chamaesyce missurica</i>	Missouri mat-spurge	5
EUPHORBIACEAE	<i>Chamaesyce nutans</i>	eyebane	0
EUPHORBIACEAE	<i>Chamaesyce serpens</i>	round-leaf mat-spurge	0

EUPHORBIACEAE	<i>Chamaesyce stictospora</i>	slim-seed mat-spurge	0
EUPHORBIACEAE	<i>Croton capitatus</i>	woolly croton	1
EUPHORBIACEAE	<i>Croton glandulosus</i>	tropic croton	1
EUPHORBIACEAE	<i>Croton monanthogynus</i>	one-seed croton	1
EUPHORBIACEAE	<i>Croton texensis</i>	Texas croton	1
EUPHORBIACEAE	<i>Euphorbia corollata</i>	flowering spurge	5
EUPHORBIACEAE	<i>Euphorbia cyathophora</i>	painted spurge	3
EUPHORBIACEAE	<i>Euphorbia davidii</i>	western toothed spurge	0
EUPHORBIACEAE	<i>Euphorbia hexagona</i>	six-angle spurge	2
EUPHORBIACEAE	<i>Euphorbia marginata</i>	snow-on-the-mountain	0
EUPHORBIACEAE	<i>Securigera varia</i>	common crown-vetch	*
EUPHORBIACEAE	<i>Senna marilandica</i>	Maryland senna	3
FABACEAE	<i>Amorpha canescens</i>	leadplant	7
FABACEAE	<i>Amorpha fruticosa</i>	bush wild-indigo	6
FABACEAE	<i>Amphicarpaea bracteata</i>	America hog-peanut	3
FABACEAE	<i>Astragalus canadensis</i>	Canadian milk-vetch	4
FABACEAE	<i>Astragalus crassicaarpus</i>	ground-plum milk-vetch	7
FABACEAE	<i>Astragalus lotiflorus</i>	lotus milk-vetch	4
FABACEAE	<i>Astragalus plattensis</i>	Platte River milk-vetch	7
FABACEAE	<i>Baptisia australis</i>	blue wild-indigo	6
FABACEAE	<i>Baptisia bracteata</i>	plains wild-indigo	6
FABACEAE	<i>Cercis canadensis</i>	eastern redbud	2
FABACEAE	<i>Chamaecrista fasciculata</i>	showy partridgepea	2
FABACEAE	<i>Crotalaria sagittalis</i>	arrow rattlebox	4
FABACEAE	<i>Dalea aurea</i>	golden prairie-clover	5
FABACEAE	<i>Dalea candida</i>	white prairie-clover	7
FABACEAE	<i>Dalea enneandra</i>	nine-anther prairie-clover	5
FABACEAE	<i>Dalea leporina</i>	hare-foot prairie-clover	2
FABACEAE	<i>Dalea multiflora</i>	round-head prairie-clover	7
FABACEAE	<i>Dalea purpurea</i>	purple prairie-clover	7
FABACEAE	<i>Desmanthus illinoensis</i>	Illinois bundle-flower	2
FABACEAE	<i>Desmodium canadense</i>	Canadian tick-clover	4
FABACEAE	<i>Desmodium canescens</i>	hoary tick-clover	4
FABACEAE	<i>Desmodium cuspidatum</i>	long-leaf tick-clover	6
FABACEAE	<i>Desmodium glutinosum</i>	large-flower tick-clover	3
FABACEAE	<i>Desmodium illinoense</i>	Illinois tick-clover	5
FABACEAE	<i>Desmodium perplexum</i>	Dillen's tick-clover	5
FABACEAE	<i>Gleditsia triacanthos</i>	common honey-locust	0
FABACEAE	<i>Glycyrrhiza lepidota</i>	American licorice	3
FABACEAE	<i>Gymnocladus dioica</i>	Kentucky coffeetree	4
FABACEAE	<i>Kummerowia stipulacea</i>	Korena low-bush-clover	*

FABACEAE	<i>Lespedeza capitata</i>	round-head bush-clover	6
FABACEAE	<i>Lespedeza cuneata</i>	sericea lespedeza	*
FABACEAE	<i>Lotus corniculatus</i>	bird-foot trefoil	*
FABACEAE	<i>Lotus unifoliolatus</i>	prairie trefoil	3
FABACEAE	<i>Medicago lupulina</i>	black medic	*
FABACEAE	<i>Medicago minima</i>	prickly medic	*
FABACEAE	<i>Medicago sativa</i>	alfalfa	*
FABACEAE	<i>Melilotus alba</i>	white sweet-clover	*
FABACEAE	<i>Melilotus officinalis</i>	yellow sweet-clover	*
FABACEAE	<i>Mimosa quadrivalvis</i>	cat-claw mimosa	6
FABACEAE	<i>Oxytropis lambertii</i>	Lambert's crazyweed	5
FABACEAE	<i>Pedimelum argophyllum</i>	silver-leaf scurf-pea	8
FABACEAE	<i>Pedimelum esculentum</i>	bread-root scurf-pea	7
FABACEAE	<i>Psoraleidum tenuiflorum</i>	wild-alfalfa	3
FABACEAE	<i>Robinia pseudoacacia</i>	black locust	*
FABACEAE	<i>Strophostyles helvula</i>	trailing wildbean	3
FABACEAE	<i>Strophostyles leiosperma</i>	slick-seed wildbean	3
FABACEAE	<i>Trifolium pratense</i>	red clover	*
FABACEAE	<i>Trifolium repens</i>	white clover	*
FABACEAE	<i>Vicia americana</i>	American vetch	7
FAGACEAE	<i>Quercus macrocarpa</i>	bur oak	4
FAGACEAE	<i>Quercus muehlenbergii</i>	chinquapin oak	5
GENTIANACEAE	<i>Gentiana puberulenta</i>	downy gentian	8
GERANIACEAE	<i>Geranium carolinianum</i>	Carolina crane's-bill	0
GERANIACEAE	<i>Geranium pusillum</i>	small crane's-bill	*
GROSSULARIACEAE	<i>Ribes missouriense</i>	Missouri gooseberry	3
HYDROCHARITACEAE	<i>Najas guadalupensis</i>	common naiad	1
HYDROPHYLLACEAE	<i>Ellisia nyctelea</i>	water-pod	0
IRIDACEAE	<i>Iris germanica</i>	German iris	*
IRIDACEAE	<i>Sisyrinchium campestre</i>	prairie blue-eyed-grass	6
JUGLANDACEAE	<i>Carya cordiformis</i>	bitter-nut hickory	4
JUGLANDACEAE	<i>Carya illinoensis</i>	pecan	6
JUGLANDACEAE	<i>Juglans nigra</i>	black walnut	3
JUNCACEAE	<i>Juncus interior</i>	inland rush	2
JUNCACEAE	<i>Juncus torreyi</i>	Torrey's rush	2
LAMIACEAE	<i>Agastache nepetoides</i>	catnip giant-hyssop	4
LAMIACEAE	<i>Hedeoma hispida</i>	rough false-penny-royal	1
LAMIACEAE	<i>Lamium amplexicaule</i>	hen-bit dead-head	*
LAMIACEAE	<i>Lycopus americanus</i>	American water-horehound	3
LAMIACEAE	<i>Mentha arvensis</i>	field mint	3
LAMIACEAE	<i>Monarda fistulosa</i>	wild bergamot bee-balm	3

LAMIACEAE	<i>Nepeta cataria</i>	common catnip	*
LAMIACEAE	<i>Pycnanthemum tenuifolium</i>	narrow-leaf mountain-mint	4
LAMIACEAE	<i>Salvia azurea</i>	blue sage	4
LAMIACEAE	<i>Salvia reflexa</i>	lance-leaf sage	1
LAMIACEAE	<i>Scutellaria lateriflora</i>	side-flower skullcap	4
LAMIACEAE	<i>Scutellaria parvula</i>	southern small skullcap	5
LAMIACEAE	<i>Teucrium canadense</i>	American germander	1
LAMIACEAE	<i>Trichostema brachiatum</i>	flux-weed bluecurls	5
LILIACEAE	<i>Allium canadense</i>	Canadian onion	5
LILIACEAE	<i>Allium canadense</i>	Canadian onion	5
LILIACEAE	<i>Allium sativum</i>	garlic	*
LILIACEAE	<i>Allium stellatum</i>	summer pink onion	6
LILIACEAE	<i>Allium vineale</i>	field garlic	*
LILIACEAE	<i>Asparagus officinalis</i>	garden asparagus	*
LILIACEAE	<i>Hemerocallis fulva</i>	orange day-lily	*
LILIACEAE	<i>Maianthemum stellatum</i>	starry spikenard	8
LILIACEAE	<i>Toxicoscordion nuttallii</i>	Nuttall's death-camas	5
LINACEAE	<i>Linum pratense</i>	Norton's blue flax	5
LINACEAE	<i>Linum sulcatum</i>	grooved flax	6
LOASACEAE	<i>Mentzelia oligosperma</i>	stick-leaf	4
LYTHRACEAE	<i>Ammannia coccinea</i>	purple toothcup	2
LYTHRACEAE	<i>Ammannia robusta</i>	stout toothcup	2
LYTHRACEAE	<i>Lythrum alatum</i>	winged loosestrife	4
MALVACEAE	<i>Abutilon theophrasti</i>	common velvetleaf	*
MALVACEAE	<i>Callirhoë alcaeoides</i>	pale poppy-mallow	6
MALVACEAE	<i>Callirhoë involucrata</i>	purple poppy-mallow	1
MALVACEAE	<i>Hibiscus trionum</i>	flower-of-an-hour	*
MALVACEAE	<i>Malvastrum hispidum</i> A473	rough false-mallow	3
MALVACEAE	<i>Sida spinosa</i>	prickly sida	*
MENISPERMACEAE	<i>Menispermum canadense</i>	Canadian moonseed	4
MOLLUGINACEAE	<i>Mollugo verticillata</i>	green carpetweed	*
MORACEAE	<i>Maclura pomifera</i>	Osage-orange	*
MORACEAE	<i>Morus alba</i>	white mulberry	*
MORACEAE	<i>Morus rubra</i>	red mulberry	5
NYCTAGINACEAE	<i>Mirabilis albida</i>	white four-o'clock	5
NYCTAGINACEAE	<i>Mirabilis linearis</i>	narrow-leaf four-o'clock	5
NYCTAGINACEAE	<i>Mirabilis nyctaginea</i>	wild four-o'clock	0
OLEACEAE	<i>Fraxinus pennsylvanica</i>	green ash	0
ONAGRACEAE	<i>Calylophus serrulatus</i>	plains yellow evening-primrose	5
ONAGRACEAE	<i>Gaura longiflora</i>	large-flower butterfly-weed	2
ONAGRACEAE	<i>Gaura parviflora</i>	velvet butterfly-weed	1

ONAGRACEAE	<i>Ludwigia peploides</i>	floating seedbox	3
ONAGRACEAE	<i>Oenothera laciniata</i>	cut-leaf evening-primrose	0
ONAGRACEAE	<i>Oenothera macrocarpa</i>	Missouri evening-primrose	5
ONAGRACEAE	<i>Dactylis glomerata</i>	orchard grass	*
ONAGRACEAE	<i>Diarrhena obovata</i>	American beakgrass	6
ONAGRACEAE	<i>Dichanthelium acuminatum</i>	pointed dichanthelium	3
ONAGRACEAE	<i>Dichanthelium linearifolium</i>	slim-leaf dichanthelium	7
ONAGRACEAE	<i>Oenothera speciosa</i>	showy white evening-primrose	2
ONAGRACEAE	<i>Oenothera villosa</i>	hairy evening-primrose	0
ONAGRACEAE	<i>Stenosiphon linifolius</i>	stenosiphon	6
OPHIOGLOSSACEAE	<i>Botrychium virginianum</i>	rattlesnake fern	4
ORCHIDACEAE	<i>Spiranthes cernua</i>	nodding ladies'-tresses	5
OXALIDACEAE	<i>Oxalis dillenii</i>	gray-green wood-sorrel	0
OXALIDACEAE	<i>Oxalis violacea</i>	violet wood-sorrel	4
PAPAVERACEAE	<i>Argemone polyanthemos</i>	plains prickly-poppy	3
PHYTOLACCACEAE	<i>Phytolacca americana</i>	American pokeweed	0
PINACEAE	<i>Pinus nigra</i>	Austrian pine	*
PINACEAE	<i>Pinus ponderosa</i>	ponderosa pine	*
PLANTAGINACEAE	<i>Plantago aristata</i>	bottle-brush plantain	2
PLANTAGINACEAE	<i>Plantago lanceolata</i>	English plantain	*
PLANTAGINACEAE	<i>Plantago patagonica</i>	woolly plantain	1
PLANTAGINACEAE	<i>Plantago rhodosperma</i>	red-seed plantain	2
PLANTAGINACEAE	<i>Plantago rugelii</i>	Rugel's plantain	0
PLANTAGINACEAE	<i>Plantago virginica</i>	pale-seed plantain	1
SAPINDACEAE	<i>Platanus occidentalis</i>	common sycamore	4
POACEAE	<i>Agrostis hyemalis</i>	winter bent grass	2
POACEAE	<i>Alopecurus carolinianus</i>	Carolina foxtail	0
POACEAE	<i>Andropogon gerardii</i>	big bluestem	4
POACEAE	<i>Andropogon hallii</i>	sand bluestem	5
POACEAE	<i>Aristida oligantha</i>	old-field threeawn	0
POACEAE	<i>Bothriochloa bladhii</i>	Caucasian bluestem	*
POACEAE	<i>Bothriochloa ischaemum</i>	Turkestan bluestem	*
POACEAE	<i>Bothriochloa laguroides</i>	silver bluestem	1
POACEAE	<i>Bouteloua curtipendula</i>	side-oats grama	5
POACEAE	<i>Bouteloua gracilis</i>	blue grama	5
POACEAE	<i>Bouteloua hirsuta</i>	hairy grama	6
POACEAE	<i>Bromus inermis</i>	smooth brome	*
POACEAE	<i>Bromus japonicus</i>	Japanese brome	*
POACEAE	<i>Bromus pubescens</i>	Canadian brome	4
POACEAE	<i>Buchloë dactyloides</i>	buffalo grass	3
POACEAE	<i>Calamovilfa longifolia</i>	prairie sand-reed	7

POACEAE	<i>Cenchrus longispinus</i>	field sandbur	0
POACEAE	<i>Chasmanthium latifolium</i>	broad-leaf wood-oat	4
POACEAE	<i>Chloris verticillata</i>	whorled windmill grass	0
POACEAE	<i>Chloris virgata</i>	showy windmill grass	0
POACEAE	<i>Cynodon dactylon</i>	common bermuda grass	*
POACEAE	<i>Saccharum ravennae</i>	Ravenna grass	*
POACEAE	<i>Schedonnardus paniculatus</i>	tumble grass	3
POACEAE	<i>Schizachyrium scoparium</i>	little bluestem	5
POACEAE	<i>Setaria faberi</i>	Chinese bristle grass	*
POACEAE	<i>Dichanthelium oligosanthes</i>	Scribner's dichanthelium	4
POACEAE	<i>Digitaria ciliaris</i>	southern crab grass	*
POACEAE	<i>Digitaria cognata</i>	fall witch grass	3
POACEAE	<i>Echinochloa muricata</i>	rough barnyard grass	0
POACEAE	<i>Eleusine indica</i>	Indian goose grass	*
POACEAE	<i>Elymus canadensis</i>	Canadian wild-rye	5
POACEAE	<i>Elymus villosus</i>	hairy wild-rye	5
POACEAE	<i>Elymus virginicus</i>	Virginia wild-rye	3
POACEAE	<i>Eragrostis cilianensis</i>	stink grass	*
POACEAE	<i>Eragrostis hypnoides</i>	teal love grass	3
POACEAE	<i>Eragrostis minor</i>	little love grass	*
POACEAE	<i>Eragrostis pectinacea</i>	Carolina love grass	0
POACEAE	<i>Eragrostis spectabilis</i>	purple love grass	3
POACEAE	<i>Eragrostis trichodes</i>	sand love grass	4
POACEAE	<i>Eriochloa contracta</i>	prairie cup grass	0
POACEAE	<i>Festuca subverticillata</i>	noddig fescue	4
POACEAE	<i>Glyceria striata</i>	fowl manna grass	5
POACEAE	<i>Hesperostipa spartea</i>	porcupine grass	8
POACEAE	<i>Hordeum jubatum</i>	fox-tail barley	1
POACEAE	<i>Hordeum pusillum</i>	little barley	0
POACEAE	<i>Koeleria macrantha</i>	prairie June grass	6
POACEAE	<i>Leersia oryzoides</i>	rice cut grass	4
POACEAE	<i>Leersia virginica</i>	white grass	3
POACEAE	<i>Leptochloa fusca</i>	bearded sprangletop	0
POACEAE	<i>Leptochloa panicea</i>	red sprangletop	0
POACEAE	<i>Lolium pratense</i> .	meadow rye grass	*
POACEAE	<i>Muhlenbergia cuspidata</i> .	plains muhly	5
POACEAE	<i>Muhlenbergia frondosa</i>	wire-stem muhly	3
POACEAE	<i>Muhlenbergia mexicana</i>	Mexican wire-stem muhly	4
POACEAE	<i>Muhlenbergia racemosa</i>	marsh muhly	4
POACEAE	<i>Muhlenbergia schreberi</i> .	nimblewill	0
POACEAE	<i>Muhlenbergia sobolifera</i>	rock muhly	5



POACEAE	<i>Muhlenbergia sylvatica</i>	forest muhly	6
POACEAE	<i>Panicum capillare</i>	common witch grass	0
POACEAE	<i>Panicum dichotomiflorum</i>	fall panicum	0
POACEAE	<i>Panicum virgatum</i>	switch grass	4
POACEAE	<i>Pascopyrum smithii</i>	western wheat grass	2
POACEAE	<i>Paspalum pubiflorum</i>	hairy-seed paspalum	4
POACEAE	<i>Paspalum setaceum</i>	thin paspalum	2
POACEAE	<i>Poa annua</i>	annual blue grass	*
POACEAE	<i>Poa compressa</i>	Canadian blue grass	*
POACEAE	<i>Poa pratensis</i>	Kentucky blue grass	*
POACEAE	<i>Poa sylvestris</i>	wooland blue grass	4
POACEAE	<i>Chasmanthium latifolium</i>	broad-leaf wood-oat	4
POACEAE	<i>Chloris verticillata</i>	whorled windmill grass	0
POACEAE	<i>Chloris virgata</i>	showy windmill grass	0
POACEAE	<i>Cynodon dactylon</i>	common bermuda grass	*
POACEAE	<i>Saccharum ravennae</i>	Ravenna grass	*
POACEAE	<i>Schedonnardus paniculatus</i>	tumble grass	3
POACEAE	<i>Schizachyrium scoparium</i>	little bluestem	5
POACEAE	<i>Setaria faberi</i>	Chinese bristle grass	*
POACEAE	<i>Setaria italica</i>	foxtail bristle grass	*
POACEAE	<i>Setaria pumila.</i>	yellow bristle grass	*
POACEAE	<i>Setaria viridis</i>	green bristle grass	*
POACEAE	<i>Sorghastrum nutans</i>	yellow Indian grass	5
POACEAE	<i>Sorghum bicolor</i>	grain sorghum	*
POACEAE	<i>Sorghum halepense</i>	Johnson grass	*
POACEAE	<i>Spartina pectinata</i>	prairie cord grass	4
POACEAE	<i>Sphenopholis obtusata</i>	prairie wedgescale	4
POACEAE	<i>Sporobolus clandestinus.</i>	southeastern dropeed	6
POACEAE	<i>Sporobolus compositus</i>	tall dropseed	3
POACEAE	<i>Sporobolus compositus</i>	meadow dropseed	3
POACEAE	<i>Sporobolus cryptandrus</i>	sand dropseed	0
POACEAE	<i>Sporobolus heterolepis</i>	prairie dropseed	8
POACEAE	<i>Sporobolus neglectus</i>	puff-sheath dropseed	1
POACEAE	<i>Sporobolus pyramidatus</i>	whorled dropseed	4
POACEAE	<i>Sporobolus vaginiflorus</i>	poverty dropseed	0
POACEAE	<i>Tridens flavus</i>	purpletop	1
POACEAE	<i>Triplasis purpurea</i>	purple sand grass	7
POACEAE	<i>Tripsacum dactyloides</i>	eastern gramma grass	3
POACEAE	<i>Vulpia octoflora</i>	six-weeks annual-fescue	1
POLYGALACEAE	<i>Polygala verticillata</i>	whorled milkwort	3
POLYGONACEAE	<i>Polygonum amphibium</i>	swamp smartweed	2

POLYGONACEAE	<i>Polygonum arenastrum</i>	sand knotweed	*
POLYGONACEAE	<i>Polygonum bicomne</i>	pink smartweed	1
POLYGONACEAE	<i>Polygonum convolvulus</i>	dull-seed cornbind	*
POLYGONACEAE	<i>Polygonum lapathifolium</i>	pale smartweed	2
POLYGONACEAE	<i>Polygonum persicaria</i>	lady's-thumb smartweed	*
POLYGONACEAE	<i>Polygonum punctatum</i>	dotted smartweed	3
POLYGONACEAE	<i>Polygonum ramosissimum</i>	bushy knotweed	2
POLYGONACEAE	<i>Polygonum scandens</i>	hedge cornbind	0
POLYGONACEAE	<i>Polygonum virginianum</i>	jumpseed	2
POLYGONACEAE	<i>Rumex altissimus</i>	pale dock	0
POLYGONACEAE	<i>Rumex crispus</i>	curly dock	*
PONTEDERIACEAE	<i>Heteranthera limosa</i>	blue mud-plantain	5
PORTULACACEAE	<i>Portulaca oleracea</i>	common purslane	*
POTAMOGETONACEAE	<i>Potamogeton nodosus</i>	long-leaf pondweed	4
POTAMOGETONACEAE	<i>Potamogeton pusillus</i>	baby pondweed	5
PRIMULACEAE	<i>Salix nigra</i>	black willow	2
PRIMULACEAE	<i>Anagallis arvensis</i>	scarlet pimpernel	*
PRIMULACEAE	<i>Androsace occidentalis</i>	western rock-jasmine	0
PRIMULACEAE	<i>Lysimachia ciliata</i>	fringed loosestrife	6
PTERIDACEAE	<i>Pellaea glabella</i>	smooth cliffbrake	8
RANUNCULACEAE	<i>Anemone virginiana</i>	tall anemone	4
RANUNCULACEAE	<i>Delphinium carolinianum</i>	plains larkspur	6
RANUNCULACEAE	<i>Ranunculus abortivus</i>	early wood buttercup	1
RANUNCULACEAE	<i>Ranunculus aquatilis</i>	white water crowfoot	7
RANUNCULACEAE	<i>Ranunculus sceleratus</i>	cursed crowfoot	0
RANUNCULACEAE	<i>Thalictrum dasycarpum</i>	purple meadow-rue	4
RHAMNACEAE	<i>Ceanothus herbaceus</i>	inland ceanothus	8
ROSACEAE	<i>Agrimonia pubescens</i>	downy agrimony	5
ROSACEAE	<i>Geum canadense</i>	white avens	1
ROSACEAE	<i>Potentilla arguta</i>	tall cinquefoil	6
ROSACEAE	<i>Prunus americana</i>	American plum	3
ROSACEAE	<i>Prunus angustifolia</i>	Chickasaw plum	3
ROSACEAE	<i>Prunus mahaleb</i>	mahaleb cherry	*
ROSACEAE	<i>Prunus mexicana</i>	big-tree plum	3
ROSACEAE	<i>Pyrus communis</i>	common pear	*
ROSACEAE	<i>Rosa arkansana</i>	Arkansas rose	4
ROSACEAE	<i>Rosa multiflora</i>	leafy rose	*
ROSACEAE	<i>Rubus aboriginum</i>	one-flower dewberry	5
ROSACEAE	<i>Rubus bushii</i>	Bush's highbush blackberry	2
ROSACEAE	<i>Rubus discolor</i>	Himalayan blackberry	*
ROSACEAE	<i>Rubus hancinianus</i>	Hancin's dewberry	4

ROSACEAE	<i>Rubus laudatus</i>	praiseworthy blackberry	4
ROSACEAE	<i>Rubus mollior</i>	soft blackberry	4
ROSACEAE	<i>Rubus occidentalis</i>	black raspberry	2
RUBIACEAE	<i>Cephalanthus occidentalis</i>	common buttonbush	4
RUBIACEAE	<i>Galium aparine</i>	catch-weed bedstraw	0
RUBIACEAE	<i>Galium circaezans</i>	forest bedstraw	3
RUBIACEAE	<i>Galium pedemontanum</i>	foothill bedstraw	*
RUBIACEAE	<i>Galium triflorum</i>	sweet-scent bedstraw	6
RUBIACEAE	<i>Stenaria nigricans</i>	narrow-leaf bluet	5
RUTACEAE	<i>Zanthoxylum americanum</i>	common prickly-ash	3
SALICACEAE	<i>Populus deltoides</i>	plains cottonwood	0
SALICACEAE	<i>Populus nigra</i>	black poplar	*
SALICACEAE	<i>Salix amygdaloides</i>	peach-leaf willow	3
SALICACEAE	<i>Salix exigua</i>	sandbar willow	1
SALICACEAE	<i>Salix exigua</i>	sandbar willow	1
SANTALACEAE	<i>Comandra umbellata</i>	umbellate bastard toad-flax	6
SAPINDACEAE	<i>Platanus occidentalis</i>	common sycamore	4
SCROPHULARIACEAE	<i>Agalinis aspera</i>	rough agalinis	7
SCROPHULARIACEAE	<i>Bacopa rotundifolia</i>	round-leaf water-hyssop	4
SCROPHULARIACEAE	<i>Buchnera americana</i>	American bluehearts	9
SCROPHULARIACEAE	<i>Chaenorrhinum minus</i>	lesser dwarf-snapdragon	*
SCROPHULARIACEAE	<i>Leucospora multifida</i>	paleseed	0
SCROPHULARIACEAE	<i>Lindernia dubia</i>	false-pimpernel	4
SCROPHULARIACEAE	<i>Mimulus ringens</i>	Alleghany monkey-flower	5
SCROPHULARIACEAE	<i>Penstemon cobaea</i>	cobaea beardtongue	5
SCROPHULARIACEAE	<i>Penstemon digitalis</i>	smooth beardtongue	4
SCROPHULARIACEAE	<i>Penstemon grandiflorus</i>	shell-leaf beardtongue	6
SCROPHULARIACEAE	<i>Penstemon tubaeiflorus</i>	tube beardtongue	3
SCROPHULARIACEAE	<i>Scrophularia marilandica</i>	Maryland figwort	5
SCROPHULARIACEAE	<i>Tomanthera densiflora</i>	fine-leaf hairy-foxglove	8
SCROPHULARIACEAE	<i>Verbascum blattaria</i>	moth mullein	*
SCROPHULARIACEAE	<i>Verbascum thapsus</i>	flannel mullein	*
SCROPHULARIACEAE	<i>Veronica anagallis-aquatica</i>	blue water speedwell	*
SCROPHULARIACEAE	<i>Veronica arvensis</i>	corn speedwell	*
SCROPHULARIACEAE	<i>Veronica polita</i>	wayside speedwell	*
SMILACACEAE	<i>Smilax tamnoides</i>	bristly greenbrier	2
SOLANACEAE	<i>Lycium barbarum</i>	common matrimony-vine	*
SOLANACEAE	<i>Physalis heterophylla</i>	clammy ground-cherry	4
SOLANACEAE	<i>Physalis longifolia</i>	long-leaf ground-cherry	2
SOLANACEAE	<i>Physalis pumila</i>	prairie ground-cherry	4
SOLANACEAE	<i>Physalis virginiana</i>	Virginia ground-cherry	6

SOLANACEAE	<i>Solanum carolinense</i>	Carolina horse-nettle	1
SOLANACEAE	<i>Solanum interius</i>	plains black nightshade	2
SOLANACEAE	<i>Solanum rostratum</i>	buffalo-bur nightshade	0
SPARGANIACEAE	<i>Sparganium eurycarpum</i>	giant bur-reed	5
TAMARICACEAE	<i>Tamarix ramosissima</i>	salt-cedar	*
TILIACEAE	<i>Tilia americana</i>	American basswood	6
TYPHACEAE	<i>Typha angustifolia</i>	narrow-leaf cat-tail	0
TYPHACEAE	<i>Typha latifolia</i>	broad-leaf cat-tail	1
ULMACEAE	<i>Celtis occidentalis</i>	common hackberry	1
ULMACEAE	<i>Ulmus americana</i>	American elm	2
ULMACEAE	<i>Ulmus pumila</i>	Siberian elm	*
ULMACEAE	<i>Ulmus rubra</i>	slippery elm	3
URTICACEAE	<i>Boehmeria cylindrica</i>	small-spike false-nettle	3
URTICACEAE	<i>Laportea canadensis</i>	Canadian wood-nettle	4
URTICACEAE	<i>Parietaria pensylvanica</i>	Pennsylvania pellitory	0
URTICACEAE	<i>Pilea pumila</i>	dwarf clearweed	2
URTICACEAE	<i>Urtica dioica</i>	American stinging nettle	1
VERBENACEAE	<i>Phryma leptostachya</i>	American lopseed	5
VERBENACEAE	<i>Phyla cuneifolia</i>	wedge-leaf fogfruit	3
VERBENACEAE	<i>Phyla lanceolata</i>	northern fogfruit	1
VERBENACEAE	<i>Verbena bracteata</i>	prostrate vervain	0
VERBENACEAE	<i>Verbena hastata</i>	blue vervain	4
VERBENACEAE	<i>Verbena xmoechina</i>	pasture vervain	*
VERBENACEAE	<i>Verbena simplex</i>	narrow-leaf vervain	2
VERBENACEAE	<i>Verbena stricta</i>	hoary vervain	1
VERBENACEAE	<i>Verbena urticifolia</i>	nettle-leaf vervain	2
VIOLACEAE	<i>Hybanthus verticillatus.</i>	nodding green-violet	6
VIOLACEAE	<i>Viola bicolor</i>	Johnny-jump-up	0
VIOLACEAE	<i>Viola pedatifida</i>	prairie violet	5
VITACEAE	<i>Ampelopsis cordata</i>	heart-leaf raccoon-grape	2
VITACEAE	<i>Vitis cinerea</i>	gray-bark grape	5
VITACEAE	<i>Vitis riparia</i>	riverbank grape	2
ZYGOPHYLLACEAE	<i>Tribulus terrestris</i>	goat's-head	*

**Appendix I, Table 2.** Complete list of mammals reported from Fort Riley, either from Pitts et al. (1987), or from surveys and sightings performed by Conservation Branch staff.

Common Name	Scientific Name	Pitts et al. 1987	In-house sighting
Virginia opossum	<i>Didelphis virginiana</i>	x	x
Elliot's short-tailed shrew	<i>Blarina hylophaga</i>	x	x

Least shrew	<i>Cryptotis parva</i>	x	x
Eastern mole	<i>Scalopus aquaticus</i>	x	x
Big brown bat	<i>Eptesicus fuscus</i>	x	x
Eastern red bat	<i>Lasiurus borealis</i>	x	x
Hoary bat	<i>Lasiurus cinereus</i>	x	
Little brown bat	<i>Myotis lucifugus</i>	x	
Tri-colored bat	<i>Pipistrellus subflavus</i>	x	x
Evening bat	<i>Nycticeius humeralis</i>		x
Brazilian free-tailed bat	<i>Tadarida brasiliensis</i>		x
Nine-banded armadillo	<i>Dasyurus novemcinctus</i>		x
Black-tailed jackrabbit	<i>Lepus californicus</i>	x	x
Eastern cottontail	<i>Sylvilagus floridanus</i>	x	x
Woodchuck	<i>Marmota monax</i>	x	x
Gray squirrel	<i>Sciurus carolinensis</i>	x	
Fox squirrel	<i>Sciurus niger</i>	x	x
Thirteen-lined ground squirrel	<i>Spermophilus tridecemlineatus</i>	x	x
Plains Pocket gopher	<i>Geomys bursarius</i>	x	x
Hispid pocket mouse	<i>Chaetodipus hispidus</i>		x
Beaver	<i>Castor canadensis</i>	x	x
Prairie vole	<i>Microtus ochrogaster</i>	x	x
Woodland vole	<i>Microtus pinetorum</i>	x	x
Eastern woodrat	<i>Neotoma floridana</i>	x	x
Muskrat	<i>Ondatra zibethicus</i>	x	x
Northern grasshopper mouse	<i>Onychomys leucogaster</i>	x	x
White-footed mouse	<i>Peromyscus leucopus</i>	x	x
Deer mouse	<i>Peromyscus maniculatus</i>	x	x
Western harvest mouse	<i>Reithrodontomys megalotis</i>	x	x
Plain's harvest mouse	<i>Reithrodontomys montanus</i>	x	x
Hispid cotton rat	<i>Sigmodon hispidus</i>	x	x
Southern bog lemming	<i>Synaptomys cooperi</i>	x	x
House mouse	<i>Mus musculus</i>	x	x
Norway rat	<i>Rattus norvegicus</i>	x	x
Meadow jumping mouse	<i>Zapus hudsonius</i>	x	x
Porcupine	<i>Erethizon dorsatum</i>	x	x
Coyote	<i>Canis latrans</i>	x	x
Red fox	<i>Vulpes vulpes</i>	x	x
Raccoon	<i>Procyon lotor</i>	x	x
Striped skunk	<i>Mephitis mephitis</i>	x	x
Long-tailed weasel	<i>Mustela frenata</i>	x	x
Mink	<i>Mustela vison</i>	x	x
Eastern spotted skunk	<i>Spilogale putorius</i>	x	

Badger	<i>Taxidea taxus</i>	x	x
Bobcat	<i>Lynx rufus</i>	x	x
Mountain Lion	<i>Felis concolor</i>		x
Mule deer	<i>Odocoileus hemionus</i>	x	x
White-tailed deer	<i>Odocoileus virginianus</i>	x	x
Elk	<i>Cervus elaphus</i>	x	x

**Appendix I, Table 3.** List of birds documented by Conservation Branch staff on Fort Riley, and each species time and frequency of occurrence.

Common Name	S	W	M
<b>GREBES</b>			
Pied-billed grebe	~	R	C
Horned grebe	~	~	R
Eared grebe	~	~	O
<b>PELICANS</b>			
American white pelican	R	~	C
<b>CORMORANTS</b>			
Double-crested cormorant	~	~	A
Neotropic cormorant	~	~	R
<b>HERONS</b>			
American bittern	~	~	O
Great blue heron	A	O	A
Great egret	O	~	C
Little blue heron	~	~	C
Snowy egret	~	~	O
Cattle egret	~	~	O
Green heron	C	~	O
Black-crowned night-heron	~	~	O
<b>IBISES</b>			
White-faced ibis	~	~	R
<b>GEESE</b>			
Greater white-fronted goose	~	~	O
Snow goose	~	O	C
Ross' goose	~	O	O
Canada goose	C	C	C
Cackling goose	~	C	O
<b>DUCKS</b>			
Wood duck	C	~	C
Green-winged teal	R	O	C
Mallard	O	C	A
Northern pintail	~	~	C

Blue-winged teal	R	~	A
Cinnamon teal	~	~	R
Northern shoveler	~	O	C
Gadwall	~	O	A
American wigeon	~	C	C
Canvasback	~	R	O
Redhead	~	O	O
Ring-necked duck	~	O	C
Lesser scaup	~	O	C
Common goldeneye	~	C	C
Bufflehead	~	O	O
Hooded merganser	~	O	O
Common merganser	~	C	C
Red-breasted merganser	~	~	R
Ruddy duck	~	~	O
<b>RAPTORS</b>			
Turkey vulture	C	~	C
Osprey	~	~	O
Mississippi kite	C	~	R
White-tailed kite			R
Bald eagle	O	C	A
Golden eagle	~	~	R
Northern harrier	R	C	O
Sharp-shinned hawk	O	O	O
Cooper's hawk	O	O	C
Northern goshawk	~	O	~
Red-shouldered hawk	R	~	R
Broad-winged hawk	R	~	R
Swainson's hawk	R	~	O
Red-tailed hawk	C	A	C
Ferruginous hawk	~	~	R
Rough-legged hawk	~	C	O

American kestrel	O	O	C
Merlin	~	R	~
Peregrine falcon	~	R	O
Prairie falcon	~	~	O
<b>FOWL</b>			
Ring-necked pheasant	A	A	A
Greater prairie-chicken	C	C	C
Ruffed grouse	~	~	~
Wild turkey	A	A	A
Northern bobwhite	A	A	A
<b>RAILS</b>			
Black rail	~	~	R
Yellow rail	~	~	R
Virginia rail	~	~	R
Sora	~	~	O
<b>GALLINULES</b>			
American coot	~	O	C
<b>CRANES</b>			
Sandhill crane	~	~	O
<b>PLOVERS</b>			
Killdeer	C	~	C
Black-bellied plover	~	~	R
American golden plover	~	~	R
Snowy plover	R	~	R
Semipalmated plover	R	~	O
Piping plover	R	~	R
<b>SANDPIPERS, PHALAROPES</b>			
American avocet	~	~	O
Greater yellowlegs	R	~	C
Lesser yellowlegs	R	~	C
Solitary sandpiper	~	~	O
Willet	~	~	O
Spotted sandpiper	R	~	C
Upland sandpiper	C	~	C
Hudsonian godwit	~	~	R
Marbled godwit	~	~	R
Ruddy turnstone	~	~	R
Sanderling	~	~	R
Semipalmated sandpiper	R	~	C
Western sandpiper	R	~	O
Least sandpiper	R	~	O

White-rumped sandpiper	R	~	O
Baird's sandpiper	R	~	O
Pectoral sandpiper	R	~	O
Stilt sandpiper	~	~	O
Buff-breasted sandpiper	~	~	R
Long-billed dowitcher	~	~	C
Whimbrel	~	~	R
Wilson's snipe	~	O	O
American woodcock	O	~	O
Wilson's phalarope	~	~	O
<b>GULLS</b>			
Franklin's gull	~	~	A
Bonaparte's gull	~	~	O
Ring-billed gull	~	A	A
Herring gull	~	A	A
<b>TERNs</b>			
Caspian tern	~	~	R
Forster's tern	C	~	C
Least tern	R	~	R
Black tern	~	~	O
<b>DOVES</b>			
Rock dove	A	A	A
Eurasian collared dove	O	O	O
Mourning dove	A	O	A
<b>CUCKOOS</b>			
Black-billed cuckoo	O	~	O
Yellow-billed cuckoo	C	~	C
<b>OWLS</b>			
Eastern screech owl	C	C	C
Great horned owl	C	C	C
Snowy owl	~	R	R
Burrowing owl	~	~	R
Barred owl	C	C	C
Long-eared owl	~	R	R
Short-eared owl	~	O	O
<b>GOATSUCKERS</b>			
Common nighthawk	C	~	C
Common poorwill	O	~	~
Chuck-will's-widow	C	~	O
Whip-poor-will	O	~	O
<b>SWIFTS</b>			

Chimney swift	A	~	A
<b>HUMMINGBIRDS</b>			
Ruby-throated hummingbird	O	~	O
<b>KINGFISHERS</b>			
Belted kingfisher	C	C	C
<b>WOODPECKERS</b>			
Red-headed woodpecker	C	R	C
Red-bellied woodpecker	C	C	C
Yellow-bellied sapsucker	~	O	R
Downy woodpecker	C	C	C
Hairy woodpecker	O	O	O
Northern flicker	C	C	C
Pileated woodpecker	O	O	O
<b>FLYCATCHERS</b>			
Eastern wood pewee	C	~	C
Olive-sided flycatcher	~	~	R
Yellow-bellied flycatcher	R	~	R
Acadian flycatcher	R	~	R
Willow flycatcher	O	~	O
Least flycatcher	~	~	O
Say's phoebe	~	~	R
Eastern phoebe	C	~	C
Great-crested flycatcher	C	~	C
Western kingbird	C	~	O
Eastern kingbird	C	~	C
Scissor-tailed flycatcher	O	~	O
<b>LARKS, SWALLOWS</b>			
Horned lark	R	O	O
Purple martin	C	~	C
Tree swallow	O	~	O
No. rough-winged swallow	O	~	C
Bank swallow	O	~	O
Cliff swallow	A	~	A
Barn swallow	A	~	A
<b>JAYS, CROWS</b>			
Blue jay	A	A	A
American crow	A	A	A
Fish crow	~	R	R
Black-billed magpie	~	~	R
<b>CHICKADEES, TITMOUSE</b>			
Black-capped chickadee	A	A	A

Tufted titmouse	A	A	A
<b>NUTHATCHES, CREEPERS</b>			
Red-breasted nuthatch	~	O	O
White-breasted nuthatch	C	C	C
Brown creeper	~	O	O
<b>WRENS</b>			
Carolina wren	C	C	C
Bewick's wren	O	~	O
House wren	A	~	A
Winter wren	~	O	O
Sedge wren	O	~	O
Marsh wren	~	R	O
<b>KINGLETS AND GNATCATCHERS</b>			
Golden-crowned kinglet	~	O	O
Ruby-crowned kinglet	~	~	O
Blue-gray gnatcatcher	O	~	O
<b>THRUSH</b>			
Eastern bluebird	C	C	C
Townsend's solitaire	~	R	~
Mountain bluebird	~	R	~
Wood thrush	O	~	O
Veery	~	~	O
Swainson's thrush	~	~	C
Gray-cheeked thrush	~	~	O
Hermit thrush	~	R	O
American robin	A	C	C
<b>THRASHERS</b>			
Gray catbird	A	~	A
Northern mockingbird	O	~	O
Sage thrasher	~	~	R
Brown thrasher	A	~	A
<b>PIPITS</b>			
American Water pipit	~	~	O
Sprague's pipit	~	~	R
<b>WAXWINGS</b>			
Cedar waxwing	R	C	C
Bohemian waxwing	~	R	R
<b>SHRIKES</b>			
Northern shrike	~	O	~
Loggerhead shrike	O	O	O
<b>STARLINGS</b>			



European starling	A	A	A
<b>VIREOS</b>			
White-eyed vireo	~	~	O
Bell's vireo	C	~	C
Blue-headed vireo	~	~	O
Yellow-throated vireo	R	~	O
Warbling vireo	O	~	O
Philadelphia vireo	~	~	O
Red-eyed vireo	A	~	C
<b>WARBLERS</b>			
Tennessee warbler	~	~	C
Orange-crowned warbler	~	~	C
Nashville warbler	~	~	C
Northern parula	O	~	O
Yellow warbler	C	~	C
Chestnut-sided warbler	~	~	R
Yellow-rumped warbler	~	O	C
Black-throated green warbler	~	~	O
Prairie warbler	R	~	R
Blackpoll warbler	~	~	O
Magnolia warbler	~	~	R
Black and white warbler	R	~	C
American redstart	R	~	O
Prothonotary warbler	R	~	S
Ovenbird	R	~	O
Louisiana waterthrush	R	~	O
Kentucky warbler	O	~	O
Mourning warbler	~	~	O
Common yellowthroat	C	~	C
Virginia's warbler	R	~	R
Wilson's warbler	~	~	C
Hooded warbler	R	~	R
Yellow-breasted chat	R	~	R
<b>TANAGERS</b>			
Summer tanager	C	~	O
Scarlet tanager	O	~	O
<b>GROSBEAKS</b>			
Northern cardinal	A	A	A
Rose-breasted grosbeak	O	~	O
Blue grosbeak	R	~	O
<b>BUNTINGS</b>			

Indigo bunting	C	~	C
Lazuli bunting	~	~	R
Painted bunting	R	~	R
Dickcissel	A	~	O
<b>SPARROWS</b>			
Eastern towhee	C	~	C
Spotted towhee	~	O	O
American tree sparrow	~	A	A
Chipping sparrow	C	~	C
Clay-colored sparrow	~	~	C
Field sparrow	C	~	C
Swamp sparrow	~	O	C
Vesper sparrow	~	~	C
Lark sparrow	C	~	C
Lark bunting	R	~	R
Savannah sparrow	~	~	C
Grasshopper sparrow	A	~	A
Henslow's sparrow	O	~	O
LeConte's sparrow	~	R	O
Fox sparrow	~	O	O
Song sparrow	R	O	C
Lincoln's sparrow	~	~	C
White-throated sparrow	~	O	O
White-crowned sparrow	~	O	O
Harris' sparrow	~	A	A
Dark-eyed junco	~	A	A
Lapland longspur	~	O	O
Snow bunting	~	R	R
<b>BLACKBIRDS</b>			
Bobolink	~	~	R
Red-winged blackbird	A	A	A
Eastern meadowlark	A	A	A
Western meadowlark	O	~	O
Yellow-headed blackbird	~	~	O
Rusty blackbird	~	O	O
Brewer's blackbird	~	R	O
Common grackle	A	~	A
Brown-headed cowbird	A	C	C
<b>ORIOLES</b>			
Orchard oriole	C	~	C
Baltimore oriole	C	~	C

Bullock's oriole	~	~	R
<b>FINCHES</b>			
Purple finch	~	O	O
House finch	O	O	O

Pine Siskin	~	O	O
American goldfinch	A	A	A
<b>WEAVER FINCH</b>			
House sparrow	A	A	A

**Appendix I, Table 4.** Complete list of birds observed during expected breeding times, and highest confirmation of confirmation of breeding status. PO=possible PR=probable CO=confirmed breeding. O-species not in breeding habitat; X-species in breeding habitat; P-pair (male & female) seen; T-bird holding territory; C-courtship/copulation; N-visiting probable nest site; A-agitated behavior or anxiety call; B-nest-building (woodpecker or wren); NB-nest building any other species; FL-fledged young; ON-adults enter or leave nest site; FY-adult carrying food; NE-nest with eggs; NY-nest with young M-Confirmed by MAPS project 1993-2005

SPECIES	Safe dates	Date seen	PO	PR	CO
American white pelican		Jun8-93	O		
Great blue heron	5/1-7/1	Jun16-94			NY
Little blue heron	5/30-7/31	Jun17-92	O		
Great egret	5/20-7/31	Jun11-07			ON
Green-backed heron	5/10-7/15	Jun7-93		P	
American bittern	5/25-8/10	My20-93	O		
Canada goose	5/1-8/1	Ap20-97			NE
Wood duck	4/1-8/1	Jun22-90			FL
Mallard*	4/20-8/31	My15-90			FL
Blue-winged teal	5/15-8/15	Jul31-89			FL
Green-winged teal	6/1-8-31	Jul--2002			FL
Common merganser		Jun8-93	O		
Hooded merganser	4/15-7/31	Jun7-93	O		
Lesser scaup		Jun7-93	O		
Turkey vulture	5/1-8/1	Jul5-95			NY
Mississippi kite	5/1-8/1	Sep8-15			FL
Bald eagle		My5-04			NY
Northern harrier	5/1-8/1	Ap29-93		A	
Sharp-shinned hawk	5/15-8/15	Jun12-93	X		
Coopers hawk	5/1-8/15				M
Red-tailed hawk	5/5-8/15	Jun1-93			NY
Broad-winged hawk	5/1-8/31	Jun10-13		P	
Red-shouldered hawk	4/1-8/31	Jun16-13			FL
American kestrel	4/5-7/31	Jul12-93			FL
Ring-necked pheasant	4/15-9/30	My25-94			FL
Gr. Prairie-chicken	4/20-8/31	Jun21-93			FL
Wild turkey	4/30-9/30	Jun28-93			FL
Northern bobwhite	4/20-8/31	Jul20-94			FL
Killdeer	4/20-7/31	Jun21-93			FL
Upland sandpiper	5/5-7/15	Jun18-90			FL
American woodcock	4/15-9/20	My 2010			NE
Ring-billed gull		Jun6-92	O		
Least tern		Jun15-97		C	

Rock dove	all year	Jul1-93			ON
Mourning dove	4/10-9/15	My18-93			NE
Black-billed cuckoo	6/1-8/15	Jul12-89			FL
Yellow-billed cuckoo	5/20-9/15	Jul18-92			NE
Eastern screech-owl	4/1-8/15	Jun17-97			FL
Great horned owl	3/1-7/31	My13-94			NY
Barred owl	3/15-8/31				M
Short-eared owl	4/1-7/15	Ap15-06		P	
Common nighthawk	5/20-7/31	Jn23-94			NE
Chuck-will's widow	5/1-8/10	My9-02			NE
Whip-poor-will	5/25-8/10	My28-95	X		
Common poorwill	5/25-8/10	Jun29-93	X		
Chimney swift	5/25-8/15				M
Ruby-throat hummingbird	6/1-7/31				M
Belted kingfisher	5/10-7/20	Jun13-99			ON
Red-headed woodpecker	5/15-8/20	Jun29-93			FL
Red-bellied woodpecker	4/15-7/31	Jun28-93			FL
Downy woodpecker	4/15-8/31				M
Hairy woodpecker	4/1-8/31				M
Northern flicker	5/1-7/31				M
Pileated woodpecker	4/15-8/31	Jun17-99		P	
Eastern wood pewee	6/1-8/1				M
Acadian flycatcher	5/20-8/5	Jun8-92	X		
Willow flycatcher	6/1-7/31		1996	X	
Least flycatcher	6/1-7/31			X	
Eastern phoebe	4/1-7/31	Jun1-93			NY
Gr-Crested flycatcher	5/25-8/1				M
Western kingbird	5/20-8/15				M
Eastern kingbird	5/25-8/15	Jul29-93			FL
Scissor-tailed flycatcher	5/25-7/15	Jun15-89			FL
Horned lark	4/20-7/15	My21-96	O		
Purple martin	5/15-6/25	Jul26-96			NY
Tree swallow	5/15-7/15	Jun13-13		P	
N. rough-winged swallow	5/25-7/15	Jun4-99			FY
Bank swallow	5/25-7/15	My20-96			ON
Cliff swallow	6/1-7/20	Jun9-93			ON
Barn swallow	5/5-8/5	Jul2-96			NY
Blue jay	4/20-7/31	My18-95			ON
Black-billed magpie	4/20-7/15	Jun4-97	X		
American crow	4/10-8/31				M
Black-capped chickadee	4/10-7/31	Jun9-93			FY
Tufted titmouse	4/15-8/31	Jun10-93			ON
White-breasted nuthatch	4/5-8/15				M
Brown creeper		Jun15-96	X		
Carolina wren	4/20-8/31				M
Bewick's wren	4/10-7/31	Jun11-93	X		
House wren	5/5-8/15	Jun27-92			ON
Sedge wren	7/1-9/10	Jul27-93	X		
Blue-gray gnatcatcher	4/20-7/31	My3-02			ON
Eastern bluebird	4/15-8/15	Jun9-93			FL
Wood thrush	5/30-8/20				M

American robin	4/15-8/20	My10-93			NE
Gray catbird	5/20-8/31				M
Northern mockingbird	4/25-8/31	My18-93	X		
Brown thrasher	5/10-7/31	My31-93			NY
Cedar waxwing	6/15-7/31				M
Loggerhead shrike	4/15-7/20	My20-95			FY
European starling	4/5-9/5	Jun28-93			FL
White-eyed vireo	5/20-8/15				M
Bell's vireo	5/15-8/15	Jul8-93			FY
Yellow-throated vireo	5/15-8/15	Jul1-05	X		
Warbling vireo	6/1-8/10				M
Red-eyed vireo	6/1-7/31	Jul1-95			FY
Northern parula	5/15-8/15				M
Prairie warbler	5/25-7/20	Jul15-03	X		
Yellow warbler	5/20-7/31	Jun4-99			FY
Black-&-white warbler	5/20-7/31	Jun9-92		P	
American redstart	5/20-7/20	Jun9-92	X		
Prothonotary warbler	5/20-7/31	Jun1-00		P	
Ovenbird	5/25-8/5				M
La. waterthrush	5/1-7/10				M
Kentucky warbler	5/15-7/15	Jun29-93			ON
Common yellowthroat	5/15-8/10				M
Yellow-breasted chat	5/25-8/5	Jun19-96		C	
Summer tanager	5/20-8/10	Jul8-95			FL
Scarlet tanager	5/20-8/10				M
Northern cardinal	4/15-9/30	Jul6-93			FL
Rose-breasted grosbeak	5/20-8/10				M
Blue grosbeak	5/25-8/10	Jul5-94	X		
Indigo bunting	5/25-8/15	Jun26-14		T	
Painted bunting	5/20-8/10	Jul5-95			FL
Dickcissel	6/1-8/15	Jul8-93			NY
Eastern towhee	5/5-8/31				M
Chipping sparrow	5/10-8/15	My20-93			NB
Field sparrow	5/1-8/31				M
Lark sparrow	5/10-7/31	Jun9-93			FY
Grasshopper sparrow	5/10-8/31	Jun25-93			NE
Henslow's sparrow	5/10-8/31				M
Song sparrow	5/1-9/10	Jun20-96			ON
Bobolink	6/1-7/20	Jun2-92	X		
Red-winged blackbird	5/10-8/31	Jul27-93			FY
Eastern meadowlark	4/20-8/15	Jun11-93			NE
Western meadowlark	4/20-8/31				M
Common grackle	5/10-7/10	Jul29-93			FY
Brown-head cowbird	5/1-7/10	Jun11-93			NE
Orchard oriole	5/20-7/31	Jul12-93			FY
Baltimore oriole	5/15-7/31	Jul31-93			FL
House finch	5/15-8/31	My31-96			NE
American goldfinch	6/20-7/30	Aug8-89			FL
House sparrow	3/15-8/31	My18-89			NY

**Appendix I, Table 5.** Reptiles, amphibians and turtles documented from Fort Riley. Records date back until 1993, and the table below depicts the observed count for the last decade. In 1993, surveys were conducted by the Kansas Biological Survey. Fort Riley Conservation Branch staff conducted all other surveys from 2002-present.

Species	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Snapping turtle	4	2	4	7		1		2	1	3	5
Painted turtle	2	10	9	11		11	25	13	6	16	28
False map turtle	6	2	3	14		3			8	1	7
Pond Slider	18	3		36	2	13	10	14	7	25	48
Ornate box turtle		2		1			1			2	
Smooth softshell				1				2			
Spiny softshell											
Softshell Sp.		1				3				3	1
Eastern collard lizard	9	20	38	19	15	65	52	34	26	20	16
Texas horned lizard	2	3	3	3	2			3	2		
Prairie lizard						1					
Great plains skink	35	30	48	35	35	64	48	23	58	12	36
Prairie skink									1		
Common Five-lined skink						1		1			
Little Brown skink		2	2	2	4	5	3	1	4	1	3
Slender Glass lizard	1	2		2	1			1	3		1
Six-lined racerunner		19	7	13	15	30	10	63	13	9	23
Western worm snake		1	4	2		2					1
Ring-necked snake	672	132	1,129	495	920	617	777	166	667	109	563
Plains hog-nosed snake											
Prairie kingsnake		1	1		3	1	1				1
Flat-headed snake				1							
Plains black-headed snake											

North American racer	3	2	25	7	13	21	9	4	12	2	4
Great plains ratsnake	5	5	23	27	17	28	25	12	20	6	35
Western ratsnake	1	4	4	7	2	4	4	1	1		3
Speckled kingsnake		1		2	1	4	1	2	2	3	1
Western milksnake	10	10	25	34	22	14	27	18	17	9	27
Gophersnake	2	2	3	1	2	5	1	2	1	3	5
Plain-bellied watersnake											
Common watersnake	4	14		7	1		1	6	1	2	4
Dekay's Brownsnake		2	1	1	3		5		1	1	3
Western ribbonsnake											
Plains gartersnake	1			1	6		2				
Common gartersnake	7	6	10	8	7	7	8	1	4	5	5
Lined snake	2	6	4	4	4			1	1	1	1
Eastern Copperhead	2		6	3	6	8	9	16	5	2	10
Timber rattlesnake		1									
Eastern Tiger Salamander											
Plains spadefoot		3		1							
Woodhouse's toad		2	3		1	45	3		1	4	
Great Plains Toad	2	1									
Blanchard's cricket frog	233	217	28	109	172	238	187	141	113+	88	254
Gray treefrog complex	1	1		1		23	5	5			
Boreal chorus frog	3	12	23	111		1848	8	4	93+	47	6
American Bullfrog	128	90	17	10	119	9	31	40	21+	24	509
Plains leopard frog	35	21		17	15	41	18	20	10+	8	25

W. narrow-mouthed toad	10	39	91	22	5	93	94	39	18	21	20
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**Appendix I, Table 6.** List of fishes on Fort Riley, Kansas.

x = collected in recent surveys; P = possible occurrence; E = extirpated

Common Name	Scientific Name	Streams	Rivers	Ponds
Shovelnose sturgeon	<i>Scaphirhynchus platyrhynchus</i>	-	X	-
Longnose gar	<i>Lepisosteus osseus</i>	X	X	X
Shortnose gar	<i>Lepisosteus platostomus</i>	X	X	X
American eel	<i>Anguilla rostrata</i>	-	P	-
Gizzard shad	<i>Dorosoma cepedianum</i>	X	X	X
Goldeye	<i>Hiodon alosoides</i>	-	X	-
Rainbow trout	<i>Oncorhynchus mykiss</i>	X	-	X
Common carp	<i>Cyprinus carpio</i>	X	X	X
Golden shiner	<i>Notemigonus crysoleucas</i>	X	-	X
Creek chub	<i>Semotilus atromaculatus</i>	X	-	-
Southern redbelly dace	<i>Phoxinus erythrogaster</i>	X	-	-
Silver chub	<i>Hybosis storeiana</i>	-	X	-
Speckled chub	<i>Hybosis aestivalis</i>	-	X	-
Sturgeon chub	<i>Hybosis gelida</i>	-	E	-
Suckermouth minnow	<i>Phenacobius mirabilis</i>	X	X	-
Emerald shiner	<i>Notropis atherinoides</i>	-	X	-
Carmine shiner	<i>Notropis percobromus</i>	X	-	-
Redfin shiner	<i>Notropis umbratilis</i>	X	-	-
Common shiner	<i>Notropis cornutus</i>	X	-	-
Red shiner	<i>Notropis lutrensis</i>	X	X	-
Topeka shiner	<i>Notropis topeka</i>	X	-	-
Sand shiner	<i>Notropis stramineus</i>	X	X	-
Plains minnow	<i>Hybognathus hankinsoni</i>	-	X	-
Fathead minnow	<i>Pimephales promelas</i>	X	X	X
Bullhead minnow	<i>Pimephales vigilax</i>	X	X	-
Bluntnose minnow	<i>Pimephales notatus</i>	X	X	-
Central stoneroller	<i>Campostoma anomalum</i>	X	X	-
Blue sucker	<i>Cycleptus elongatus</i>	-	X	-
Bigmouth buffalo	<i>Ictiobus cyprinellus</i>	X	X	X
Black buffalo	<i>Ictiobus niger</i>	-	X	-
Smallmouth buffalo	<i>Ictiobus bubalus</i>	X	X	X
Quillback	<i>Carpiodes cyprinus</i>	-	X	-
River carpsucker	<i>Carpiodes carpio</i>	X	X	X

Shorthead redhorse	<i>Moxostoma macrolepidotum</i>	x	x	-
Golden redhorse	<i>Moxostoma erythrurum</i>	x	-	-
White sucker	<i>Catostomus commersoni</i>	x	x	-
Black bullhead	<i>Ictalurus melas</i>	x	x	x
Yellow bullhead	<i>Ictalurus natalis</i>	x	P	x
Channel catfish	<i>Ictalurus punctatus</i>	x	x	x
Flathead catfish	<i>Pylodictis olivaris</i>	x	x	x
Slender madtom	<i>Noturus exilis</i>	x	-	-
Stonecat	<i>Noturus flavus</i>	x	x	-
Blackstripe topminnow	<i>Fundulus notatus</i>	x	-	-
Mosquitofish	<i>Gambusia affinis</i>	x	x	x
White bass	<i>Morone chrysops</i>	-	x	-
Wiper	<i>white bass x striped bass</i>	x	-	x
Smallmouth bass	<i>Micropterus dolomieu</i>	-	x	-
Spotted bass	<i>Micropterus punctulatus</i>	x	-	-
Largemouth bass	<i>Micropterus salmoides</i>	x	x	x
Green sunfish	<i>Lepomis cyanellus</i>	x	x	x
Redear sunfish	<i>Lepomis microlophus</i>	x	-	x
Bluegill	<i>Lepomis macrochirus</i>	x	x	x
Orangespotted sunfish	<i>Lepomis humilis</i>	x	-	-
Longear sunfish	<i>Lepomis magalotis</i>	x	-	-
White crappie	<i>Pomoxis annularis</i>	x	x	x
Black crappie	<i>Pomoxis nigromaculatus</i>	-	-	x
Walleye	<i>Stizostedion vitreum</i>	x	-	x
Saugeye	<i>Stizostedion vitreum x Stizostedion canadense</i>	-	x	-
Logperch	<i>Percina caprodes</i>	x	-	-
Johnny darter	<i>Etheostoma nigrum</i>	x	x	-
Orangethroat darter	<i>Etheostoma spectabile</i>	x	x	-
Freshwater drum	<i>Aplodinotus grunniens</i>	x	x	x

**Appendix I, Table 7.** List of fish species that have been documented in each Ft. Riley Stream.

Species	Wildcat Cr.	Silver Cr.	Sevemile Cr.	Fourmile Cr.	Threemile Cr.	Onemile Cr.	Forsyth Cr.	Little Arkansas Cr.	Honey Cr.	Wind Cr.	Dry Cr.	Drybranch Cr.	Madison Cr.	Farnum Cr.	Timber Cr.	Rush Cr.
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Bigmouth buffalo				x												
Black bullhead	x	x	x	x	x		x	x	x	x	x		x	x	x	
Blackstripe topminnow										x						
Bluegill	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x
Bluntnose minnow	x	x	x	x	x	x	x	x	x	x	x		x	x	x	
Bullhead minnow	x		x		x				x	x						
Carmine shiner	x	x	x	x	x	x	x	x	x	x						
Central stoneroller	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Channel catfish	x	x		x	x	x		x					x		x	
Common carp	x		x	x	x	x		x		x			x	x	x	x
Common shiner	x	x	x	x	x		x	x	x	x			x	x	x	
Creek chub	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Fathead minnow	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x
Flathead catfish	x												x			
Freshwater Drum*					x	x							x			
Gizzard shad					x	x	x					x		x	x	x
Golden redbreast	x															
Golden shiner	x				x		x				x		x	x	x	x
Green sunfish	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Johnny darter	x	x	x	x	x		x	x	x	x	x		x	x	x	x
Largemouth bass	x	x	x	x	x		x	x	x	x	x		x	x	x	
Logperch	x	x	x	x	x	x		x		x			x		x	
Longear sunfish	x	x	x		x		x	x	x	x						
Longnose gar	x															
Mosquitofish	x		x	x	x	x	x			x	x		x	x	x	x
Orangespotted sunfish	x	x	x		x	x	x	x	x	x	x		x		x	
Orangethroat darter	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Redear Sunfish	x				x					x					x	
Red shiner	x	x	x	x	x	x	x	x	x	x	x		x	x	x	
Redfin shiner	x	x	x	x	x	x	x	x	x	x	x		x	x	x	
River carpsucker	x			x	x										x	
Sand shiner	x		x	x	x	x	x			x			x			
Shorthead redbreast	x				x			x								
Shortnose gar												x		x		
Slender madtom	x	x	x	x	x		x	x	x	x			x			

Smallmouth bass					x											
Smallmouth buffalo													x			
Southern redbelly dace			x	x	x		x									
Spotted bass	x	x	x	x	x		x	x		x	x		x		x	
Stonecat	x		x	x	x			x	x	x			x			
Suckermouth minnow	x	x	x	x	x	x	x	x	x	x	x		x		x	
Topeka shiner	x	x	x					x	x	x						
Walleye													x		x	
White crappie	x				x								x	x	x	
White sucker	x	x	x	x	x	x	x	x	x	x			x		x	x
Wiper					x											
Yellow bullhead	x	x	x	x	x		x	x	x	x	x		x	x	x	

**Appendix I, Table 8.** Species list of fishes in Ft. Riley's 29 fishing ponds and lakes. Water bodies not listed due to none of the listed fish species being observed in them include Farnum, Marshall, and Rush Ponds.

Species	Avery	Beck	Blue	Bravo	Breakneck Lake	Cameron Springs	Campbell	Chestnut	Dale	Funston Lake	Gaches	Goens	Halasz	LeGrange	Miller	Moon Lake	CACTF (aka Nowlin)	Pritchard	Rich	Roblyer	Seven-mile	Sinn	Stone	Stortz	Vinton	Williams
Bigmouth buffalo										X																
Black bullhead										X																
Black crappie										X																
Bluegill		X	X	X	X	X	X	X	X	X	X	X		X		X	X	X	X	X	X		X	X	X	
Channel catfish		X	X	X	X	X	X	X	X	X	X	X	X	X		X	X		X	X	X	X		X	X	X
Common carp										X						X										
Fathead minnow	X		X								X			X	X		X	X	X	X		X	X		X	X
Flathead catfish		X			X	X				X						X										
Freshwater drum										X																
Gizzard shad					X					X						X										
Golden shiner		X	X			X	X		X					X						X	X	X		X	X	X
Grass carp		X			X	X																				
Green sunfish		X	X	X	X	X	X		X	X		X	X		X				X	X	X	X		X	X	X
Hybrid bluegill																										
Largemouth bass		X			X	X				X				X		X		X	X				X	X	X	
Longnose gar										X																
Mosquitofish					X					X																
Rainbow trout						X										X										
Redear sunfish					X									X		X										
River carpsucker										X																
Shortnose gar										X																
Smallmouth buffalo										X																
Walleye																										
White crappie					X	X		X		X						X										
Wiper																										

**Appendix I Table 9.** Mussel species documented from Ft. Riley's streams, rivers and lakes.

Common Name	Scientific Name	Live	Recent	Weathered
Threeridge	<i>Amblema plicata</i>	-	-	X
Wabash pigtoe	<i>Fusconaia flava</i>	-	-	X
Plain pocketbook	<i>Lampsilis cardium</i>	-	-	X
Yellow sandshell	<i>Lampsilis teres</i>	-	-	X
White heelsplitter	<i>Lasmigona complanata</i>	X	X	X
Black sandshell	<i>Ligumia recta</i>	-	-	X
Pondmussel	<i>Ligumia subrostrata</i>	X	X	X

Hickorynut	<i>Obovaria olivaria</i>	-	-	x
Fingernail clam	<i>Pisidium moitessierianum</i>			x
Fragile papershell	<i>Leptodea fragilis</i>	x		
Pink heelsplitter	<i>Potamilus alatus</i>	-	-	x
Pink papershell	<i>Potamilus ohioensis</i>	x	x	x
Giant floater	<i>Pyganodon grandis</i>	x	x	x
Mapleleaf	<i>Quadrula quadrula</i>	x	x	x
Pimpleback	<i>Quadrula pustulosa</i>	-	-	x
Lilliput	<i>Toxolasma parvus</i>	-	-	x
Pondhorn	<i>Unio merus tetralasmus</i>	x	x	x
Pistol-grip	<i>Tritogonia verrucosa</i>			x
Creeper	<i>Strophitus undulatus</i>			x

**Appendix I, Table 10.** Complete list of rare species of Fort Riley, the species' federal, state and Fort Riley status, and current Fort Riley occurrence.

	<b>SPECIES</b>	<b>Federal</b>	<b>State</b>	<b>Fort Riley Status</b>	<b>Fort Riley Occurrence</b>
Insects	American burying beetle, <i>Nicrophorus americanus</i>	T	E	**	Historic range
	Prairie mole cricket, <i>Grylotalpa major</i>	**	SINC, SGCN	**	Present all year
	Monarch, <i>Danaus plexippus</i>	CAN	SGCN	**	Summer resident Migrant
	Regal fritillary, <i>Speyeria idalia</i>	Status review	**	SAR	Present all year
	Regal fritillary, <i>Bombus pensylvanica</i>	Status Review	**	**	Historic Range
Mussels	Pondhorn, <i>Unio merus tetralasmus</i>	**	SGCN	**	Present all year
	Black Buffalo <i>Ictiobus niger</i>	**	SGCN	**	Present all year
	Blue sucker, <i>Cycleptus elongatus</i>	**	SINC, SGCN	**	Present all year
	Common shiner, <i>Luxilus cornutus</i>	**	SINC, SGCN	**	Present all year
	Flathead Chub <i>Platygobio gracilis</i>	**	T, SGCN	**	Historic range
	Golden Redhorse <i>Moxostoma erythrurum</i>	**	SGCN	**	Present all year

Fish	Johnny Darter, <i>Etheostoma nigrum</i>	**	SINC	**	Present all year
	Northern Plains Killifish <i>Fundulus kansae</i>	**	SGNC	**	Historic range
	Orangethroat darter, <i>Etheostoma spectabile</i>	**	SGCN	**	Present all year
	Ozark Logperch <i>Percina caprodes</i>	**	SGCN	**	Present all year
	Plains minnow, <i>Hybognathus placitus</i>	**	T, SGCN	**	Transient
	Quillback <i>Carpionodes cyprinus</i>	**	SGCN	**	Present all year
	River Redhorse <i>Moxostoma carinatum</i>	**	SINC	**	Present all year
	Shoal chub, <i>Macrhybopsis hyostoma</i>	**	T, SGCN	**	Historic range
	Shorthead Redhorse <i>Moxostoma macrolepidotum</i>	**	SGCN	**	Present all year
	Shovelnose sturgeon, <i>Scaphirhynchus platyrhynchus</i>	**	SGCN	**	Present all year
	Silver chub, <i>Macrhybopsis storeriana</i>	**	E, SGCN	**	Historic range
	Slender madtom, <i>Noturus exilis</i>	**	SGCN	**	Present all year
	Southern redbelly dace, <i>Phoxinus erythrogaster</i>	**	SINC, SGCN	**	Present all year
	Stonecat, <i>Noturus flavus</i>	**	SGCN	**	Present all year
	Sturgeon chub, <i>Macrhybopsis gelida</i>	**	T, SGCN	**	25 years since found
	Topeka shiner, <i>Notropis topeka</i>	E	T, SGCN	**	Present all year
White sucker, <i>Catostomus commersonii</i>	**	SGCN	**	Present all year	
Reptiles	Massasauga, <i>Sistrurus catenatus</i>	**	SGCN	**	Historic range
	Texas horned lizard, <i>Phrynosoma cornutum</i>	**	SGCN	SAR	Present all year
	Timber rattlesnake, <i>Crotalus horridus</i>	**	SINC, SGCN	**	Present all year

	Eastern hog-nosed snake, <i>Heterodon platirhinos</i>	**	SINC, SGCN	**	Historic range
	Plains hog-nosed snake, <i>Heterodon nasicus</i>	**	SINC, SGCN	**	Present all year
Turtles	Smooth softshell, <i>Apalone mutica</i>	**	SGCN	**	Present all year
Birds	Acadian flycatcher, <i>Empidonax virescens</i>	BCC	**	**	Summer resident
	American Avocet, <i>Recurvirostra americana</i>	**	SGCN	**	Migrant
	American bittern, <i>Botaurus lentiginosis</i>	BCC	SGCN	**	Migrant
	American golden plover, <i>Pluvialis dominica</i>	**	SGCN	**	Migrant
	American Tree Sparrow, <i>Spizella arborea</i>	**	SGCN	**	Winter resident
	American white pelican, <i>Pelecanus erythrorhynchos</i>	**	SGCN	**	Migrant
	Baird's Sandpiper, <i>Calidris bairdii</i>	**	SGCN	**	Migrant
	Bald eagle, <i>Haliaeetus leucocephalus</i>	EA, BCC	SGCN	**	Present all year
	Baltimore oriole, <i>Icterus galbula</i>	**	SGCN	**	Summer resident
	Barn Owl <i>Tyto alba</i>	**	SGCN	**	Present all year
	Bell's vireo, <i>Vireo bellii</i>	BCC	SGCN	**	Summer resident
	Bewick's wren, <i>Thryomanes beweckii</i>	BCC	**	**	Migrant
	Black-bellied plover, <i>Pluvialis squatarola</i>	**	SGCN	**	Migrant
	Black-billed cuckoo, <i>Coccyzus erythrophthalmus</i>	BCC	SGCN	**	Summer resident
	Black-crowned night-heron, <i>Nycticorax nycticorax</i>	BCC	**	**	Migrant
	Black-necked Stilt <i>Himantopus mexicanus</i>	**	SGCN	**	Migrant
	Black tern, <i>Chlidonias niger</i>	BCC	SINC, SGCN	**	Migrant
	Blue-winged warbler <i>Vermivora cyanoptera</i>	BCC	**	**	Transient

Bobolink, <i>Dolichonyx oryzivorus</i>	**	SINC, SGCN	**	Migrant
Buff-breasted sandpiper, <i>Tryngites subruficollis</i>	BCC	SGCN	**	Migrant
Bullock's oriole, <i>Icterus bullockii</i>	**	SGCN	**	Vagrant
Burrowing owl, <i>Athene cunicularia</i>	**	SGCN	**	Migrant
Canvasback, <i>Aythya valisineria</i>	**	SGCN	**	Migrant
Cerulean warbler, <i>Dendroica cerulea</i>	**	SINC, SGCN	**	Migrant, not documented
Chestnut-collared Longspur <i>Calcarius ornatus</i>	**	SGCN	**	Migrant
Chuck-will's-widow, <i>Antrastomus carolinensis</i>	**	SGCN	**	Summer resident
Common nighthawk, <i>Chordeiles minor</i>	**	SGCN	**	Summer resident
Common poorwill, <i>Phalaenoptilus nuttalli</i>	**	SGCN	**	Summer resident
Common Tern <i>Sterna hirundo</i>	BCC	**	**	Migrant
Dickcissel, <i>Spiza americana</i>	BCC	SGCN	**	Summer resident
Eared grebe, <i>Podiceps nigricollis</i>	**	SGCN	**	Migrant
Eastern Black rail, <i>Laterallus jamaicensis</i>	T	T	**	Migrant
Eastern kingbird, <i>Tyrannus tyrannus</i>	**	SGCN	**	Summer resident
Eastern meadowlark, <i>Sturnella magna</i>	**	SGCN	**	Present all year
Eastern whip-poor-will, <i>Antrastomus vociferus</i>	BCC	SINC, SGCN	**	Summer resident
Eastern wood-pewee, <i>Contopus virens</i>	**	SGCN	**	Summer resident
Ferruginous hawk, <i>Buteo regalis</i>	**	SINC, SGCN	**	Migrant
Field sparrow, <i>Spizella pusilla</i>	BCC	**	**	Summer resident
Forster's tern, <i>Sterna forsteri</i>	**	SGCN	**	Migrant

Golden eagle, <i>Aquila chrysaetos</i>	EA	SINC, SGCN	**	Transient
Grasshopper sparrow, <i>Ammodramus savannarum</i>	BCC	SGCN	**	Summer resident
Greater prairie-chicken, <i>Tympanuchus cupido</i>	**	SGCN	**	Present all year
Greater yellowlegs, <i>Tringa melanoleuca</i>	**	SGCN	**	Migrant
Harris' sparrow, <i>Zonotrichia querula</i>	**	SGCN	**	Winter resident
Henslow's sparrow, <i>Ammodramus henslowii</i>	BCC	SINC, SGCN	SAR	Summer resident
Horned Grebe <i>Podiceps auritus</i>	BCC	**	**	Migrant
Hudsonian godwit, <i>Limosa haemastica</i>	BCC	SGCN	**	Migrant
Kentucky warbler, <i>Oporornis formosus</i>	BCC	SGCN	**	Summer resident
Lark bunting, <i>Calamospiza melanocorys</i>	**	SGCN	**	Migrant
Lark sparrow, <i>Chondestes grammacus</i>	**	SGCN	**	Summer resident
Least Bittern <i>Ixobrychus exilis</i>	BCC	SGCN	**	Summer resident
Least sandpiper, <i>Calidris minutilla</i>	**	SGCN	**	Migrant
Lesser yellowlegs, <i>Tringa flavipes</i>	**	SGCN	**	Migrant
Loggerhead shrike, <i>Lanius ludovicianus</i>	BCC	SGCN	**	Present all year
Long-billed curlew, <i>Numenius americanus</i>	**	SINC	**	Transient, not documented
Long-billed dowitcher, <i>Limnodromus scolopaceus</i>	**	SGCN	**	Migrant
Marbled godwit, <i>Limosa fedoa</i>	BCC	SGCN	**	Migrant
Mississippi kite, <i>Ictinia mississippiensis</i>	**	SGCN	**	Summer resident
Northern bobwhite, <i>Colinus virginianus</i>	**	SGCN	**	Present all year



Northern flicker, <i>Colaptes auratus</i>	BCC	**	**	Present all year
Northern pintail, <i>Anas acuta</i>	**	SGCN	**	Migrant
Painted bunting, <i>Passerina ciris</i>	**	SGCN	**	Summer resident
Pectoral sandpiper, <i>Calidris melanotos</i>	**	SGCN	**	Migrant
Peregrine falcon, <i>Falco peregrinus</i>	BCC	SGCN	**	Migrant
Pied-billed grebe, <i>Podilymbus podiceps</i>	BCC	**	**	Migrant
Piping plover, <i>Charadrius melodus</i>	T	T, SGCN	**	Migrant
Prothonotary warbler, <i>Protontaria citrea</i>	BCC	SGCN	**	Summer resident
Red-headed woodpecker, Melanerpes erythrocephalus	BCC	SGCN	**	Summer resident
Red knot, <i>Calidris canutus rufa</i>	T	**	**	Transient, not documented
Rusty blackbird, <i>Euphagus carolinus</i>	BCC	SGCN	SAR	Winter resident
Scissor-tailed flycatcher, <i>Tyrannus forficatus</i>	**	SGCN	**	Summer resident
Semipalmated sandpiper, <i>Calidris pusilla</i>	**	SGCN	**	Migrant
Short-billed dowitcher <i>Limnodromus griseus</i>	BCC	**	**	Migrant
Short-eared owl, <i>Asio flammeus</i>	BCC	SINC, SGCN	**	Winter resident
Smith's longspur <i>Calcarius pictus</i>	BCC	**	**	Migrant
Snowy plover, <i>Charadrius alexandrinus</i>	**	T, SGCN	**	Migrant
Solitary sandpiper, <i>Tringa solitaria</i>	BCC	**	**	Migrant
Spotted towhee, <i>Pipilo maculatus</i>	**	SGCN	**	Winter resident
Sprague's pipit, <i>Anthus spragueii</i>	**	SGCN	**	Migrant
Stilt sandpiper, <i>Calidris himantopus</i>	**	SGCN	**	Migrant

	Swainson's hawk, <i>Buteo swainsoni</i>	**	SGCN	**	Migrant
	Upland sandpiper, <i>Bartramia longicauda</i>	BCC	SGCN	**	Summer resident
	Western Grebe <i>Aechmophorus occidentalis</i>	**	SGCN	**	Migrant, not documented
	Western kingbird, <i>Tyrannus verticalis</i>	**	SGCN	**	Summer resident
	Whimbrel <i>Numenius phaeopus</i>	BCC	**	**	Migrant
	White-rumped sandpiper, <i>Calidris fuscicollis</i>	**	SGCN	**	Migrant
	Whooping crane, <i>Grus americana</i>	E	E	**	Transient, not documented
	Wilson's phalarope, <i>Phalaropus tricolor</i>	**	SGCN	**	Migrant
	Wood thrush, <i>Hyocichla mustelina</i>	BCC	**	**	Summer resident
	Yellow rail, <i>Coturnicops moveborancensis</i>	**	SGCN	**	Migrant
	Yellow-throated warbler, <i>Dendroica dominca</i>	BCC	SINC	**	Migrant, not documented
Mammals	Eastern spotted skunk, <i>Spilogale putorius</i>	**	T	**	Historic range, Pitts*
	Franklin's ground squirrel, <i>Spermophilus franklinii</i>	**	SINC, SGCN	**	Historic range
	Northern long-eared bat, <i>Myotis septentrionalis</i>	T	T, SGCN	**	Historic range
	Southern bog lemming, <i>Synaptomys cooperi</i>	**	SINC, SGCN	**	Resident year round
Plants	Western prairie fringed orchid, <i>Platanthera praeclara</i>	T	**	**	Historic range

E = Endangered, any species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary to constitute a pest whose protection under the provisions of this Act would present an overwhelming and overriding risk to man.

T = Threatened, likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range

SINC = Species in Need of Conservation.

SGCN = Kansas designated as Species of Greatest Conservation Need

SAR = Fort Riley Species At Risk designation

BCC = Birds of Conservation Concern, 2008 list

EA = Protected under Bald and Golden Eagle Protection Act

CAN = Candidate for federal listing

\* It is unclear whether the author actually observed this species, or included it based on a literature review of the range for the species.

**Appendix I, Table 11.** Habitat abundance and distribution of rare species occurring on Fort Riley

**American burying beetles** occur in grass, forest and shrubby habitats that grow in sandy soil. Speculation is that soil type is more important than vegetation for this species. Despite intensive surveys throughout the 1990's, this species has not been documented from the installation.

**Prairie mole crickets** are restricted to native tallgrass prairie and most generally occur in areas that have not been plowed. This species has been found at sites in Training Areas 10, 52, 58, 75 and 79. Its distribution on the installation is likely more widespread than what is currently known.

**Monarchs** are seasonally abundant, and are often in association with milkweed plants. This butterfly may be observed May through October, but is most abundant in September during fall migration and may be observed throughout the installation.

**Regal fritillaries** are endemic to high quality tallgrass prairie sites, and are often in association with milkweed plants. This butterfly is active June through August and is abundant in appropriate habitat throughout the installation.

**Pondhorns** were located in Sevenmile and Timber creeks during surveys conducted in 1998. This was the fourth most abundant mussel on the installation. Surveys have not been repeated.

**Blue suckers** occur in swift currents in the main channels of the Kansas River. It has been found during surveys conducted in 1996 and 1997 (Quist unpubl data) and in 2018 upstream of Henry Bridge during KDWP survey.

**Common shiners** occur in small to mid-sized streams with clear water, gravel bottoms, a moderate to swift current, that are within the Kansas River system. It is common in Wildcat, Silver, Sevenmile, Fourmile, Threemile, Forsyth, Little Arkansas, Honey, Farnum, Madison and Wind creeks.

**Johnny darters** are found in shallow pools with little current, or riffles near the pools, typically in small, spring-fed tributaries of the Kansas River. However, on Fort Riley they have been found in the mainstems of the Kansas and Republican rivers, in Timber, Madison, Rush and Farnum creeks, all of which drain into Milford Lake, as well as in Honey, Threemile, Wind and Fourmile creeks.

**Orangethroat darters** are found in shallow riffles having bottoms of fine gravel or mixed gravel and sand. On Fort Riley they have been found in all mainstem streams as well as the Kansas and Republican rivers.

**Plain's minnows** occur in large streams that have broad beds of sand and shallow, braided flow. It is most common in shallow backwaters, gentle eddies, and along the edges of "sand waves" (Cross and Collins 1995). It has been found rarely in the Kansas River.

**Shoal chubs** live in shallow riffles of large, sandy streams, in the Republican, Missouri and Kansas rivers' watersheds. Previously classified as a subspecies of the speckled chub, the shoal chub was collected on the Republican and Kansas River during 2018 KDWP survey.

**Shovelnose sturgeons** live in rivers with swift currents and broad, sandy bottoms. It has been collected from the Kansas River on Fort Riley.

**Silver chubs** live in large, sandy rivers, common only in the Missouri and Kansas rivers in Kansas. Documented occurrence exists from the Republican River above Milford Lake (17 July 1984, Kansas Biological Survey Collection). The silver chub is likely extirpated from the Fort Riley area.

**Slender madtoms** occur in riffles of small, permanent streams with clear, cool water and rocky bottoms. This species is occasional in streams that drain directly into the Kansas and Republican rivers.

**Southern redbelly dace** occur in small, clear streams, often near the sources of streams. This species is occasional to common in Sevenmile, Fourmile, Threemile and Forsyth creeks.

**Stonecats** occur in riffles of permanent streams with clear, cool water and rocky bottoms. This species is occasional in streams that drain directly into the Kansas and Republican rivers.

**Sturgeon chubs** historically occurred in shallow, turbulent areas of the Kansas and Smoky Hill Rivers. Three sturgeon chubs were collected south of Fort Riley in 1964; none have been located in the Fort Riley vicinity since (USFWS 1993).

**Topeka shiner** pools are near the headwaters of prairie streams that have stable water levels, clear water, and gravel bottoms. Topeka shiners have been found in Little Arkansas, Wind, Wildcat, Honey, Silver and Sevenmile creeks. They have not been documented in these streams since 2011.

**White suckers** occur in small streams that have some area of rocky bottom. This species is occasional in most Fort Riley streams.

**Massasaugas** occur in a variety of habitats, from rocky, prairie hillsides to open wetlands, and are most abundant in wet grasslands. One unconfirmed report of this species exists for Fort Riley, from Maneuver Area J in 2005. However, the snake was not captured, no picture was taken to confirm the identification, and the individual was uncertain of the identification.

**Texas horned lizards** occur on dry, flat areas with sandy, loamy, or rocky surfaces and sparse vegetation. Numerous sightings of horned lizards have occurred in Training Units Training Areas 12, 14, 15, 17, 22, 23, 25, 26, 27, 29, 33, 35, 45, 46, 51, 91, 92, 102, 103, and Custer Hill Cantonment.

**Timber rattlesnakes** occur along heavily vegetated, rocky outcrops on partially forested hills. In 2010, an amateur herpetologist provided a photo of a timber rattlesnake reportedly from a rocky outcrop in Training Area 33. Subsequent surveys of this area have not relocated another rattlesnake.

**Eastern hog-nosed snakes** occur in a variety of habitats, from eastern forests to open prairies in western Kansas, and are most abundant in sandy areas. While documented specimens occur from Riley and Geary counties, none of this species has been located on Fort Riley.

**Plains hog-nosed snakes** occur in sand prairie habitat. This habitat occurs in sandy grasslands along the Kansas and Republican Rivers. Two individuals were discovered in 1993 surveys (Busby et al. 1994).

**Smooth softshell turtles** are semi-aquatic organisms rarely found far from water. It is commonly found in the Smoky Hill, Republican and Kansas rivers.

**Acadian flycatchers** are uncommon migrants and rare summer residents, and have only been documented from mature, riverine, floodplain forests. The species' relative breeding abundance ranking is low (RTLA-94<sup>th</sup> most abundant, BBS-not located).

**American avocets** are common transients, generally preferring larger wetland complexes than what is found on Fort Riley. Most Fort Riley observations have occurred in association with Milford Lake.

**American bitterns** are uncommon transients rarely observed on Fort Riley. Generally found in marshes, on Fort Riley observations have occurred in small fishing ponds ringed lightly by cattails.

**American golden-plovers** are primarily spring migrants, typically occurring in recently burned grasslands. They have been rare on Fort Riley, only documented in 2006 on burned grassland in the Douthitt Gunnery Complex.

**American tree sparrows** are common to abundant winter residents. This species is found in all habitats throughout the installation, and is frequently attracted to backyard feeding stations.

**American white pelicans** are common migrants observed on Fort Riley. Generally found loafing on Milford Lake or casually soaring, this species has been observed along the Kansas River as well.

**Baird's sandpipers** are occasional migrants observed on Fort Riley. Generally found on open sandbars, observations have occurred along the Kansas and Republican rivers, Milford Lake shoreline, and ponds with low water and unvegetated shoreline.

**Bald eagles** are common winter residents and summer residents that use mature trees and snags along the Republican, Smoky Hill and Kansas rivers, and the shoreline of Milford Lake. Eagle nests occur around Milford Lake and along the Kansas, Republican, and Smoky Hill Rivers.

**Baltimore orioles** are summer residents commonly observed on Fort Riley in woodland, residential and park-like habitats. The species' relative breeding abundance ranking is moderate (RTLA-25<sup>th</sup> most abundant, BBS-36<sup>th</sup> most abundant).

**Bell's vireos** are common summer residents breeding in riparian thickets and short, shrubby patches that are situated within larger grasslands. The species relative breeding abundance ranking is high (RTLA-13<sup>th</sup> most abundant, BBS-11<sup>th</sup> most abundant).

**Bewick's wrens** are uncommon migrants and uncommon summer residents, usually found in woodlands of various sizes. The species relative breeding abundance is moderately low (RTLA-75<sup>th</sup> most abundant, BBS-91<sup>st</sup> most abundant).

**Black-bellied plovers** are uncommon transients that have been observed on Milford Lake mudflats when the lake has been drawn down. Observations have been of single birds during fall migration.

**Black-billed cuckoos** are uncommon but regular summer residents, in woodlands and woodland edges. The species relative breeding abundance ranking is moderate to moderately low (RTLA-67<sup>th</sup> most abundant, BBS-52<sup>nd</sup> most abundant).

**Black-crowned night-herons** are uncommon migrants, occurring in shallow water wetlands by night and rookeries by day. Trees along Threemile Creek near the Threemile wetland have been used by black-crowned night-herons.

**Black rails** are secretive creatures usually found in wet meadows or meadows near marshes. Black rails have been documented during fall migration in grassland and food plot areas located in Maneuver Areas A, B, D, E, H and K. Their exact distribution and abundance are unclear.

**Black terns** are occasional spring migrants, numbering in the hundreds in some years. This species migrates above grassland and wetland habitats, and has been observed above Milford Lake and the Threemile wetland.

**Bobolinks** are rare transients, occurring in dense grasslands and alfalfa fields. Only one documented sighting of this species exists, from an unburned grassland in Maneuver Area O.

**Buff-breasted sandpipers** are rare migrants, generally occurring in dry uplands during migration. They have been rare on Fort Riley, only documented in 2006 on burned grassland in the MPRC training land.

**Bullock's orioles** are western vagrants rarely observed on Fort Riley. Generally, this species favors habitats frequented by Baltimore orioles.

**Burrowing owls** are typically found in short grass habitats, often associated with prairie dogs. Little habitat for this species is present. Three confirmed sightings of this species exist, in Maneuver Area B, H, K, and the Douthit Gunnery Complex.

**Canvasbacks** are uncommon migrants regularly observed during winter and early spring on Fort Riley on Milford Lake and the Custer Hill Sedimentation Ponds.

**Cerulean warblers** are rare migrants, not documented on Fort Riley, but could potentially occur in mature, riverine, floodplain forests. Sighting records exist from Riley (Manhattan) and Clay (Wakefield Arboretum) counties.

**Chuck-will-widows** are summer residents, presumably occurring in woodlands across the installation. Due to its nocturnal vocalizations, current bird surveys are inadequate to capture meaningful data for this species.

**Common nighthawks** are summer residents, observed flying over grasslands and urban areas. Being more active during daylight than other nightjars, current surveys do encounter this species; its relative breeding abundance is moderate (RTLA-42<sup>nd</sup> most abundant, BBS-50<sup>th</sup> most abundant).

**Common poorwills** seem to be an uncommon summer resident. Documented sightings have been in grassland habitats near the tops of hills, in Training Area 17 and Maneuver Area I. Due to its nocturnal vocalizations, current bird surveys are inadequate to capture meaningful data for this species.

**Dickcissels** are abundant summer residents, nesting in virtually every type of grassland that occurs on the installation. This is one of the most common breeding birds on the installation, with its relative breeding abundance high (RTLA-1<sup>st</sup> most abundant, BBS-1<sup>st</sup> most abundant).

**Eared grebes** are uncommon migrants regularly observed during migration on Fort Riley, most often on Milford Lake and the Custer Hill Sedimentation Ponds.

**Eastern kingbirds** are common summer residents, breeding in grassland habitats, although they are also found in woodlands during migration. The species relative breeding abundance ranking is moderately high (RTLA-9<sup>th</sup> most abundant, BBS-24<sup>th</sup> most abundant).

**Eastern meadowlarks** are common summer and winter residents, occurring in open grasslands of all types and sizes. This is one of the most common breeding birds on the installation, with its relative breeding abundance high (RTLA-3<sup>rd</sup> most abundant, BBS-3<sup>rd</sup> most abundant).

**Eastern whip-poor-wills** typically occur in woodland habitats from April to October. Fort Riley occurs at the extreme western portion of their range. Although occasionally encountered, actual abundance on the installation is unknown as current bird surveys are inadequate to capture meaningful data for this species due to the species nocturnal habits.

**Eastern wood-pewees** are common summer residents in woodland habitats, more frequently encountered in larger blocks of forest. This is a fairly common breeding bird on the installation, with its relative breeding abundance moderately high (RTLA-24<sup>th</sup> most abundant, BBS-26<sup>th</sup> most abundant).

**Ferruginous hawks** may rarely occur as transients during the winter months, occurring in open grassland habitats. Only one confirmed sighting of this species exists.

**Field sparrows** are common summer residents that occur in grasslands with shrubs and thickets, and on the edge between grasslands and riparian woodlands. It occurs throughout the training areas. The species relative breeding abundance ranking is high (RTLA-8<sup>th</sup> most abundant, BBS-4<sup>th</sup> most abundant).

**Forster's terns** are regular migrants during spring and fall, observed above large marshes, rivers and impoundments. It is regularly observed foraging in and above the Republican River and Milford Lake.

**Golden eagles** are rare transients and winter visitors, and occur most regularly over open grasslands in western states. Confirmed sighting of this species exists in Training Areas 49, 60 and 64.

**Grasshopper sparrows** are abundant summer residents, nesting in virtually every grassland with little or no shrubby vegetation, especially shorter grass areas. This is one of the most common breeding birds on the installation, with its relative breeding abundance high (RTLA-4<sup>th</sup> most abundant, BBS-12<sup>th</sup> most abundant).

**Greater prairie-chickens** are common year-round residents, occurring regularly in the larger grassland fields that occur in Maneuver Areas A, D, E, H, K, L, and O, the MPRC box and the Impact Area. The species relative breeding abundance ranking is moderately low (RTLA-59<sup>th</sup> most abundant, BBS-64<sup>th</sup> most abundant).

**Greater yellowlegs** are common migrants observed on Fort Riley, they are generally found in shallow water wetlands wherever those occur, as open sandbars along the Kansas and Republican rivers, Milford Lake shoreline, shallow ponds and ephemeral wetlands.

**Harris' sparrows** are common to abundant winter residents. This species is found in all habitats that provide a shrubby component throughout the installation, and may be attracted to backyard feeding stations.

**Henslow's sparrows** breed in large, grassland tracts (> 30 ha) that have not been burned or hayed for 2-5 years. This bird is more common in some years than others. The species relative breeding abundance ranking is moderate (RTLA-28<sup>th</sup> most abundant, BBS-51<sup>st</sup> most abundant).

**Hudsonian godwits** are uncommon migrants rarely observed on Fort Riley. Generally found in marsh and wetland areas, this species has also been observed in burned, upland prairie.

**Kentucky warblers** are occasional summer residents, occurring in the understory vegetation of mature woodlands. The species relative breeding abundance ranking is moderately low (RTLA-53<sup>rd</sup> most abundant, BBS-62<sup>nd</sup> most abundant).

**Lark buntings** are western vagrants rarely observed on Fort Riley during migration. Generally, this species favors shortgrass and open fields for feeding and loafing.

**Lark sparrows** are common summer residents that typically occur in ecotones between grassland or shrub and forested habitat types. The species relative breeding abundance ranking on Fort Riley is moderate (RTLA-51<sup>st</sup> most abundant, BBS-31<sup>st</sup> most abundant).

**Least sandpipers** are common migrants observed on Fort Riley. Generally found on open sandbars, observations have occurred along the Kansas and Republican rivers, Milford Lake shoreline, and ponds with low water and unvegetated shoreline.

**Least terns** use unvegetated sandbars and islands in wide, riverine channels. Other unvegetated, exposed shorelines also may be used. Least terns were frequently observed along the Kansas River following the 1993 Kansas River flood, and along the shoreline of Milford Lake. None have been reported since 2012.

**Lesser yellowlegs** are occasional migrants observed on Fort Riley, they are generally found in shallow water wetlands wherever those occur, as open sandbars along the Kansas and Republican rivers, Milford Lake shoreline, shallow ponds and ephemeral wetlands.

**Loggerhead shrikes** regularly occur in low numbers throughout the year, with peak sightings typically occurring in spring. Shrikes inhabit grasslands that are interspersed with scattered, woody vegetation. The species relative breeding abundance ranking is low (RTLA-85<sup>th</sup> most abundant, BBS-89<sup>th</sup> most abundant).

**Long-billed curlews** are rare migrants through the area, breeding in high plains rangeland and wintering on coastal mudflats. While sighting records exist for Clay, Geary and Riley counties, no documented sightings are known from Fort Riley.

**Long-billed dowitchers** are common migrants through the area, foraging primarily on exposed mudflats. This habitat is often scarce on Fort Riley, so they are only occasionally seen. Most sightings of this species have occurred along the shoreline of Milford Lake.

**Marbled godwits** are uncommon migrants rarely observed on Fort Riley. Generally found in mudflats, documented sightings from Fort Riley occurred on Milford Lake mudflats and a stormwater retention basin in Camp Forsyth.

**Mississippi kites'** populations are expanding in eastern Kansas, nesting in urban and wild areas, with the only seemingly requirement being the presence of mature trees for the nest. Kite sightings are becoming more frequent each year, with at least three nests documented on the installation. Increasing numbers of this species on the installation is anticipated.

**Northern bobwhites** are common, year-round residents that typically occur in ecotones between grassland, shrub and forested habitat types. The species relative breeding



abundance ranking on Fort Riley is high (RTLA-15<sup>th</sup> most abundant, BBS-6<sup>th</sup> most abundant).

**Northern flickers** are present on Fort Riley throughout the year. Most of the breeding birds probably move southward in the winter; the wintering birds are northern and western individuals. This species occurs across the installation, needing only isolated trees or poles for breeding. The species relative breeding abundance ranking is moderate (RTLA-39<sup>th</sup> most abundant, BBS-43<sup>rd</sup> most abundant).

**Northern pintails** are common migrants irregularly observed on Fort Riley due to lack of large, emergent wetlands. Areas on Fort Riley more prone to view this species are Milford Lake, and Madison Creek and Foxtrot wetlands.

**Painted buntings** are a rare summer resident, typically occurring in woodland edge habitats or where extensive cedar encroachment is occurring into grassland. This species has not yet been detected during spring breeding bird surveys, but one breeding pair is documented.

**Pectoral sandpipers** are regular migrants through the area, frequenting the grassy edges of marshes, flooded fields and exposed mudflats. This species has been observed on mudflat habitat created at Milford Lake during a late summer drawdown.

**Peregrine falcons** are spring and fall migrants and can occur as occasional winter transients. These falcons most often are observed in wetland environments. The species is rare, with a confirmed sighting being received approximately once every 2-3 years.

**Pied-billed grebes** are common transients during spring and fall, observed on impoundments. It is regularly observed swimming on installation ponds and Milford Lake.

**Piping plovers** use unvegetated sandbars and islands that provide good visibility in wide, riverine channels. Other unvegetated, exposed shorelines also may be used. Piping plovers were observed along the Republican and Kansas Rivers in 1996, but have not been seen since then.

**Prothonotary warblers** are uncommon migrants and rare summer residents, and have only been documented from mature, riverine, floodplain forests. At least one breeding pair is documented.

**Red-headed woodpeckers** are common summer residents and, in years with abundant oak mast, may overwinter. This species may occur throughout the installation, needing only isolated trees or poles for breeding. The species relative breeding abundance ranking is moderately low (RTLA-55<sup>th</sup> most abundant, BBS-47<sup>th</sup> most abundant).

**Rufa red knots** are unlikely migrants through the area, nesting on the Canadian Arctic and wintering along coasts of the Gulf of Mexico, Caribbean, and South America. Generally, the birds make very brief stops, foraging on exposed mudflats. This species has been observed at Tuttle Creek Reservoir; no other local sightings are known.

**Rusty blackbirds** are uncommon transients and local winter residents, observed in woodlands and wooded thickets along streams and rivers. They have been documented in Training Areas 3, 19, 20, 25, 27, 28, 53, 75, 91, 92, 103, and along the Kansas River.

**Scissor-tailed flycatchers** are occasional summer residents, occurring in open habitats with scattered trees. The species relative breeding abundance ranking is moderately low (RTLA-61<sup>st</sup> most abundant, BBS-57<sup>th</sup> most abundant).

**Semipalmated sandpipers** are occasional migrants observed on Fort Riley. Generally found on open sandbars, observations have occurred along the Kansas and Republican rivers, Milford Lake shoreline, and ponds with low water and unvegetated shoreline.

**Short-eared owls** are regular winter residents, occurring in low numbers on the installation in the large tallgrass prairie tracts of Maneuver Areas A, D, E, G, H, K, L, O and the MPRC box. In one year a pair of owls was observed well into the spring months, but a breeding attempt was never confirmed.

**Snowy plovers** use unvegetated sandbars and islands that provide good visibility in wide, riverine channels. Other unvegetated, exposed shorelines also may be used. A snowy plover was observed along the Kansas River in 1996.

**Solitary sandpipers** are uncommon migrants through the area, foraging primarily on exposed mudflats. This species has been observed along the unvegetated shoreline of Milford Lake, along sandbars and mudflats of the Kansas and Republican rivers, and in vernal pools in upland locations.

**Spotted towhees** are occasional winter residents, occurring in woodland and woodland edge habitats.

**Sprague's pipits** may be more common than what is observed during migration, but remain obscure due to the species's tendency to not vocalize or sit on perches during migration. Occurring in open grasslands, there is only one documented sighting of this bird.

**Stilt sandpipers** are uncommon migrants through the area, foraging primarily on exposed mudflats. This species has been observed along the shoreline of Milford Lake and along unvegetated sandbars and mudflats of the Kansas and Republican rivers.

**Swainson's hawks** are common migrants, usually observed flying over large open fields that are being burned, or recently burned, and have also been observed following tractors that are disking food plots.

**Trumpeter swans** are rare migrants on Fort Riley, but may be observed during migration on large lakes, wetlands, and rivers in Kansas. This species was observed at the MAAF in 2019.

**Upland sandpipers** are common summer residents, breeding in grassland tracts larger than 40 acres in size. The species relative breeding abundance ranking is moderately common (RTLA-19<sup>th</sup> most abundant, BBS-21<sup>st</sup> most abundant).

**Western kingbirds** are common summer residents, occurring in open habitats with scattered trees as well as in urban settings. The species relative breeding abundance ranking is moderate (RTLA-50<sup>th</sup> most abundant, BBS-53<sup>rd</sup> most abundant).

**White-rumped sandpipers** are occasional migrants observed on Fort Riley. Generally found on open sandbars, observations have occurred along the Kansas and Republican rivers, Milford Lake shoreline, and ponds with low water and unvegetated shoreline.

**White-tailed kites** are rare migrants through Kansas. A pair was observed in Maneuver Area E during the 2017 migratory season.

**Whooping cranes** are migrants through Kansas. Selected stopover sites generally are wetlands 1 ha or larger in size that provide shallow water and good visibility. Whooping cranes have not been documented on FRK, although they have been along other stretches of the Kansas River and Milford Lake.

**Wilson's phalaropes** are occasional migrants observed on Fort Riley. Generally found on open sandbars, observations have occurred along the Kansas and Republican rivers, Milford Lake shoreline, and ponds with low water and unvegetated shoreline.

**Wood thrushes** are uncommon summer residents, often heard singing in the larger tracts of floodplain and riparian woodlands. The species relative breeding abundance ranking is low (RTLA-66<sup>th</sup> most abundant, BBS-72<sup>nd</sup> most abundant).

**Yellow rails** are rare on Fort Riley, occurring around the edges of heavily-vegetated wetlands. One sighting is documented from the installation.

**Yellow-throated warblers** are rare migrants, not documented on Fort Riley, but could potentially occur in mature, riverine, floodplain forests. Sighting records exist from Riley and Geary counties.

**Brazilian free-tailed bats** are known residents of SW Kansas and will migrate long distances. It was recently documented (2019) on Fort Riley when one was captured in a building.

**Eastern spotted skunks** use natural and manmade structures such as fences, embankments, hedgerows, brush piles, abandoned buildings, and woody stream corridors. Pitts et al. (1987) reported sightings of this species. However, none have been documented on the installation since that publication.

**Franklin's ground squirrels** are associated with the zone where tallgrass prairie and deciduous forest come into contact. While documented specimens occur from Riley County, none of this specie has been located on Fort Riley.

**Northern long-eared bats** are associated with deciduous forest and has an assumed range that includes Fort Riley. No documented specimens occur from Clay, Geary or Riley counties.

**Southern bog lemmings** are colonial and inhabit communities of thick matted ground cover with high overhead vegetation in both forests and grasslands. This species has been occasionally captured during small mammal trapping performed on the installation.

**Western prairie-fringed orchid** occurs in wet areas of native, tallgrass prairies. It has not been documented on Fort Riley, but there is an historic record within the Wildcat Creek watershed north of the installation.

### **Literature Cited**

Busby, W.H., J.R. Parmelee, C.M. Dwyer, E.D. Hooper, and K.J. Irwin. 1994. *A Survey of the Herpetofauna on the Fort Riley Military Reservation*. Kansas Biological Survey Report No. 58. 79 pp.

Obermeyer, B.K. 1998. Freshwater Mussels on Fort Riley Military Reservation, Kansas. Unpubl. Report.

Pitts, R.M., LeValley, M.J. and S. Klinger. 1987. *Mammals of Fort Riley, Kansas*. Transactions of the Kansas Academy of Science. 90(102):75-80.

USFWS (US Fish & Wildlife Service) 1993. Status Report on Sturgeon Chub (*Macrhybopsis gelida*), a Candidate Endangered Species.

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**APPENDIX J: DISTRIBUTION AND ABUNDANCE OF GAME ON FORT RILEY**

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**Upland Game**

**Northern Bobwhite:** Northern bobwhites occur throughout the installation but are most plentiful in extensive edge habitat and mosaic vegetation communities. Their preferred habitat is a mixture of grassland, shrubland, woodland, and ground dominated by annual plants (e.g., cropland and other disturbed areas) interspersed to provide abundant edge. The first three are present in adequate quantities along the installation's stream courses. The amount of disturbed areas producing early successional plants varies from year to year due to the amount and intensity of military training. Cropland areas are limited and restricted to those firebreak areas leased for crop production (less than 1,600 acres) and wildlife food plots (approximately 800 acres).

Northern bobwhite populations fluctuate annually and are susceptible to adverse weather. Spring auditory counts and other empirical evidence suggest that bobwhite populations were generally stable from 1995-2020. However, overall abundance has not reached numbers observed between 1987-1993.

**Ring-necked pheasant:** Fort Riley supports a modest population of ring-necked pheasants. Annual spring auditory surveys indicate that ring-necked pheasants are most abundant north of Vinton School Road. Their preferred habitat is roughly equal proportions of grassland, cropland, and shrubland with less woodland. Spring surveys suggest that the ring-necked pheasant population varies annually, but has remained steady over time.

Fort Riley will probably never support high densities of ring-necked pheasants, especially if biologically appropriate prairie management continues. Prescribed burning and mechanical removal of shrublands have produced more homogeneous grassland by removing the brushy cover that pheasants prefer. Also, haying of grasslands and insufficient cropland area are important factors suppressing the number of ring-necked pheasants and, therefore, available for harvest. Additionally, much of the grassland has been invaded by isolated trees that provide roosting sites for avian predators of pheasants and other game birds.

**Greater prairie-chicken:** Greater prairie-chickens sustain a viable population because of Fort Riley's extensive grasslands. Spring lek surveys indicate that the greatest densities of greater prairie-chickens are in the central area on the largest expanse of high quality grassland. This grassland, relatively free of riparian timber along its creeks, is in the Danger Fan of the Douthit Gunnery Complex (17,000 acres of contiguous native grassland). No leks recently have been found on the installation's east side (Maneuver Areas C, F, and I) or south of Vinton School Road.

Spring lek surveys have been conducted since the mid-1980s. Results indicate that greater prairie-chicken numbers generally increased from 1994-2002, generally decreased from 2003-2012, and increased again from 2013-2021. Overall, results indicate that prairie-chicken populations are remaining stable, as the number of leks and the number of birds on leks in 2021 were stable and higher, respectively, than similar data from 1990.

Spring lek surveys indicate the breeding population's size has been relatively stable, which contrasts to populations in other parts of the Flint Hills. Many parts of the Flint Hills use a popular grazing management system termed Intensive Early Season Grazing, in which landowners annually burn their entire pastures in mid-April, intensely graze cattle on the burned prairie through mid-summer, and then remove the cattle from the grassland to allow it to recover before the onset of winter dormancy. Intensive Early Season Grazing is believed to be detrimental to prairie-chickens. In contrast, Fort Riley range management practices do not manage for livestock, and may be adjusted to favor prairie-chicken production.

***Mourning dove:*** Mourning doves are well distributed because interspersed grassland, "go-back" shrubland, woodland, and weedy, disturbed sites provide excellent spring and summer habitat. Consequently, many doves nest on Fort Riley each year. Most migrate from Fort Riley by late October, but a few individuals do winter at the installation. Mourning doves are found where annual forbs are most abundant, often in disturbed areas.

European rock doves are also found on Fort Riley and often with mourning doves. This naturalized species is very similar to mourning doves and is also considered a game species in Kansas.

***Cottontail rabbits:*** Cottontail rabbits inhabit open forests (40–50 percent crown cover), forest edges, brushy areas and uncultivated fields, all of which are abundant and especially common around old building sites and on improved grounds.

***Fox Squirrel and Gray Squirrel:*** Fox squirrels, which are occasionally seen as black-phase individuals, are common in the woodlands, especially in open oak-hickory gallery forests along Wildcat, Timber, and Madison creeks. They are also common throughout the cantonment and other improved grounds. Conversely, eastern gray squirrels are rare, as Fort Riley lies on the extreme western edge of their geographical range.

***American Woodcock:*** American woodcock are uncommon fall migrants on Fort Riley and rarely have been found nesting. Kansas is the western most limit of their range and as such are not a high priority management species. They are closely associated with woodland areas, particularly those along the rivers and streams.

### **Big Game**

Of the wildlife found on Fort Riley, those the Kansas Department of Wildlife and Parks (KDWP) defines as "big game" are white-tailed deer, mule deer, and elk. Fort Riley

supports established and huntable populations of white-tailed deer and elk. Few mule deer occur the installation, as Fort Riley lies along the extreme eastern edge of their distribution range. The most recent recorded harvest of mule deer at Fort Riley was in 1984 when three were taken.

***White-tailed Deer:*** The white-tailed deer in Kansas is a highly adaptable species whose numbers peaked in the early 2000's and has now stabilized below that high. This species can adapt to many habitats but is most common in forest edges, woodlands, and riparian corridors. On Fort Riley, this species also inhabits mixed shrub and prairie communities as well as prairie/woodland edges.

Fort Riley's deer herd is characterized as productive since most animals have good body condition and males exhibit excellent antler development. Reproductive tract analysis and the fawn-doe ratio of harvested animals indicate that many female fawns of 6-months of age by early-December are bred, and most yearling and adult does give birth to two fawns. Field dressed weights of female and male yearlings average 100 and 115 pounds, respectively. Adult males are occasionally documented exceeding 200 pounds field-dressed.

Competition for deer hunting opportunities has increased dramatically in recent years. That trend is likely to continue as the overall population of Fort Riley and surrounding communities continues to grow. Significant changes in the 2008 Kansas Deer Hunting Regulations greatly increased the number of hunters eligible to hunt on Fort Riley. Thus, adjustments to permit distribution and participation were made in 2008 to preclude a reduction in opportunities for Active Duty Military.

***Elk:*** Elk (also known as wapiti) are primarily grazing animals that inhabit open prairies and woodlands and woodland edges. They were extirpated from Kansas early during state settlement and were reintroduced to the Fort Riley region in 1986 as a collaborative effort between the installation and the KDWP. Other Federal agencies, the Kansas State University-Cooperative Fish and Wildlife Research Unit, and private, non-profit conservation organizations have supported various aspects associated with the reintroduction.

Initially, twelve elk were reintroduced to Fort Riley in 1986 with five supplemental stockings since then. The total number of elk released on Fort Riley to date is 50. Most came from a captive herd maintained by the KDWP near McPherson, Kansas, although a few were trapped from free-ranging herds in Colorado and Montana. The latest stocking was in 1994 when 18 elk were brought from Wind Cave National Park, South Dakota. The purpose of this stocking was not to increase absolute numbers but to increase the genetic diversity of the herd. All elk stocked were certified to be free of disease.

Intermittent aerial surveys of elk were conducted from 1986 until 1997, when systematic, rigorous aerial population surveys began. Surveys indicate that the herd had been increasing at approximately 20% annually. Surveys conducted in February 1998 suggested that the elk population was approximately 152-164 head. However, surveys

in August 1998 (after spring calving), estimated the population to be 200-225. Surveys in 1999, 2000 and 2001 indicate that hunting mortality had reduced the herd size substantially.

Aerial surveys completed between 2010 and 2017 have documented between 112 and 232 total elk. The population is considered to be slightly increasing in overall number with an estimated size of 275-300 animals. The antlered to antlerless ratio is estimated to be between 3:1 and 4:1. The high bull to cow ratio reflects that the bull harvest is conservative while the cow to calf ratio is approximately 1.6:1.0, which suggests high herd productivity.

**Wild turkey:** Wild turkeys are another species extirpated during Kansas's early settlement. Fort Riley, in cooperation with the KDWP, began reintroducing wild turkeys to the installation in 1984. Six (two male, four female) eastern wild turkeys were released along Wildcat Creek in January 1984, with an additional stocking of one male and three female eastern subspecies birds near the original release site in January 1985. At about the same time, the KDWP released both eastern wild turkeys and Rio Grande wild turkeys in the Timber Creek Drainage on its Milford Lake Public Hunting Area, which lies adjacent to Fort Riley's western boundary. From those and other stockings in the Kansas River drainage, turkeys have spread and are now commonly found throughout the installation.

Wild turkeys prefer oak-hickory gallery forests, but they also like secondary growth woodlands and mixed shrub/woodland habitats. Most wild turkeys on the installation are hybrids of the eastern and Rio Grande subspecies.

### **Waterfowl**

Fort Riley's numerous water impoundments provide feeding and loafing areas for waterfowl using the Central Flyway Migration Corridor during their spring and fall migrations. Nineteen species of ducks and five species of geese have been observed on Fort Riley. Ducks observed have been mallard, gadwall, green-winged teal, blue-winged teal, cinnamon teal, northern shoveler, wood duck, American wigeon, northern pintail, common merganser, hooded merganser, red-breasted merganser, bufflehead, ring-necked duck, ruddy duck, lesser scaup, common goldeneye, redhead, and canvasback. Canada, snow, Ross's, cackling and greater white-fronted are the geese that have been observed on Fort Riley. Canada goose, wood duck, mallard, green-winged teal and blue-winged teal have been confirmed nesting on Fort Riley.

### **Furbearers**

Fort Riley's mixture of diverse vegetative communities, impoundments, and streams provides good habitat for several commercially valuable furbearers. Beaver, bobcat, muskrat, raccoon, coyote, red fox, striped skunk and badger are relatively abundant on the installation. Gray fox are less common whereas few mink have been recorded. Long-tailed weasels have been recorded only twice.

The Kansas State University Cooperative Unit conducted research (1996-2000) regarding niche partitioning among mammalian predators on Fort Riley. Data from that

study show that Fort Riley had one of the highest densities of bobcats, coyotes, raccoons, and opossums reported in the literature.

Wildcat, Madison, Farnum, Threemile, Rush, and Timber creeks were surveyed for furbearer activity during the summer of 1986 (Robel et al., 1987). Signs of beaver, muskrats, and raccoons were abundant along Madison Creek and the northern portions of Wildcat Creek. Relatively few signs were seen along Rush and Timber creeks. The other streams surveyed had moderate signs along their banks. No detailed population data is available for other furbearers; however, coyotes and striped skunks were considered abundant.

Furbearer populations are underutilized as a recreational resource on Fort Riley. Typically fewer than ten coyotes and raccoons are reported harvested per year. Little effort is, therefore, expended directly to manage their populations except to control nuisance individuals. Nuisance individuals are routinely trapped and euthanized.

### **Literature Cited**

Busby, W.H., J.R. Parmelee, C.M. Dwyer, E.D. Hooper, and K.J. Irwin. 1994. *A Survey of the Herpetofauna on the Fort Riley Military Reservation*. Kansas Biological Survey Report No. 58. 79 pp.

USFWS (US Fish & Wildlife Service) 1993. Status Report on Sturgeon Chub (*Macrhybopsis gelida*), a Candidate Endangered Species.

Pitts, R.M., LeValley, M.J. and S. Klinger. 1987. *Mammals of Fort Riley, Kansas*. Transactions of the Kansas Academy of Science. 90(102):75-80.



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**APPENDIX K: SURVEYS PERFORMED ON FORT RILEY.**

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**History of Flora and Fauna Monitoring and Surveys**

Various surveys have been conducted through the years. Conservation Branch, Directorate of Public Works, primarily conduct these surveys, but DPTMS personnel through the RTLA portion of the ITAM program have conducted long-term flora and fauna surveys. Conservation Branch has on file data collected since the early 1980's regarding various populations of wildlife.

Surveying and collecting of harvest information require substantial effort. Until recently, inadequate staffing has been a problem. Beginning in the mid-1990s, added staff began conducting expanded surveys. In particular, surveys of non-game fish populations, threatened and endangered species, and non-game wildlife were greatly expanded.

**Threatened and Endangered Species**

Federally- and state-listed species have been inventoried, and Federally-listed species are monitored as part of overall compliance with the Endangered Species Act. Population monitoring objectives for Federally-listed threatened and endangered species are specified in the species' management plans.

Surveys are conducted each year to assess abundance, distribution and habitats used on the installation. This information is used for management as well as compliance, specifically, to assess the effects of the Army's actions and to develop Biological Assessments.

**Piping Plover**

Surveys to locate piping plovers on Fort Riley were initiated in 1994 as part of an overall Riverine Bird Survey. Survey sites provide a view of the sandbar and beach habitats on the installation. Approximately 40% of Milford Reservoir's shoreline on Fort Riley is surveyed, and more than 76% of riverine sandbar habitat is surveyed. This includes more than 90% of sandbar habitat along the Republican River and approximately 60% of habitat along the Kansas River. Surveys are performed between early April and mid-May, and mid-July and mid-September. Other shorebirds or waterbirds of interest, such as least terns and black terns, are recorded as well.

**Topeka Shiner**

The first systematic, extensive surveys for Topeka shiners occurred in 1991. The USFWS used a minnow seine to survey Wildcat, Little Arkansas, Wind, Four Mile, Threemile, Timber and Rush creeks on Fort Riley during that summer. No Topeka shiners were found, although the USFWS reported the presence of apparently suitable habitat in a number of survey areas.

Annual surveys of all Fort Riley streams by Conservation Branch personnel began in 1995. These surveys followed protocol used by the USFWS, which consisted of identifying the fish and recording only the species present. Such a sampling design

allowed for personnel to conduct many surveys and to sample all streams on the installation in a timely manner, but did not provide the means to collect detailed population data. Topeka shiners have been located in six streams as a result of these surveys; Wildcat, Little Arkansas, Sevenmile, Honey, Silver and Wind creeks.

Surveys for Topeka shiners are conducted every other year in streams in which this species has been found. Surveys are conducted a minimum of one out of every five years in streams in which Topeka shiners have not been found. The objectives of these surveys are to determine Topeka shiner presence, fish species assemblages, the density of the various species, water flow values and qualitative information of silt loads. Data will be recorded as needed to meet these objectives. Additional data during surveys may be collected if new information indicates such efforts to be warranted.

### **Northern Long-Eared Bats**

Fort Riley has conducted bat surveys since 2011 using the Anabat SD2 bat detector. Bat echolocation calls are recorded by the detector. Several software programs are used to analyze the calls. These programs automatically analyze each call recorded, identify which species the call most closely resembles, and assign a probability that the classification is correct. After this automated process is complete, the program AnalookW can be used to manually view any calls of interest. AnalookW generates a spectrogram of the call, allowing the user to visually compare the call in question to known spectrograms for the species, and therefore determine if the classification was correct. The presence of the northern long-eared bat has not been confirmed on the installation. The Conservation Branch will continue surveys for northern long-eared bats. If the presence of northern long-eared bats is confirmed on Fort Riley, more intensive surveys for this species will be conducted, both to further delineate where this species occurs on the installation, and to better understand when, where and how this species is using Fort Riley habitats. The surveys may include Anabat technology, drift nets, visual inspections of potential roost sites, or other survey technologies that may come available.

### **Black Rail**

Black rails on Fort Riley have previously never occurred. In the past, Conservation Branch biologists have most often observed black rails during the fall mowing season in food plots. Because black rails are primarily known to nest and conglomerate within wetlands, future Fort Riley Black Rail surveys will be focused on conducting callplayback surveys during the twilight hours from April 15- May 30, as described in the USFWS Secretive Marsh Bird Monitoring Program (Conway 2015). If personnel and logistics allow, additional surveys will include repeated surveys efforts (up to 3 efforts) to each of the estimated 60 wetland areas, as well as later summer surveys of the various food plots located around the installation.

### **Others**

Several species have not been observed on the installation but could potentially occur. Thus, the objective of monitoring is simply to record their presence if it occurs. Whooping crane surveys have been conducted by observing possible roosting sites on the Kansas River. The American burying beetle was systematically surveyed by using pitfall traps

from 1995 to 1998. These systematic searches were suspended after 1998 after failure to document any of this species. Other species such as the western prairie fringed orchid and white-faced ibis also are searched for incidentally to other fieldwork.

Future searches for species potentially occurring on the installation will be secondary to monitoring efforts for occurring species.

### **Non-Game Mammals**

#### **Pitts et al. (1987)**

Pitts et al. (1987) conducted mammalian surveys and literature reviews while stationed at Fort Riley. Five of the species reported in that study are not known to have been seen since. From that report, it is sometimes difficult to distinguish animals actually documented from animals that the literature suggested should be present.

#### **RTLA surveys**

The RTLA procedure recommends inventorying small mammal populations to help determine health of training lands. Various protocols have been used to perform these surveys. Initially, small mammals were monitored using snap traps distributed in a specified pattern paralleling a vegetation transect line. Sixty transects were sampled for two consecutive nights, once during the spring. The first change to this protocol was to substitute Sherman live traps for the snap traps. Other changes have included altering the time of year for trapping, altering the number of times sampling each transect, and changing the number and locations of transects per year. Training land availability, weather, personnel availability, and improving the protocol have all been reasons for the changes.

The emphasis during the last several years had been to find a rigorous and appropriate methodology and have it become the standard. Small mammal trapping is no longer conducted as part of the RTLA program on Fort Riley.

### **Bats**

Bat surveys were conducted annually from 1996 through 2002. Surveys conducted from 1996 to 1998 were performed primarily in the improved grounds and in historic buildings. The Corps of Engineers Waterway Experiment Station conducted a limited bat survey in 1997 as part of their Conservation Assistance Program and initially identified two bat species using mist-nets: the little brown bat and the big brown bat. The single little brown bat collection was later discredited using forearm length and determined to be a juvenile big brown bat. Surveys were expanded in 1999 to include unimproved grounds. Bat roost and acoustic surveys have been conducted annually from 2011 to present.

Survey methods for bats included use of a bat detector, direct observation, and direct capture. Mist nets were used on the outside of bat roosts and where bats were likely to fly. Mist nets were also put up over creeks, at the edge of timber, and along lakes and ponds. A bat detector was used to first determine the presence of bats in an area. Bats were also hand-captured at roost sites. Bat houses are checked for use.

Fort Riley Pest Managers have documented bats in buildings since 1989. To date, all bats except three that have been removed from buildings have been big brown bats; the exceptions were two eastern red bats, and a recent capture of a Brazilian free-tailed bat from Building 229. Overall, 202 buildings have registered bat complaints. Some buildings had a one-time complaint, while in others bats are a recurring conflict. Buildings that have registered bat complaints are shown in Exhibits K.1-3.

## **Non-Game Birds**

### **Bald Eagles**

Staff intermittently performed aerial surveys for bald eagles from 1982 to 1990. These surveys consisted of a one-time helicopter fly-over of the Republican and Kansas rivers, from Highway 77 to Marshall Army Airfield. All eagles observed were counted and identified as adult or immature. In 1990-1991, the USFWS conducted bi-weekly ground surveys on the Republican and Kansas rivers and on Milford Reservoir from December to mid-March. All eagles observed were counted and identified as whether adult or immature, and weather conditions at the time of survey were recorded.

Conservation Branch personnel began systematic annual surveys in 1993 using the protocol established by the USFWS in previous surveys. A nocturnal roost was discovered as a result of these surveys in 1994. Two sets of surveys are now conducted annually; a Diurnal Habitat Utilization Survey and a Nocturnal Roost Utilization Survey. Each survey is conducted from mid-October to mid-March annually.

Diurnal surveys are performed weekly. The objectives for the diurnal survey are to determine which areas of Fort Riley are most utilized by bald eagles during daylight hours, whether this utilization changes over time, and how eagle numbers fluctuate throughout the winter.

Roost surveys are performed weekly. The objectives of the nocturnal roost survey are to determine how many eagles roost on Fort Riley, under what weather conditions roosts are most utilized, and for which winter dates eagles roost on the installation. Data have been rigorously collected and statistically analyzed relative to nocturnal use and have contributed greatly to the understanding of the use of Fort Riley for roosting.

### **Henslow's sparrow surveys**

Henslow's sparrows have been systematically monitored since 1994. Data indicate that Fort Riley supports one of the largest breeding populations in the United States. In addition, data derived from this effort directly contributed to the USFWS decision not to list this species.

Surveys for Henslow's sparrows occur only in high-quality habitats. Native tallgrass prairie is considered high-quality habitat. Grasslands which received a high degree of disturbance due to military-vehicle maneuvering are not considered high-quality habitat, even though they may not have been burned or hayed.

From 2005-2012 grassland bird surveys were conducted to capture other grassland species. Five-minute point counts are conducted at 500 m intervals along roads that occur through and at the periphery of areas identified to potentially contain Henslow's sparrow habitat. Surveys are performed 100 m from the roads to reduce bias caused by roadside habitat features. Survey routes are driven between 0600-1000 hours on mornings with no precipitation and winds less than 15 mph. Census points along the routes that occur in woodlands are not surveyed. Hayed, burned and vehicle-tracked fields encountered along survey routes are surveyed. In 2013 the grassland surveys were consolidated with the existing Breeding Bird Survey (BBS) routes listed below.

The three most common breeding species found by this are the brown-headed cowbird, dickcissel, and eastern meadowlark. Other common birds identified include Henslow's sparrow, upland sandpiper, Bell's vireo, mourning dove, grasshopper sparrow and eastern kingbird.

### **Loggerhead Shrike surveys**

Systematic monitoring of the loggerhead shrike was conducted by a Kansas State University-Division of Biology graduate student (1995 to 1997) as part of research on shrike habitat use. Loggerhead shrikes also are monitored incidentally to other fieldwork, but are not systematically surveyed.

### **Fort Riley's Breeding Bird Monitoring Plan**

INTRODUCTION. Encompassing 41,170 ha, Fort Riley is one of the largest tracts of tallgrass prairie remaining available for long-term research programs in comparison to the Nature Conservancy's Oklahoma Tallgrass Prairie Preserve (16,000-ha), Konza Prairie Biological Station (3,500-ha), and the U.S. Tallgrass Prairie National Preserve (11,000-ha). As a U.S. Department of Defense (DoD) military installation, Fort Riley must comply with all applicable federal and state statutes, including the Sikes Act (16 USC 670a-670o, 74 Stat. 1052). This act states that the department is responsible for implementing conservation and rehabilitation of natural resources on each military installation, working in conjunction with an Integrated Natural Resources Management Plan (INRMP). The Fort Riley INRMP includes wildlife management goals and objectives guided by a variety of monitoring programs, specifically highlighting duties dedicated to species designated as "mission sensitive." Mission sensitive species are species that if federally listed, their presence could encumber the military training mission across multiple installations in which they occur due to the Endangered Species Act. It is the DPW, Environmental Division's responsibility to monitor and manage these species to preserve the success of the military mission so that if listed, we may provide a solid foundation of reasoning and planning as to why the species may or may not be affected by training.

Mission sensitive bird species that occur on the Fort Riley Military Reservation include the Northern Bobwhite (*Colinus virginianus*) (resident), Henslow's Sparrow (*Ammodramus henslowii*) (breeding bird), and the Rusty Blackbird (*Euphagus carolinus*) (winter migrant). The Department of Defense Partners in Flight (PIF) also provides a "Tier 2" species list, which includes bird species in steep decline that have a high probability of becoming mission sensitive species in the future. Tier 2 species that have been observed

on Fort Riley are the Grasshopper Sparrow (*Ammodramus savannarum*) (breeding bird), Redheaded Woodpecker (*Melanerpes erythrocephalus*) (resident), Wood Thrush (*Hylocichla mustelina*) (breeding bird), Kentucky Warbler (*Ammodramus savannarum*) (breeding bird), Prairie Warbler (*Setophaga discolor*) (breeding bird), Prothonotary Warbler (*Protonotaria citrea*) (breeding bird), and Loggerhead Shrike (*Lanius ludovicianus*) (resident). All of these species have an unknown density, distribution, and demography on the installation, making us unprepared for anticipated species listings and therefore not meeting an essential DoD goal of being “mission ready”. The following proposal details the implementation of a robust breeding bird monitoring program across Fort Riley, with a pilot year beginning in May of 2021. As described in the Journal of Wildlife Management (Gibbs et al. 1999), a successful program must meet the following Monitoring Program Objectives:

- (1) Be framed by well-articulated objectives that are closely linked to management goals;
- (2) Measure a subset of informative indicators with sampling methods that permit unbiased and statistically powerful results while minimizing costs and logistical problems
- (3) Ensure program continuity despite the vagaries of change in personnel, technology, and program objectives; and
- (4) Quickly make accessible appropriately analyzed information to a wide audience, particularly policymakers.

By revising the Fort Riley bird monitoring efforts, we can begin to meet the criteria of all four of the above-mentioned objectives for successful monitoring program of both game and nongame bird species, thus more readily achieving objectives listed in the INRMP. For Monitoring Program Objective (1), the newly revised breeding bird survey protocol will have the following articulated objectives:

- (1) Estimate the density of breeding bird species occurring on Fort Riley, based upon land cover type and management regime. This objective specifically applies to threatened, endangered, and species of concern.
- (2) Establish annual, installation-wide presence-absence maps of bird species of concern on the installation to aid in the identification of where management practices should expand or contract.
- (3) Create standardization and conglomeration of summer bird-surveying efforts on the installation to increase the efficiency of breeding bird population monitoring and management.

These objectives are not only linked to avian management, but also the overarching management goals of the INRMP, which is conservation of tallgrass prairie and sustaining a heterogeneous landscape for training purposes. These protocol objectives will allow the determination of how military training and conservation practices such as food plot management, woody encroachment removal, herbicide/pesticide application, and brush mowing affect avian species densities on the installation, subsequently allowing us to adapt practices accordingly. To increase the efficiency and accuracy of avian population monitoring and management on the Fort Riley Military Installation, the proposed revision

includes eliminating the Land Condition Trend Analysis (LCTA) bird survey, breeding bird survey, grassland bird survey, and spring game bird counts.

To meet monitoring program objective (2), Fort Riley biologists will begin utilizing the modern professional standard for avian population monitoring, distance sampling. Since its inception in the early 2000s, the implementation of detection probabilities has become one of the most important tools in population ecology (Buckland et al. 1993, 2001, Kissling and Garton 2006, Thompson and La Sorte 2008). Distance sampling is a method in which the biologist records the distance and species of each bird observed from the center of the radial point count. The biologist then uses the distances along with their associated variables such as vegetation structure or weather in an algorithm, resulting in unique detection probabilities and density estimates. When used properly, distance sampling accounts for the varying levels of detection probability based on an array of environmental and species-specific variables, resulting in higher accuracy in estimating species abundances (Thompson and La Sorte 2008). The distance sampling method is a progressive step from the method currently employed at the Fort Riley Military Reservation, which is the rudimentary numeric count (Table 1). Previous records show that Fort Riley has utilized relative abundance to report densities of various game and nongame species, which we now understand as misleading and unrepresentative of local population statuses and trends (Thompson and La Sorte 2008, Rigby and Johnson 2019, Kissling and Garton 2006). Additionally, the numeric count method that we currently employ in our protocols detects changes in populations two to three years later than the proposed distance-sampling based, fixed-radius point count method (Diefenbach et al. 2003).

For local management, distance sampling can use multiple survey efforts, or repeated measures design, to create a robust analyses and output of densities by collecting more detections over time and specifically within a single season. This will involve survey-level stratification within Program Distance to account for the repeated surveying of a location (Thomas et al. 2010). The temporal stratification of survey effort is the preferred method of effort due to the high spatial correlation, low temporal correlation, and minimal observer error that occurs on the local scale of Fort Riley (Rhodes and Jonzen 2011). This contrasts the previously used single-survey effort design of the citizen-science based Breeding Bird Survey that occurs throughout the continent (Sauer et al. 2013). The nationwide Breeding Bird Survey has low spatial correlation and high temporal correlation paired with high observer variance, supporting the format of single annual observations of locations over a large number of sites (Rhodes and Jonzen 2011). While this design is beneficial in determining population trends on a continental scale, it is insufficient in guiding a local management program (Sauer et al. 2013).

Along with the type of data that is collected, the placement of survey sites holds importance as well. The breeding bird survey, grassland bird survey, spring pheasant survey, and spring bobwhite survey each have survey points located along roads, which creates bias in the data collected (Droege 1990, Sauer et al. 2013, Wellicome et al. 2014). In the past, founders of bird monitoring efforts supported road surveys due to their practicality of travel and locating points (Ralph et al. 1995). However, we now have in-hand GPS technology that allows for ease of navigation to randomized survey sites and

understand the bias that roads create. For example, previous studies show that the Henslow's sparrow, a Fort Riley species of concern, increases in abundance up to 59% at 600-m away from a road (Lituma and Buehler 2016). However, it should be noted that the same study describes low-traffic roads as creating minimal bias on other grassland bird species estimates such as the Northern bobwhite. Further research on the road-based Breeding Bird Survey design states that species groups such as warblers, wetland birds, and sparrows are significantly misrepresented (Sauer et al. 2013). Roadside surveys also introduce more than bias in just species estimates, they can also result in biologists observing different bird communities overall than what is actually occurring at the interior of grassland expanses (Wellicome et al. 2014).

Lastly, with this proposed revision we can increase the efficiency of bird monitoring efforts as well. Modern efforts of the Fort Riley bird monitoring involve five separate types of avian surveys, each at different locations with varying methods and efforts of data collection (Table 1). Although the initiation of each unique bird survey may have been warranted at the time, the consolidation and improvement of each effort can improve the efficiency of limited time and resources while increasing the accuracy of avian population reports. Each breeding season that we conduct the BBS, LCTA, ring-necked pheasant, and northern bobwhite quail surveys, Fort Riley biologists spend a minimum of 91.5 hours of labor collecting avian population data (Table 1). These 91.5 hours of effort result in collections of statistically low-quality data, providing little more than rough population indices and species accounts. The proposed methods in this report would require an estimated 100-110 hours of labor to complete, all while providing higher quality data that we may be analyze using advanced techniques to meet the new standard of wildlife science.

## METHODS.

**Summer Field Collection. *Breeding Birds.*** Survey site locations will be located across the entire installation, excluding sections known as cantonment, MPRC, and Impact Area (Figure 1). We determined the site locations using a fishnet design with 1600-m<sup>2</sup> cell sizes in ArcMap, meeting a core assumption of distance sampling, which is randomized survey locations while still maintaining full monitoring coverage of the installation (Buckland et al. 2001). The survey contains 101 points total, with each point being a sufficient distance from the next to avoid the double recording of birdcalls and reduce chances of movement between points (Ralph et al 1995) (Figure 1). The number of survey points was determined based upon the size of Fort Riley, as well as the amount of effort previously dedicated by the conservation branch to breeding bird surveys. Additionally, literature states that a minimum of 50, 5-min surveys is required to begin capturing differences between rare and common species, and a minimum of 30, 5-min surveys per habitat type are required to investigate community differences (DeSante 1986, Ralph et al 1995). To account for the change in detection probability across years, each location will be surveyed a minimum of three times within each breeding season to collect an adequate number of observation for most species (Kissling and Garton 2006, Reidy et al. 2011). Surveys will take place between 0630-hrs and 1030-hrs, when weather conditions are appropriate (Ralph et al. 1995). Surveys will not occur during high winds (20 km/hr, or 12 mph), precipitation, or fog (Ralph et al. 1995). We will conduct a minimum of 3 survey



efforts at each location, the first effort conducted between May 10 - May 31, second between June 1 – June 22, and third between June 23- 14 (Ralph et al 1995). Additional surveys, such as a survey between April and May or during winter, may be added as well to account for game bird species, migratory variants, and wintering species.

We have chosen the radial point-count method of distance sampling rather than the line-transect approach due to the goal monitoring of multiple species at once, as well as being the modern standard for breeding bird monitoring (Buckland et al. 2008, Matsuoka et al. 2014). The radial point method will also allow for clearer assessment of changes in population density and habitat structure over time compared to the line-transect method (Buckland et al. 2008). Upon arrival to the survey site, the wildlife biologist will record observer name, temperature, time, cloud cover, and date. The biologist will then allow a silent 2-min adjustment period to account for the human disturbance created upon arrival to the site. Recording and using the covariate of observer in analyses will allow us to be partially fulfilling monitoring program objective (3) by accounting for the inherent bias that change in personnel creates in the reported breeding bird densities each year. Each survey will then ensue for 5-minutes, and the biologist will record the species and detection distance using a rangefinder, to the nearest meter, of every bird seen or heard within 200-m during the survey period (Kissling and Garton 2006, Reidy et al 2011). We selected a survey duration of 5-min due to the standards set in previous literature, and that travel time between most survey points in a given morning is estimated to be equal to or less than 15-m (Ralph et al. 1995). Additionally, the 5-min survey period allows a long enough period to detect inconspicuous bird species while limiting the time for movement among common species (Fuller and Langslow 1984). We define detection distance as the distance of the bird from the center of the radial point count at first detection, whether flying or stationary. Prior to the collection of any avian survey data, all biologists will train on the identification of Kansas bird species, proper steps of the point count survey, and detection distance estimation (Kepler and Scott 1981, Kissling and Garton 2006).

Each of these methods is subject to change following the 2021 pilot year to allow proper adjustment of length of survey, distance of fixed-width radius, survey locations, and the introduction of new information (Efford and Dawson 2009, Hutto 2016).

*Vegetation Assessments.* At each survey location, we will annually collect habitat-related covariates in the field to meet our objective of investigating the effects of management practices on breeding bird communities. These vegetation assessments will occur at four separate locations per survey, one in each cardinal direction and 100-m from the survey center. We will collect information at two nested scales: 1-m<sup>2</sup> and 10-m<sup>2</sup>. Within the 1-m<sup>2</sup> plot, we will record percent litter, bare ground, native grass, non-native grass, native forb, and non-native forb. Within the 10-m<sup>2</sup> area imposed over the same location, we will record average vegetation height using a Robel pole, native to non-native plant ratio, number of trees present, presence or absence of tank trails, and recent management regime if applicable.

Floristic inventory surveys will also be conducted at each point count survey location on a quarterly annual rotation. Floristic inventory surveys at each point will consist of five sections of 1-m<sup>2</sup> floristic inventory, four sections located in each cardinal direction, 30-m

out from the point count coordinate (Olechnowski et al 2009). Collecting these variables, specifically plant species composition, will help maintain proper inventory of flora occurring on Fort Riley while additionally annually monitoring the status of invasive plant species as required by the INRMP. Management regimes we will record include chemical application, fire, haying, and mechanical woody removal. The wildlife biologist will assess the management status of each site during every survey effort to account for seasonal change, and estimate the time since the management regime occurred. When used in the multiple-covariate distance sampling approach, these covariates will bolster the accuracy of the resulting density estimates (Marques et al. 2007).

**Winter Field Collection. *Rusty Blackbird Surveys.*** Monitoring for the rusty blackbird should take place during the winter, beginning November 1 and ending around the end of March (Douthitt 1919). We will conduct the surveys in the same format as the breeding bird monitoring program, as a 200-m radial point count that ensues for 5-min. Although the rusty blackbird will be our main objective for the winter bird-monitoring program, we will also record all other bird species observed within the limits of the survey to allow further assessment of the installations winter bird communities. Surveys will not take place during low-visibility, precipitation, or extreme temperatures. Due to their gregarious behavior, we will record rusty blackbirds relative to flock sizes. Our winter monitoring program will only include locations that fall in or near land cover types that are more likely to be selected by rusty black birds, such as woodland mosaics, food plots, and wetlands areas. A second modification from the summer breeding bird program is that our winter field methods will allow for a longer window for observation, with surveys occurring anywhere between 700-hrs and 1600-hrs. To investigate how our management regimes affect the rusty blackbird, we will simultaneously collect habitat-related information including management practices (mowing, tree removal, food plot treatment, chemical application, and fire) and structural compositions (percent grass, percent litter, percent forb, and percent bare ground) at each location. Besides studies of management effects and habitat use, future investigations specific to the rusty blackbird should also include monitoring of mercury levels within our wetland areas (Greenberg et al 2011).

**Analyses- *Distance Sampling.*** To prevent oversampling, and thus any unneeded expenditure of biologist labor hours, we will calculate a species-accumulation curve following the completion of the pilot year (2021). This ecological tool will allow us to assess the efficiency of our study design by describing whether our number of samples are adequately representing the annual avian species composition of Fort Riley. Reassessment is a pertinent step in successful monitoring programs, and should continue to be routinely completed on a 2-5 year basis to ensure enacted surveys continue to support informed management decisions. Repeated assessment of the efficiency and success of this monitoring program will ensure completion of objective (3).

We will analyze the collected distance sampling data using Program Distance, as well as Program R. The subsequent results will then provide species-specific density estimates based upon environmental variables, meeting objective (1). Distance categories will include a minimum of five 10-m interval “bins” of estimated detection distances to ensure that there is adequate amount of information for the creation of a detection function (Kissling and Garton 2006, Buckland et al. 2008).

*Analyses- Geographic Information System.* The design and expected longevity of this monitoring program should provide a multitude of options for future research and analysis. The Environmental Division will utilize spatial analysis and maps as a tool to assess annual, installation-wide statuses of vegetation characteristics and bird species abundances. By creating these maps, we will be meeting Objective (2). The maps will additionally allow us to meet Monitoring Objective (1) by creating a powerful visual tool to provide to our cooperators, policy makers, and overseers. As an overarching goal, we will aim to depict any changes or stagnations in the following year-by-year variables on the maps, in addition to their relationships: bird species densities, habitat management completed (woody removal, haying, burning, chemical application, mowing), and vegetation compositions. Current analysis options within program ArcMap include (but are not limited to) the following:

- Suitability Index: Calculates an index value from multiple layers for each pixel and creates a ranked-order map. Input includes various layers with predefined importance, which rely upon habitat recommendations from reviewed literature.
- Interpolation: Interpolates predictive values in unsampled areas, based upon data provided by surveys. Results include a “heat map” of a value, such as Henslow’s Sparrow density.

Analysis- General Statistics in Program R.

Current analysis options within Program R include (but are not limited to) the following:

- Detrended Correspondence Analysis (DCA): DCA is a statistical ordination, resulting in a description how species or groups of species respond to a variety of ecological gradients, such as management regime intervals or land cover types. (Hill and Gauch 1980, Freemark and Kirk 2001, Hovick et al 2015)
- Generalized Linear Mixed Models: Commonly used for non-normal data to involve random effects. (Batary et al 2006, Bolker et al 2008)

## **LITERATURE CITED**

- Althoff, D. P., J. S. Pontius, P. S. Gipson, and P. B. Woodford. 2005. A Comprehensive Approach to Identifying Monitoring Priorities of Small Landbirds on Military Installations. *Environmental Management*. 34:887-902.
- Bolker, B.M., M. E. Brooks, C. J. Clark, S. W. Geange, J. R. Poulsen, M. H. H. Stevens, and J. S. S. White. 2009. Generalized linear mixed models: a practical guide for ecology and evolution. *Trends in Ecology and Evolution*. 24: 127-135.
- Buckland, S. T., S. J. Marsden, and R. E. Green. 2008. Estimating bird abundance: making methods work. *Bird Conservation International*. 18:S91-S108.
- DeSante, D. F. 1986. A field of the variable circular-plot censusing method in a Sierran subalpine forest habitat. *The Condor*. 88: 129-142.

- Diefenbach, D. R., D. W. Brauning, and J. A. Mattice. 2003. Variability in Grassland Bird Counts Related to Observer Differences and Species Detection Rates. *The Auk*. 120:1168-1179.
- Douthitt, B. P.. 1919. Migration Records for Kansas Birds (Continued). *The Wilson Bulletin*. 31:6-20.
- Droege, S.. 1990. The North American Breeding Bird Survey. In: Sauer, John R.; Droege, Sam, editors. Survey designs and statistical methods for the estimation of avian population trends. Biological Report 90(1). Washington, DC: Fish and Wildlife Service, U.S, Department of the Interior; 1-4.
- Efford, M. G., and D. K. Dawson. 2009. Effect of Distance-Related Heterogeneity on Population Size Estimates from Point Counts. *The Auk*. 126:100-111.
- Freemark, K. E., and D. A. Kirk. 2001. Birds on organic and conventional farms in Ontario: Partitioning effects of habitat and practices on species composition and abundance. *Biological Conservation*. 101:337-350.
- Fuller, R. J., and D. R. Langslow. 1984. Estimating numbers of birds by points counts: How long should counts last?. *Bird Study*. 31: 195-202.
- Gibbs, J. P., H. L. Snell, and C. E. Causton. 1999. Effective Monitoring for Adaptive Wildlife Management: Lessons from the Galapagos Islands. *Journal of Wildlife Management*. 63:1055-1065.
- Greenberg, R., D.W. Demarest, S.M. Matsuoka, C. Mettke-Hofmann, D. Evers, P. B. Hamel, J. Luscier, L.L. Powell, D. Shaw, M. L. Avery, and K.A. Hobson. 2011. Understanding declines in rusty blackbirds. *Studies in Avian Biology*. 41: 107-125.
- Hill, M. O., and H. G. Gauch. 1980. Detrended correspondence analysis: An improved ordination technique. *Vegetatio*. 42: 47-58.
- Hovick, T. J., R. D. Elmore, S. D. Fuhlendorf, D. M. Engle, and R. G. Hamilton. 2015. Spatial heterogeneity increases diversity and stability in grassland bird communities. *Ecological Applications*. 25: 662-672.
- Hutto, R. L.. 2016. Should scientists be required to use a model-based solution to adjust for possible distance-based detectability bias?. *Ecological Applications*. 26: 1287-1294.
- Kepler, C. B. and J. M. Scott. 1981. Reducing bird count variability by training observers. *Estimating Numbers of Terrestrial Birds*. *Studies in Avian Biology*. 6:366-371.
- Kissling, M. L. and E. O. Garton. 2006. Estimating detection probability and density from point-count surveys: A combination of distance and double-observer sampling. *The Auk*. 123: 735-752.

- Lituma, C. M. and D. A. Buehler. 2016. Minimal bias in surveys of grassland birds from roadsides. *The Condor: Ornithological Applications*. 118:715-727.
- Marques, T. A., L. Thomas, S. G. Fancy, and S. T. Buckland. 2007. Improving estimates of bird density using multiple-covariate distance sampling. *The Auk*. 124:1229-1243.
- Matsuoka, S. M., C. L. Mahon, C. M. Handel, P. Solymos, E. M. Bayne, P. C. Fontaine, and C. J. Ralph. 2014. Reviving common standards in point-count surveys for broad inference across studies. *The Condor, Ornithological Applications*. 116:599-608.
- Olechnowski, B. F., D. M. Debinski, P. Drobney, and K. Viste-Sparkman. 2009. Changes in vegetation structure through time in a restore tallgrass prairie ecosystem and implications for avian diversity and community composition. *Ecological Restoration*. 27: 449- 457.
- Ralph, C.J., S. Droege, and J. R. Sauer. 1995. Managing and monitoring birds using point counts: Standards and applications. In *Monitoring Bird Populations by Point Counts* (C. J. Ralph, J. R. Sauer, and S. Droege, Editors). USDA Forest Service General Technical Report PSW-GTR-149. pp. 161–175.
- Reidy, J. L., F. R. Thompson III, and J. W. Bailey. 2011. Comparison of methods for estimating density of forest songbirds from point counts. *The Journal of Wildlife Management*. 75:558-568.
- Rigby, E. A. and D. H. Johnson. 2019. Factors affecting detection probability, effective area surveyed, and species misidentification in grassland bird point counts. *The Condor, Ornithological Applications*. 121:1-10.
- Thomas, L., S. T. Buckland, E. A. Rexstad, J. L. Laake, S. Strindberg, S. L. Hedley, J. R. B. Bishop, T. A. Marques, and K. P. Burnham. Distance Software: Design and analysis of distance sampling surveys for estimating population size. *Journal of Applied Ecology*. 47:5-14.
- Thompson, F. R., and F. A. La Sorte. 2008. Comparison of Methods for Estimating Bird Abundance and Trends from Historical Count Data. *Journal of Wildlife Management*. 72:1674-1682.
- Wellicome, T. I., K. J. Kardynal, R. J. Franken, and C. S. Gillies. Off-Road sampling reveals a different grassland bird community than roadside sampling: Implications for survey design and estimates to guide conservation. *Avian Conservation and Ecology*. 9:4.

## TABLES

**Table 1.** Past and present spring/summer bird surveys occurring on Fort Riley. Objectives and methods are directly from the “Survey Fact Sheets” on the Conservation Branch server.

Survey	Objective	Methods	Discrepancies	Labor Hours
Breeding Bird Survey	Started: 1999 Locate and document all breeding bird species on Fort Riley, census suitable habitat, and establish and index of bird species numbers in the habitat surveyed	One survey effort May 15 – June 30 Radial point count method 0.25 mile radius 3-min roadside survey Points located along roads, 0.50 miles apart 134 points total	Since 1999, there were 5 years of data not collected. Bins of 0-100-m, >100-m, and “flyover” used.	Est. time between points: 5 mins  Total: 17.87 hours
Land Condition Trend Analysis (LCTA)	Started: 1990 Inventorying breeding bird populations to determine health and sustainability of training lands.	One survey effort Late May - Early June Radial point count method, followed by a walked transect 100 meter radius/buffer 3-min point count, 6-min transect walk (100 m) Stratified point locations 60 points/transects total  Majority of point locations now appear to be in woodland/edge areas.  Original points (1994) contained 48 grassland surveys, 12 wooded surveys.	1990-1993 used bins of 0-100-m, >100-m, and “flyovers”  1994-2002 used abundance only.  2003-2008 used four bins of 25-m increments to 100-m, and “flyovers”.  2009-2020 used bins of 0-100-m, >100-m, and “flyovers”  The research project that initiated the LCTA survey states at the end of their publication that distance sampling provides a more valid estimate of breeding bird densities and population indices than the method they employed (Althoff et al. 2005)	Est. time between points: 15 mins  Total: 24.00 hours

Grassland Bird Survey	Started: 1994 Locate and document grassland bird species of concern. Census suitable habitat, and to establish and index of grassland bird species numbers in the habitat surveyed.	One survey effort May 15 – June 30 Radial point count method 100 meter radius 5-min survey  Points located 100-m from roadside, in “high quality” grasslands. 500-m apart Number of points unknown	Bins of 0-50-m , 50-100-m used  Data collection lasted from 1995- 2012?  Numeric counts used to estimate density	Unknown-not currently being collected
Ring-necked Pheasant Survey	Started: 1982 Monitor the breeding population of ring-necked pheasants each year to obtain an index of population trends	Three survey efforts April 20 – May 15 Surveys last from 30-mins before sunrise to 30-mins after sunrise. 3-min survey  Four road routes Each point 1-mile apart 62 points surveyed total	No distance data collected.  Density estimates and population trends based on numeric counts.  Currently, no weather data is associated with counts in database	Est. time between points: 5 mins  Total: 24.80 hours
Bobwhite Spring Whistle Counts	Started: 1982 Monitor the breeding population of norther bobwhite quail to obtain an index of population trends	Three survey efforts May 20 – June 15 Surveys last from 30-mins before sunrise to 30-mins after sunrise. 3-min survey  Four road routes Each point 1-miles apart 62 points surveyed total	No distance data collected.  Density estimates and population trends based on numeric counts.  Currently, no weather data is associated with counts in database	Est. time between points: 5 mins  Total: 24.80 hours

**Table 2.** Land cover type proportions, determined by a survey completed by the Kansas Biological Survey (KBS) in 2012. Percent of Fort Riley total is the proportion of each community divided by the amount of area surveyed by KBS, which is 188746.34 hectares.

Community Name	Hectares	Percent of FORT RILEY Total
Abandoned Farmstead	1637.86	0.87 %
Ash-Elm-Hackberry-Oak Forest Mosaic	26814.05	14.21 %
Brome Fields	444.52	0.24 %
Cottonwood-Sycamore-Willow Forest Mosaic	3073.85	1.63 %
Cropland-Abandoned	62189.77	32.95 %
Cultivated Field	1089.80	0.58 %
Developed	608.67	0.32 %
Fire Break	3022.72	1.60 %
Flint Hills Tallgrass Prairie	72909.42	38.63 %
Food Plot	1367.68	0.72 %
Lawn	74.42	0.04 %
Quarry	671.41	0.36 %
Riverine Sand Flats-Bars Sparse Vegetation	183.04	0.10 %
Ruderal-Mixed	7562.03	4.01 %
Sand Prairie	177.70	0.09 %
Tree Plantation	332.15	0.18 %
Water/Pond	276.45	0.15 %
Woodland-Brushy	6310.80	3.34 %

**Table 3.** Current PIF Watch List Species occurring on Fort Riley projected to lose another 50% within the next 20-25 years.

Common Name	Scientific Name	PIF group	Habitat Type	Decline since 1970
Black rail	<i>Laterallus jamaicensis</i>	Common bird in steep decline	Wetlands, uplands	unknown
Rusty blackbird	<i>Euphagus carolinus</i>	Common bird in steep decline	Wetland	unknown
Long-eared owl	<i>Asio otus</i>	"D" Yellow Watch List	Forest generalist	91%
Short-eared owl	<i>Asio flammeus</i>	Conservation concern	Breeding: Arctic tundra Wintering: Temperate grassland	65%
Grasshopper sparrow	<i>Ammodramus savannarum</i>	Common bird in steep decline	Grassland	68%
Common nighthawk	<i>Chordeiles minor</i>	Common bird in steep decline	Generalist, agricultural	58%
Harris's sparrow	<i>Zonotrichia querula</i>	"D" yellow watch list	Breeding: Boreal forest Winter: Temperate grasslands	63%



Greater prairie chicken	<i>Tympanuchus cupido</i>	Red watch list	Temperate grassland	>50%
Wood thrush	<i>Hylocichla mustelina</i>	"D" Yellow watch list	Deciduous forest	59%

**Table 4.** Breeding bird survey point descriptions and their associated x-y coordinates. Community refers to the description of the land cover type of which the point falls within, and Grade is the designated status of the health of the tallgrass prairie communities as determined by Kansas Biological Survey in 2012.

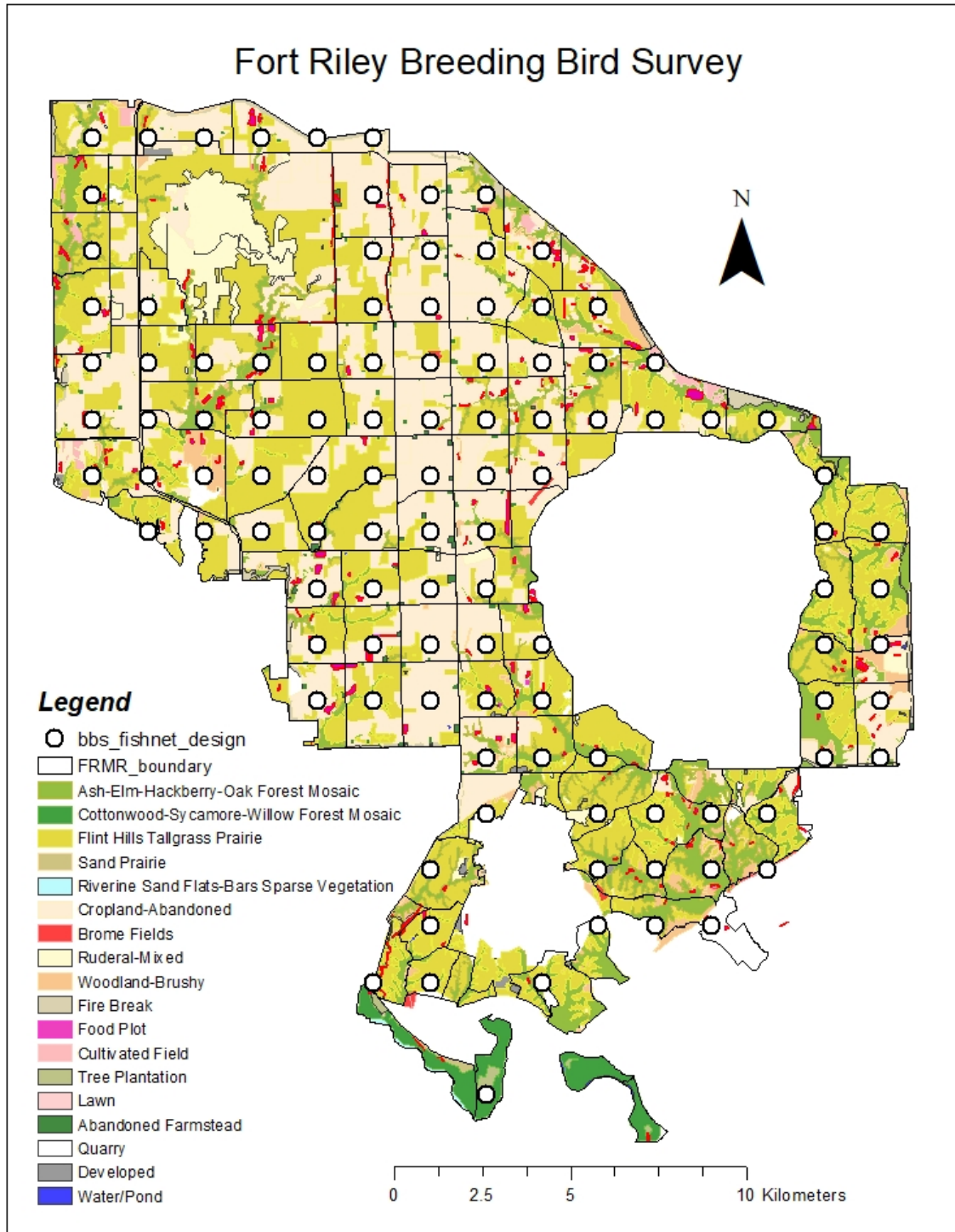
ID	Community Type	Grade	Training Area	x-coordinates	y-coordinates
0	Flint Hills Tallgrass Prairie		47	683409	4335626
1	Flint Hills Tallgrass Prairie	B	23	686609	4329226
2	Flint Hills Tallgrass Prairie	B	90	691409	4343626
3	Ash-Elm-Hackberry-Oak Forest Mosaic		10	694609	4330826
4	Flint Hills Tallgrass Prairie	B	13	691409	4330826
5	Cropland-Abandoned		93	688209	4345226
6	Cropland-Abandoned		60	678609	4343626
7	Cropland-Abandoned		56	686609	4340426
8	Cropland-Abandoned		74	686609	4345226
9	Cropland-Abandoned		26	699409	4335626
10	Flint Hills Tallgrass Prairie	A	75	677009	4346826
11	Ash-Elm-Hackberry-Oak Forest Mosaic		91	693009	4345226
12	Developed		38	688209	4337226
13	Flint Hills Tallgrass Prairie	A	32	699409	4340426
14	Ash-Elm-Hackberry-Oak Forest Mosaic		87	681809	4351626
15	Cropland-Abandoned		78	686609	4348426
16	Ash-Elm-Hackberry-Oak Forest Mosaic		90	691409	4345226
17	Cropland-Abandoned		62	686609	4342026
18	Flint Hills Tallgrass Prairie	B	50	683409	4337226
19	Flint Hills Tallgrass Prairie	B	39	689809	4337226
20	Flint Hills Tallgrass Prairie	A	12	693009	4332426
21	Flint Hills Tallgrass Prairie	B	72	683409	4345226
22	Flint Hills Tallgrass Prairie	C	89	689809	4343626
23	Flint Hills Tallgrass Prairie	A	58	685009	4342026
24	Ash-Elm-Hackberry-Oak Forest Mosaic		58	683409	4340426
25	Food Plot		71	681809	4345226
26	Ash-Elm-Hackberry-Oak Forest Mosaic		24	686609	4330826

27	Ash-Elm-Hackberry-Oak Forest Mosaic		30	699409	4338826
28	Cropland-Abandoned		44	688209	4342026
29	Ash-Elm-Hackberry-Oak Forest Mosaic		12	694609	4332426
30	Cropland-Abandoned		68	685009	4343626
31	Ash-Elm-Hackberry-Oak Forest Mosaic		37	689809	4335626
32	Cropland-Abandoned		52	686609	4337226
33	Cropland-Abandoned		83	685009	4350026
34	Cropland-Abandoned		87	683409	4351626
35	Flint Hills Tallgrass Prairie	A	61	681809	4342026
36	Cropland-Abandoned		65	677009	4343626
37	Cropland-Abandoned		69	686609	4343626
38	Cropland-Abandoned		26	699409	4334026
39	Cropland-Abandoned		54	685009	4338826
40	Flint Hills Tallgrass Prairie	B	92	696209	4343626
41	Flint Hills Tallgrass Prairie	C	102	691409	4334026
42	Cropland-Abandoned		77	685009	4348426
43	Flint Hills Tallgrass Prairie	B	77	685009	4346826
44	Woodland-Brushy		60	680209	4342026
45	Ash-Elm-Hackberry-Oak Forest Mosaic		66	680209	4343626
46	Cropland-Abandoned		97	691409	4346826
47	Flint Hills Tallgrass Prairie	B	57	681809	4340426
48	Ash-Elm-Hackberry-Oak Forest Mosaic		96	689809	4346826
49	Cropland-Abandoned		25	697809	4334026
50	Cottonwood-Sycamore-Willow Forest Mosaic		18	688209	4324426
51	Flint Hills Tallgrass Prairie	B	63	680209	4340426
52	Cropland-Abandoned		40	688209	4338826
53	Flint Hills Tallgrass Prairie	C	87	685009	4351626
54	Ash-Elm-Hackberry-Oak Forest Mosaic		35	689809	4334026
55	Flint Hills Tallgrass Prairie	A	67	681809	4343626
56	Flint Hills Tallgrass Prairie	B	20	685009	4327626
57	Flint Hills Tallgrass Prairie	C	4	691409	4329226
58	Ash-Elm-Hackberry-Oak Forest Mosaic		33	697809	4342026
59			5	694609	4329226
60	Cropland-Abandoned		84	686609	4350026
61	Cropland-Abandoned		91	693009	4343626
62	Food Plot		34	688209	4334026
63	Flint Hills Tallgrass Prairie		3	689809	4327626

64	Cropland-Abandoned		94	689809	4345226
65	Flint Hills Tallgrass Prairie	A	91	694609	4343626
66	Woodland-Brushy		11	693009	4330826
67	Cropland-Abandoned		101	678609	4346826
68	Flint Hills Tallgrass Prairie	B	27	697809	4337226
69	Flint Hills Tallgrass Prairie	D	65	677009	4345226
70	Cropland-Abandoned		95	688209	4346826
71	Cropland-Abandoned		58	683409	4342026
72	Woodland-Brushy		31	697809	4340426
73	Flint Hills Tallgrass Prairie	C	36	688209	4335626
74	Flint Hills Tallgrass Prairie	B	85	677009	4351626
75	Flint Hills Tallgrass Prairie	B	71	680209	4345226
76	Flint Hills Tallgrass Prairie	B	7	696209	4332426
77	Cropland-Abandoned		78	686609	4346826
78	Cropland-Abandoned		70	678609	4345226
79	Cropland-Abandoned		95	688209	4348426
80	Flint Hills Tallgrass Prairie	B	22	686609	4327626
81	Cropland-Abandoned		99	689809	4348426
82	Flint Hills Tallgrass Prairie	B	88	688209	4343626
83	Cropland-Abandoned		55	686609	4338826
84	Woodland-Brushy		98	688209	4350026
85	Cropland-Abandoned		53	683409	4338826
86	Cropland-Abandoned		45	689809	4342026
87	Flint Hills Tallgrass Prairie	B	64	677009	4342026
88	Flint Hills Tallgrass Prairie	B	25	697809	4335626
89	Flint Hills Tallgrass Prairie	A	14	691409	4332426
90	Cropland-Abandoned		51	685009	4337226
91	Flint Hills Tallgrass Prairie	B	48	685009	4335626
92	Flint Hills Tallgrass Prairie	D	42	688209	4340426
93	Cropland-Abandoned		59	685009	4340426
94	Flint Hills Tallgrass Prairie	C	81	677009	4350026
95	Flint Hills Tallgrass Prairie	A	67	683409	4343626
96	Cropland-Abandoned		49	686609	4335626
97	Flint Hills Tallgrass Prairie	A	29	697809	4338826
98	Flint Hills Tallgrass Prairie	B	79	677009	4348426
99	Woodland-Brushy		28	699409	4337226
100	Flint Hills Tallgrass Prairie	D	73	685009	4345226

## FIGURES

**Figure 1.** Locations of the 108 radial point count surveys randomly distributed throughout the Fort Riley Military Installation, using a fishnet design approach. Each point is 1600-m apart from the next. These locations are subject to change following ground checking in spring of 2021 to ensure each site is readily accessible by a Fort Riley biologist.



### **Mapping Avian Productivity and Survivorship (MAPS)**

The Institute for Bird Populations (IBP) initiated the MAPS project (funded by Army's *Legacy Program*) on Fort Riley in 1993. The purpose of the MAPS project is to provide annual indices and estimates of adult population size, post-fledging productivity, adult survivorship and recruitment for certain terrestrial bird species. The MAPS project uses constant-effort mist-netting to attain long-term demographic data on target bird species. Six MAPS stations were established on Fort Riley. Each station studied a 20-ha area by operating 10 mist nets placed throughout the station. Three of the sites were located on forested areas (TA 2 and 81 and the Funston Landfill area), and three were on prairie locations (TA 24, 39 and 65).

Volunteers began taking over this work from the IBP in the summer of 1999. After that time, the three forested sites were abandoned. In 2005, all sites were abandoned.

The three most abundant breeding bird species captured at MAPS sites were the gray catbird, dickcissel, and grasshopper sparrow. Other common species were the common yellowthroat, Bell's vireo, yellow warbler, brown-headed cowbird, and northern cardinal.

### **Raptor Surveys**

Conservation Branch staff has conducted wintertime raptor surveys since 1983. Winter raptor surveys are conducted along standardized routes each year from early January to mid-February. The surveys are performed in accordance with Raptor Vehicle Census Survey Guidelines (Raptor Vehicle Census Survey Guidelines, Army Technical Manual No. 5-633, Natural Resources, Fish and Wildlife Management). The objectives of the winter survey are (1) to identify concentrations and distributions of winter raptors; (2) to monitor relative abundance of species; (3) to document threatened and/or endangered or rare species; (4) to monitor year-to-year changes in raptor densities and diversities; and (5) to monitor changes in raptor densities and diversities during winter months.

The most common raptor observed is the red-tailed hawk, followed in descending order of frequency by northern harrier, bald eagle, rough-legged hawk, and American kestrel. Other raptors occasionally observed are sharp-shinned hawk, Cooper's hawk, prairie falcon, and merlin.

### **Shorebird Surveys**

Systematic surveys of shorebirds found along the rivers adjacent to Fort Riley have been conducted annually since 1994, in conjunction with least tern and piping plover surveys. During these surveys, thirty-eight species have been observed. Two of these species were county records (sanderling, ruddy turnstone).

### **Roosting/Nesting Structures**

Use of roosting and nesting structures is monitored to determine success of the program. Results show eastern bluebird houses, purple martin houses, and Kestrel boxes are the most frequently used structures, followed by wood duck nesting boxes. Bats are using houses associated with structures such as buildings, bridges, and culverts.

### **Christmas Bird Count**

Fort Riley's inaugural Christmas Bird Count occurred during the winter of 2008-09. The Fort Riley Count Circle was placed to minimize overlapping areas with the Junction City, Manhattan and Wakefield counts, and is roughly centered on UTM grid 930 370 within the Impact Area.

### **Reptiles and Amphibians**

***Calling Amphibian Surveys:*** Surveys for calling amphibians have been performed intermittently since 1999.

***KBS Survey:*** The Kansas Biological Survey (KBS) systematically documented herpetofauna in 1993 (Busby et al. 1994). Thirty-nine species of reptiles and amphibians (17 species of snakes, 6 lizards, 7 turtles, and 9 amphibians) were captured or observed during the study.

***Annual Spring Herpetology Survey:*** During the month of May, Conservation Branch biologists and volunteers take one or two days to canvas the installation, specifically searching for all amphibians, reptiles and turtles that can be found. Biologists and amateur herpetologists from across the state are invited to participate in the count.

***Ornate Box Turtle Tracking Surveys:*** In 2006, ten ornate box turtles were fitted with radio transmitters and then tracked for movement locations throughout the year. This was a one year study that was discontinued.

### **Game**

Populations of six principle game species on Fort Riley are monitored. Objectives vary from obtaining annual indices of population trends to obtaining specific population parameters such as numbers and age and sex ratios. Some population data are derived from the harvested animals themselves.

***Upland Game Bird Surveys:*** Spring surveys are conducted for greater prairie-chicken, northern bobwhite, and ring-necked pheasant. Greater prairie-chicken surveys count numbers of leks and numbers of birds on each lek to yield population numbers. Auditory surveys of northern bobwhite and ring-necked pheasant yield indices of population trends and do not enumerate population size directly. They are used only for annual comparative information. These surveys have been conducted annually since 1982.

The overall objective for these three surveys is to assess long-term population trends. Data derived from upland game surveys are not used to adapt annual harvest frameworks or bag limits for each subsequent hunting season. However, information is provided to hunters who expect a fall hunting forecast.

***Northern Bobwhite:*** Spring whistle counts, with 2-3 replications, are conducted in June along four standardized routes. Procedures and data analyses are standardized from

year to year. These procedures and analysis methods are on file at the Conservation Branch.

In 2012, Fort Riley completed a research project that tracked monthly survival rates for bobwhites in treated and untreated areas. Treated areas consisted of habitat that had received strip disking and edge feathering of timber edges management actions. Results of this project were published in the Transactions of the Kansas Academy of Science (Smith et al., 2014. 117, no. 1-2: p. 1-14).

**Ring-necked Pheasant:** Spring crow counts are conducted in May along four standardized routes with 2-3 replications. Procedures and data analyses are standardized from year to year. These procedures and the analysis method are on file at the Conservation Branch.

**Greater Prairie-chicken:** Greater prairie-chicken lek counts are conducted from late March to late April. Lek counts are made on each Maneuver Area. Standardized routes are not run. Each Maneuver Area is surveyed twice. Active leks are located by sound and counted. If time is available, flush counts are made on each lek. Lek counts are considered more accurate for assessing populations than are flush counts of leks. Numbers of birds on a lek can vary greatly from day to day, but the numbers of leks remain stable throughout the breeding season.

### **Big Game Surveys**

**Elk:** Elk monitoring is more rigorous because it is a reintroduced species that requires more management. Elk have been surveyed since their reintroduction in 1986. Aerial surveys were conducted intermittently until 1997 when a systematic protocol for conducting the surveys twice annually was established. These procedures and the analysis method are on file at the Conservation Branch. Data collected also are on file.

The overall objective for elk surveys is to obtain population information for the establishment of an appropriate harvest framework. These data are used to recommend harvest quotas to KDWP, and KDWP uses the data to establish long-term management strategies for this herd.

The specific objectives of the surveys differ somewhat, depending on the season during which the surveys are conducted. The primary objectives of winter surveys are to determine total population size and to determine antlered-to-antlerless ratios. The primary objectives of summer surveys are to obtain cow-to-calf ratios and antlered-to-antlerless ratios. A secondary objective of the survey during both periods is to obtain a breakdown of age classes of bulls. Only winter surveys have been conducted since 2004.

Elk populations also are monitored through harvest. Hunters are encouraged to bring harvested elk to the Conservation Branch Office. Antler measurements are taken based on the Boone and Crockett protocol and pictures are taken of the animals. The age structure of the harvested segment is determined by tooth cementum annuli analysis.

**White-tailed Deer:** In addition to harvest data collected through iSportsman, Fort Riley conducts Spotlight Deer Counts to monitor population trends and establish harvest quotas. Spotlight Deer Counts, with up to 3 replications of two routes, are conducted in November along four standardized routes. Procedures and data analyses are standardized from year to year. These procedures and analysis methods are on file at the Conservation Branch.

**Wild Turkey:** Monitoring of wild turkey populations is limited to data collected during the spring hunting season. Hunters are asked to report the beard size, and spur length of harvested turkeys in iSportsman. These data are compiled and summarized to make year to year comparisons.

Conservation Branch monitors the proportion of jakes (last year's male poults) in the harvest. This indicates reproductive success from the previous year. If the proportion of jakes remains high year after year, this reflects an increasing turkey population.

**Furbearers:** Furbearer populations are not routinely surveyed. However, their relative abundance has been estimated during two research projects conducted by Kansas State University. The first project involved estimating and assessing quantity of "sign" along major streams bisecting the installation (Robel 1987). The second study estimated small mammalian predator densities (Gipson and Kamler 2006).

## **Fish**

**Sport Fish:** Sport fish populations and species assemblages are systematically monitored. Electrofishing and seining are used to sample fish communities in installation ponds and lakes. Currently, electrofishing is used in Moon and Breakneck lakes and Beck and Vinton ponds. Creel surveys are conducted intermittently depending on captor availability.

**Non-Game Fish:** Numerous inventories have been conducted by personnel of the Conservation Branch, Kansas State University, KDWP, and USFWS in Fort Riley's streams and rivers (see Section 2.2, above).

Kansas State University conducted a study of fish assemblages in Fort Riley streams (Quist 1996). This study produced a general portrait of fish assemblages on Fort Riley. Fish species in streams in the western portion of the installation show a definite 'lake effect', and are largely represented by centrarchids (sunfish family). Largemouth bass, green sunfish, and bluegill are the major representatives. Cyprinids (minnows) occur in low densities and diversities in these streams, and are primarily represented by central stonerollers, fathead minnows, and red shiners. Streams on the eastern side of the installation that do not drain into Milford Lake are dominated by cyprinids, not centrarchids. Species assemblages are more diverse. Major representatives in these streams include redbfin shiners, bluntnose minnows, common shiners and central stonerollers.



Personnel of the Conservation Branch, the USFWS and Kansas State University have conducted surveys of the Kansas, Smoky Hill, and Republican rivers for the sturgeon chub and other resident fishes. Fish species typically associated with the pool, run, or riffle habitats of these rivers include shovelnose sturgeon, suckermouth minnow, red shiner, sand shiner, bullhead minnow, bluntnose minnow, central stoneroller, river carpsucker, catfish, stonecat, western mosquitofish, Johnny darter, and orangethroat darter.

### **Invertebrates**

***KDWP:*** Surveys conducted by the KDWP of Timber Creek in 1996 and Fourmile Creek in 2000 included inventories of aquatic insects and mussels. Altogether, 19 orders/families of aquatic insects and five species of mussels were observed in Madison Creek. Fourteen orders/families of aquatic insects and no mussels were found in Fourmile Creek. Mussels were counted as present whether observed alive or from relic shells.

***In House Mussel Survey:*** During 1998–1999, Conservation Branch staff conducted a systematic survey of the fort's streams for mussels and found evidence of 17 species that have resided on Ft. Riley, of which seven species were found extant. The other ten species have apparently been extirpated from the installation. Two of the ten (black sandshell and hickorynut) have apparently been extirpated from the entire state. The most common species collected alive were the pondhorn, fragile papershell, pink papershell, and mapleleaf. These surveys have not been repeated.

***Regal Fritillary and Monarch Surveys:*** Prior to 2013, regal fritillaries were monitored only incidentally to other fieldwork.

In 2013, Fort Riley funded the KSU CO-OP Unit to perform a two-year research project to 1) provide spatially explicit estimates of the distribution and abundance of the regal fritillary and its host plant, prairie violet; 2) provide models that identify habitat features and management practices that influence the density of regal fritillary adults; and 3) produce information on the effectiveness of management strategies for the regal fritillary populations on Fort Riley.

In 2015, Fort Riley further funded the this project to provide baseline population estimates of adult monarch and population trend estimates of adult regal fritillary. The study also identified environmental attributes such as hay removal and fire land management practices that influence those species, including an analysis of land management implications.

Current monitoring protocols for regal fritillary and monarch butterflies are outlined in the regal fritillary management plan in appendix C.

***Prairie Mole Cricket surveys:*** Listening surveys for calling prairie mole crickets have occurred in 1992, 1994, 1998, 2002, and 2008. Surveys consisted of driving through native prairie habitat in the hour after sunset listening for calling males. USFWS

personnel conducted the 1992 surveys. Conservation Branch staff performed the 1994, 1998, 2002, and 2008 surveys.

**Other Invertebrates:** Kansas State University collected large arthropods, earthworms and microarthropods from soil samples as part of a research study (Schaeffer et al. 1990).

### **Flora Inventory and Monitoring**

Three Planning Level Surveys have been conducted of the installation's flora. The first was completed in 1985, when the vegetative characteristics of the entire installation, excluding the permanent impact area, were described and mapped. The second was completed in 2003, in which the KBS assessed the current condition of vegetation on the installation, located tracts of native prairie, and determined the locations and severity of noxious weed species infestations. The KBS developed a new vegetation classification for the installation, identifying eight primary habitat types; floodplain forest, ravine woodland, Flint Hills tallgrass prairie, sand prairie, limestone butte vegetation, altered grassland vegetation, woodland-brushy, and planted/cultivated vegetation. The third was completed in 2012 that included updates to the 2003 assessment and additional analysis of shrub cover across the installation.

**RTLA:** The RTLA procedure recommends inventorying vegetation to help determine health and sustainability of training lands. RTLA flora inventory provides long-term assessment of changes in the botanical composition and cover across the installation and estimates associated soil loss under varying levels and kinds of uses. RTLA flora surveys consists of monitoring 162 permanent transects located across the installation. RTLA vegetation surveys began on Fort Riley in 1990, but have been discontinued.

**Forest Inventory:** Fort Riley's forest conditions were inventoried in 1988-1989 and again in 1998-2000. The most recent inventory was initiated in 2012, and field measurements were completed in 2015.

**Savanna Inventory:** An inventory of Fort Riley's savannas was conducted in 1999. Sizes, locations, plant associations and characteristics of the savannas were determined. Compilation of this information was not completed. Savanna areas were determined to have at least 5% and less than 15% tree cover, on slopes from zero to nine percent. At least 42 locations were identified as having savanna-like characteristics. At least 11 other locations fell close to the parameters of the classification. Additional data on Fort Riley Savannas are located with the Management Agronomist in the Conservation Branch.

**Forest Stand Mapping:** Forest inventory plot data were associated with forest stands where data overlapped to provide characterization of those forest stands. Where forest inventory plots were not associated with forest stands, simple stand compartment examinations were made to create the Forest Stand Management Plans. Forest Stand Management Plans are completed for identified stands north of Vinton School Road. Those stands south of Vinton School Road are not all completed but development of remaining stand plans were initiated again during FY10. Maps are created to identify locations and boundaries for these stands and stand treatments. All but the earliest forest

inventory maps are digitized into GIS coverages. The forest maps are on file at the Conservation Branch.

**Natural Community Evaluation:** The KBS (Lauver 1994) conducted a project to characterize the vegetation communities by analyzing multi-spectral digital LANDSAT data and conduct field surveys of selected natural communities to determine their natural quality. This project produced a general land use/land cover database of Fort Riley. The report concluded that Fort Riley contains a variety of high quality natural communities, with the dominant vegetation type being grassland, and that large areas contain Flint Hills Tallgrass Prairie in good to excellent natural condition. Several examples of high-quality upland forests were located on the southern end of the post, whereas only small patches of high quality wetlands were found. The report is on file at the Conservation Branch.

**Invasive Weeds:** In addition to the Planning Level Survey completed in 2003 and 2012 by the KBS that determined the locations and severity of noxious weed species infestations, other noxious weed surveys have been performed. An aerial survey flying predetermined transects north of Vinton School Road had observers marking on maps locations of sericea lespedeza. These surveys were supplemented with driven survey routes conducted south of Vinton School Road. Conservation Branch staff conducted mandatory surveys of vegetation in fields receiving aerial applications of herbicides to control sericea lespedeza. Conservation Branch staff also informally tracks locations of noxious weeds encountered incidentally to other field activities.

**Habitat Evaluation:** A number of surveys and research projects have evaluated wildlife habitat on Fort Riley. Two recent surveys are described.

The KBS completed a project in 1996 to identify and delineate loggerhead shrike habitat on Fort Riley (Lauver et al., 1996). An existing model for assessing the suitability and availability of shrike breeding habitat in the upper Midwest was modified using remote-sensing to predict shrike habitat. Satellite data was ground-truthed to determine accuracy. A GIS model and map overlays depicting shrike habitat were produced.

The USFWS completed a National Wetlands Inventory in 1994 according to USFWS standard procedures. Remote sensing identified wetlands, and then ground-truthing of a sample of wetlands was completed. This NWI is used for planning but is not accurate enough to use to delineate jurisdictional boundaries for permitting requirements. A GIS data layer was produced.

### **Literature Cited**

- Gipson, P.S. and J.F. Kamler. 2006. Density and minimum numbers of mesopredators on the Fort Riley Reservation. *Trans. KS Acad. Sci.* 109:36-40.
- Lauver, C.L. 1994. Natural Community Analysis of Fort Riley Military Reservation. KBS Report #59, 31 pp.

Schaeffer, D.J., T.R. Seastedt, D.J. Gibson, D.C. Hartnett, B.A.D. Hetrick, S.W. James, D.W. Kaufmann, A.P. Schwab, E.E. Hendricks, and E.W. Novak. 1990. Field bioassessments for selecting test systems to evaluate military training lands in tallgrass prairie. *Env. Management* 14:81-93.

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## APPENDIX L: SHRUB DENSITY DETERMINATION

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### **Process Used to Determine Shrub Density**

A Digital Elevation Model (DEM) in the form of a 32-bit floating point gridded matrix generated by the U.S. Army Topographic Engineering Center (TEC) from Light Detection and Ranging (LIDAR) data collected at Fort Riley, Kansas during March and April 2006 was obtained. The DEM, resolved to 1 meter, was projected to the Universal Transverse Mercator (UTM) coordinate system based on the World Geodetic System 1984 (WGS84) G1150 ellipsoid as defined for both the horizontal and vertical datum. Accuracies reflect 0.5 meter absolute horizontal, and 0.3 meter absolute vertical at a 90% confidence level. Separate DEMs were created representing a bare-ground surface and one including all surface structures.

The 32-bit matrices (GEOTIFF format) were added to an ESRI ArcMap document for analysis with ESRI's Raster Calculator. Since corresponding pixels in both DEMs represent the same geographic point, it was possible to subtract pixel values of the bare-ground DEM from those of the full-featured DEM to obtain the height of surface structures in meters. Analysis to locate various vegetation structures was initiated once the grid of surface feature heights had been generated. Shrubs, the main point of interest, were defined as any vegetative structure from 0.9144 m – 6.096 m. Anything above 6.096 m in height was classified as a tree for the purpose of this analysis.

Since the grid of surface structure heights included the heights of buildings, water towers, vehicles, etc., all known man-made structures for which there was geographic data were masked out, leaving a grid of surface feature heights presumably reflecting the height of above ground biomass. In addition to man-made features, harvestable stands of timber were also masked out for the purposes of determining woody encroachment onto valuable grassland areas.

Utilizing mathematical operators and functions in a geoprocessing environment, a single grid of height values was developed for shrubs, and one for trees. The SetNull function in ESRI's raster calculator sets identified cell locations to NoData based on specified criteria. The SetNull function returns NoData if the evaluation on an input conditional raster is true; otherwise, it returns the value identified by the false raster or constant. The cell values of the grid representing above-ground biomass height were set to NoData if they fell outside the 0.9144 m – 6.096 m range, leaving a grid of cell values that represented shrub height. Similarly, a grid of cell values representing tree height was generated.

ESRI's GeoStatistical Analyst toolbox was used to determine density, or “hotspots” of shrub encroachment. Geostatistical Analyst uses sample points taken at different locations in a landscape and creates (interpolates) a continuous surface. The sample points are measurements of some phenomenon, such as radiation leaking from a nuclear power plant, an oil spill, or elevation heights. Geostatistical Analyst derives a surface using the values from the measured locations to predict values for each location in the

landscape, relying on the similarity of nearby sample points to create the surface. Deterministic techniques use mathematical functions for interpolation. Geostatistics rely on both statistical and mathematical methods, which can be used to create surfaces and assess the uncertainty of the predictions.

In addition to providing various interpolation techniques, Geostatistical Analyst also provides many supporting tools. For example, prior to mapping, Exploratory Spatial Data Analysis tools can be used to assess the statistical properties of the data. Having explored the data, the user can then create a variety of output map types (for example, prediction, error of prediction, probability, and quantile) using many variants of kriging and cokriging algorithms (for example, ordinary, simple, universal, indicator, probability, and disjunctive) and associated tools (for example, data transformation, declustering, and detrending). We adopted probability cokriging algorithms, and the resulting map was a series of iso-lines (surface area) indicating a range of predicted shrub densities based on the percentage of land area covered by shrubs on individual 160 acre plots.

### **Validating Process**

Because the shrub percentage iso-line values created by the GeoStatistical Analyst toolbox seemed lower than expected, a separate analysis occurred to validate the map. The Training Area figures found in Appendix L were compared side by side to subjectively rate the extent of tree cover, shrub cover, and grassland fragmentation within each Training Area. For each category, training areas were given a rating of 0 if it was determined no representative of that category was observed, 1 if that category was present in light quantities, 2 if present in moderate quantities, and 3 if present in heavy quantities. Images depicting the relative amounts of tree and shrub cover, and grassland fragmentation were produced (Exhibits K.1 – K.4).

Further refinement of the training area ratings occurred in order to more readily identify areas with similar scores, resulting in the creation of six new categories. These new categories became:

- Training areas determined to have no shrub cover.
- Training areas determined to have a light shrub cover.
- Training areas determined to have a heavy shrub cover.
- Training areas determined to have a moderate shrub cover, with both a tree cover and fragmentation rating of either none or light.
- Training areas determined to have a moderate shrub cover, with either a tree cover or fragmentation rating of heavy.
- Training areas determined to have a moderate shrub cover, with a tree cover and fragmentation rating other than those listed above.

A new, color-coded image was created based on the six categories that were created (Exhibit K.5). The shrub percentage iso-line values created by the GeoStatistical Analyst toolbox were overlaid onto this image for comparison. Through this comparison, it was

concluded that the iso-line values created by the GeoStatistical Analyst toolbox accurately reflect the shrub invasion levels observed in the field.

It was further concluded that in grasslands with an iso-line value  $< 0.4$ , prescribed burning should be sufficient for shrub control. In grasslands with an iso-line value at or greater than 0.41, management beyond prescribed burning will be needed to reduce woody encroachment. In grasslands with an iso-line value exceeding 0.82, the most aggressive management will be required to combat woody encroachment.

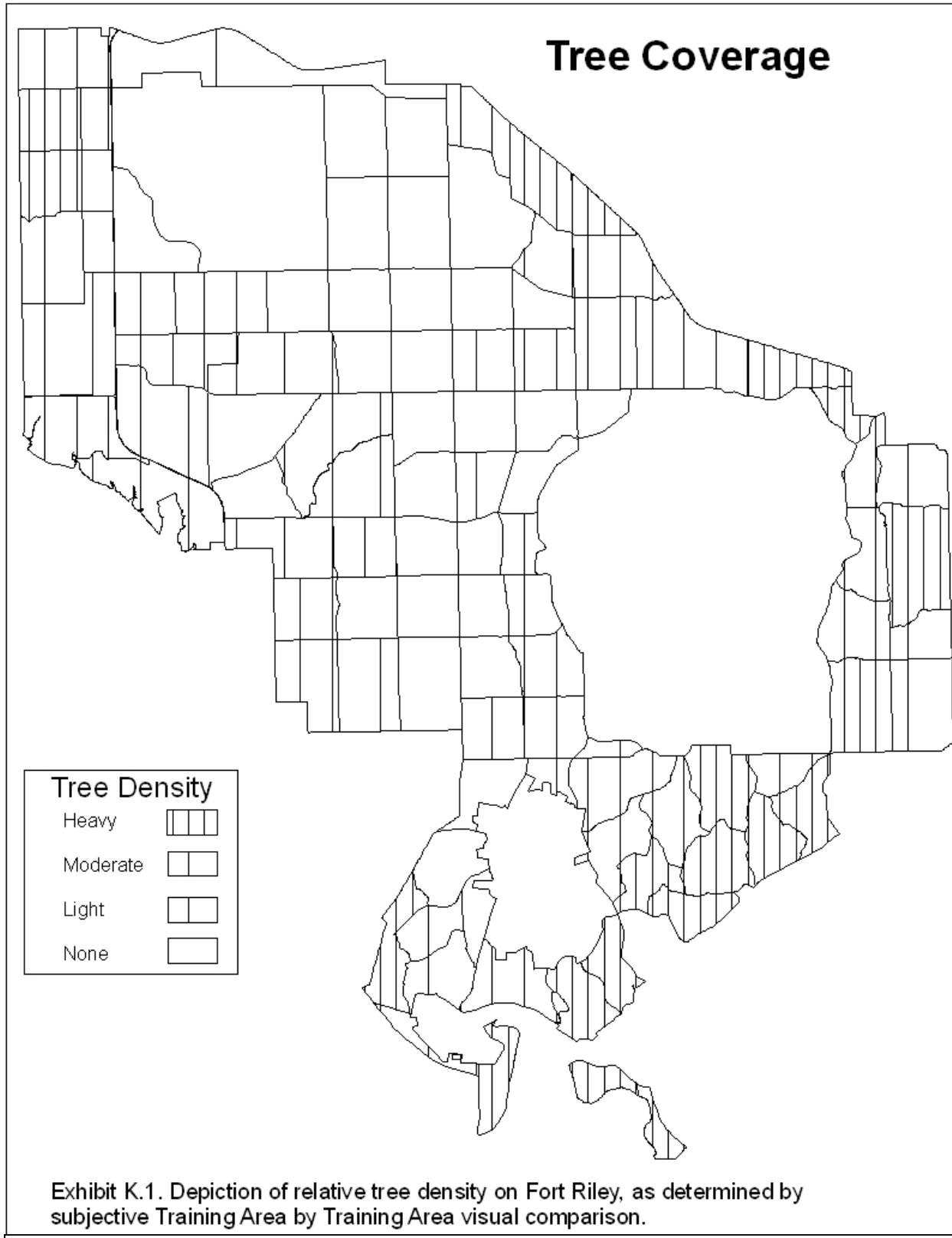
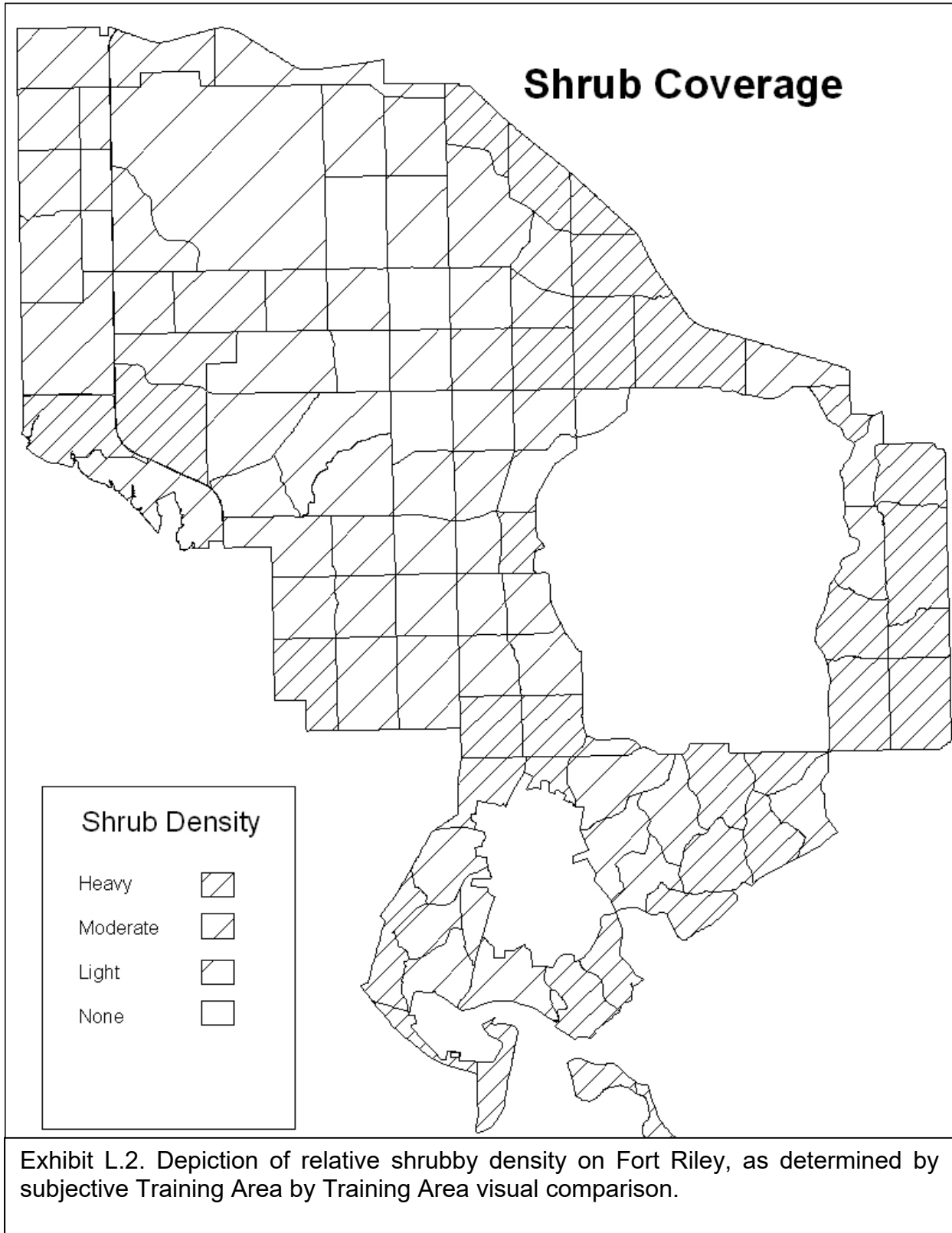
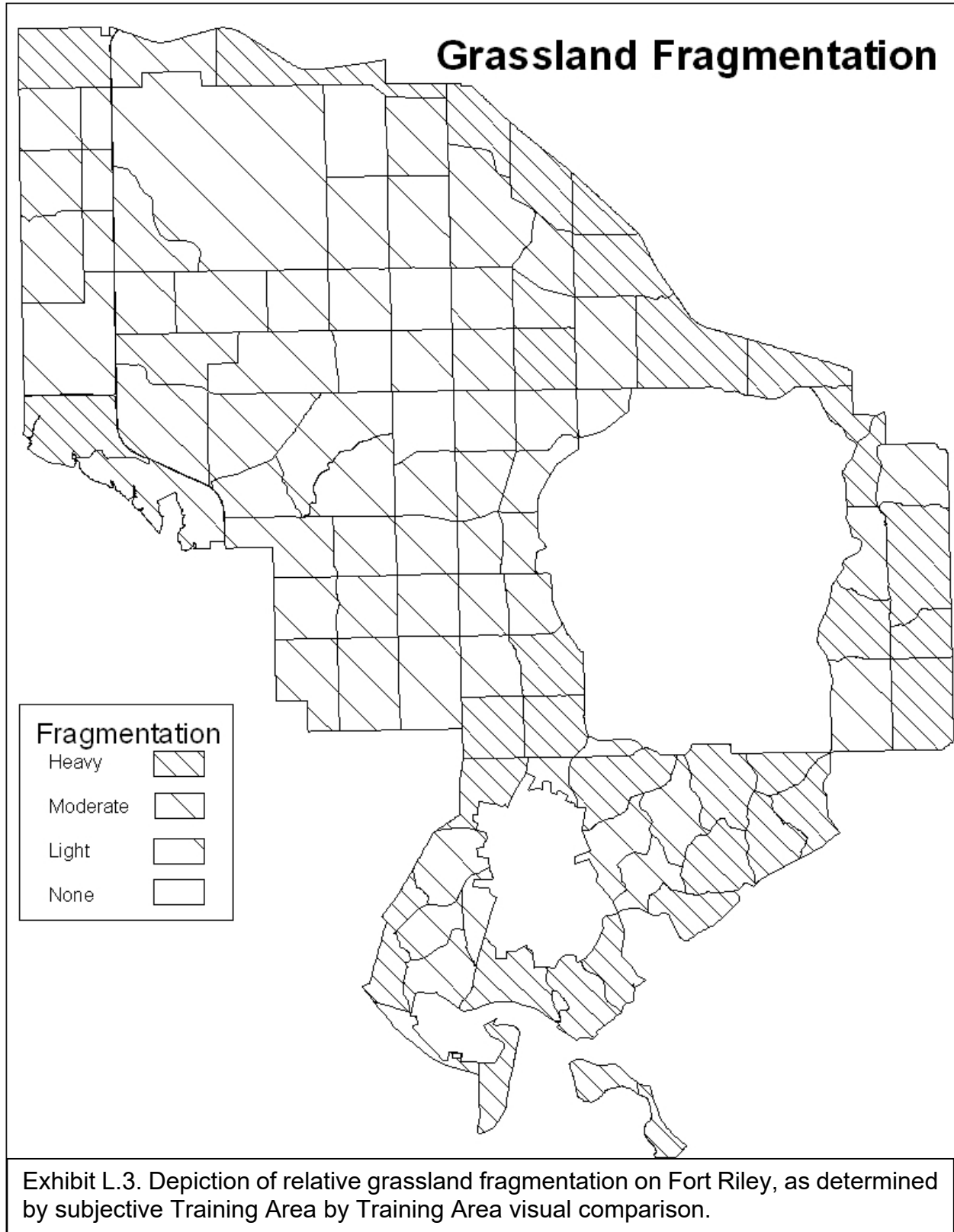
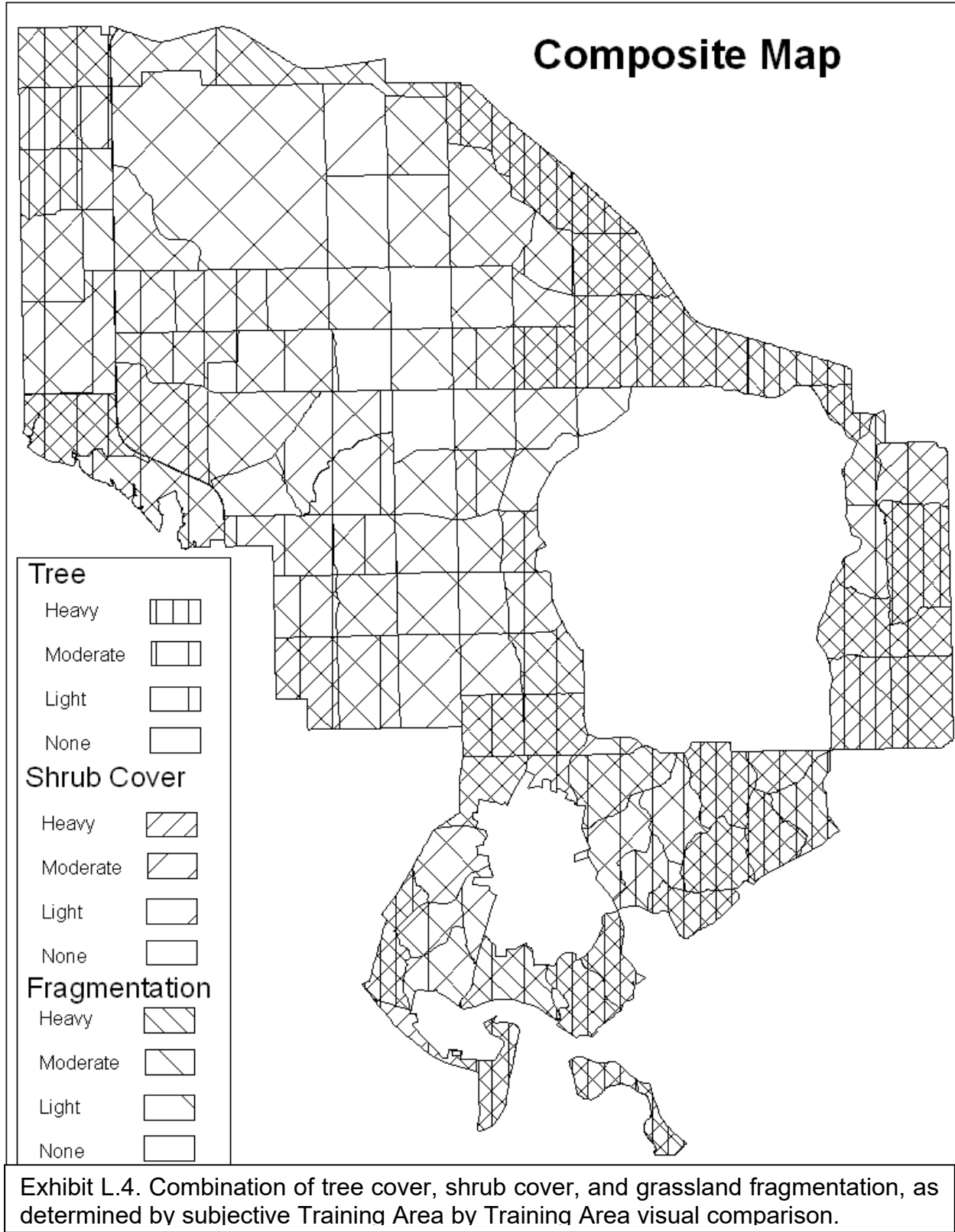


Exhibit L.1. Depiction of relative tree density on Fort Riley, as determined by subjective Training Area by Training Area visual comparison.









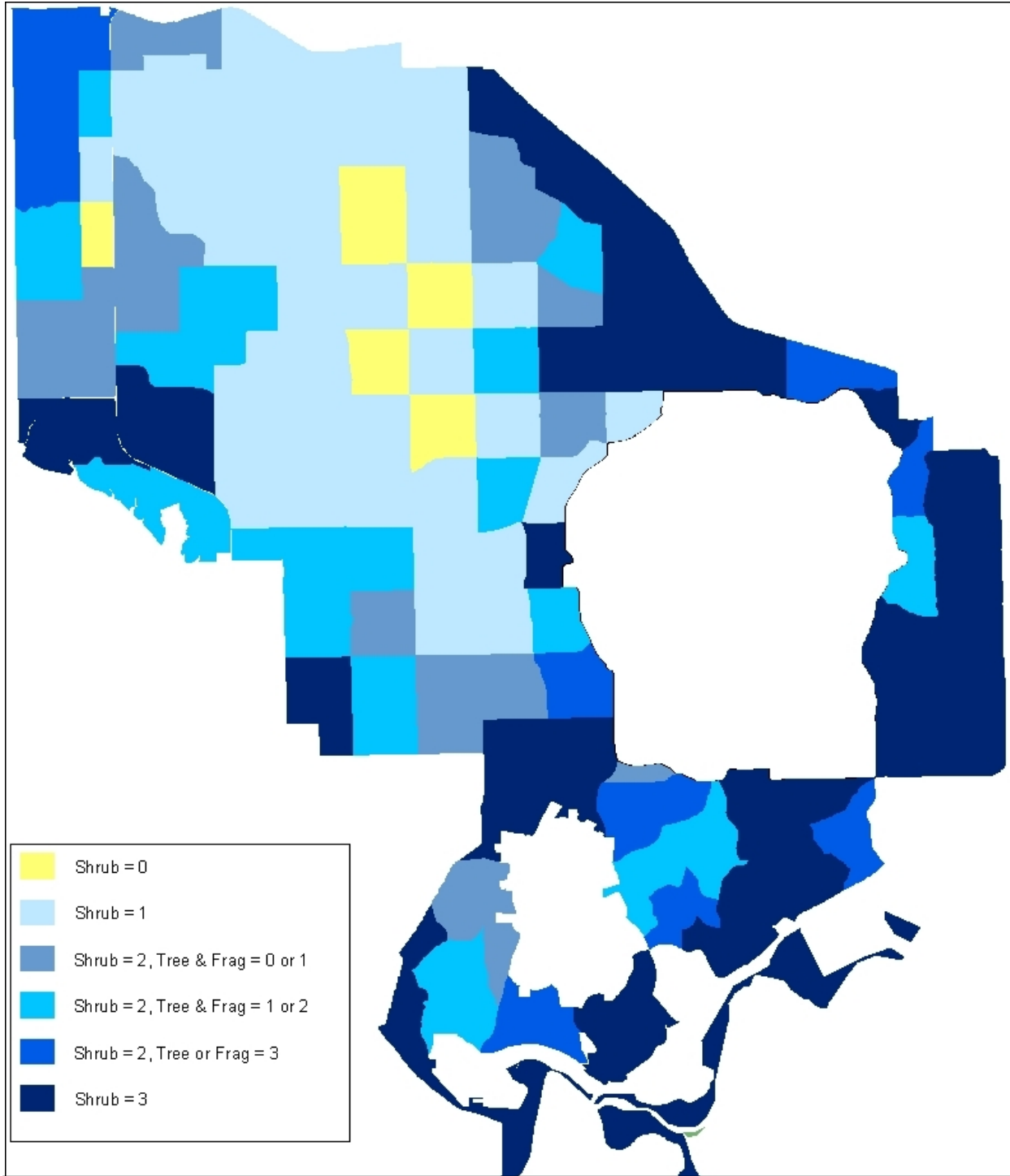
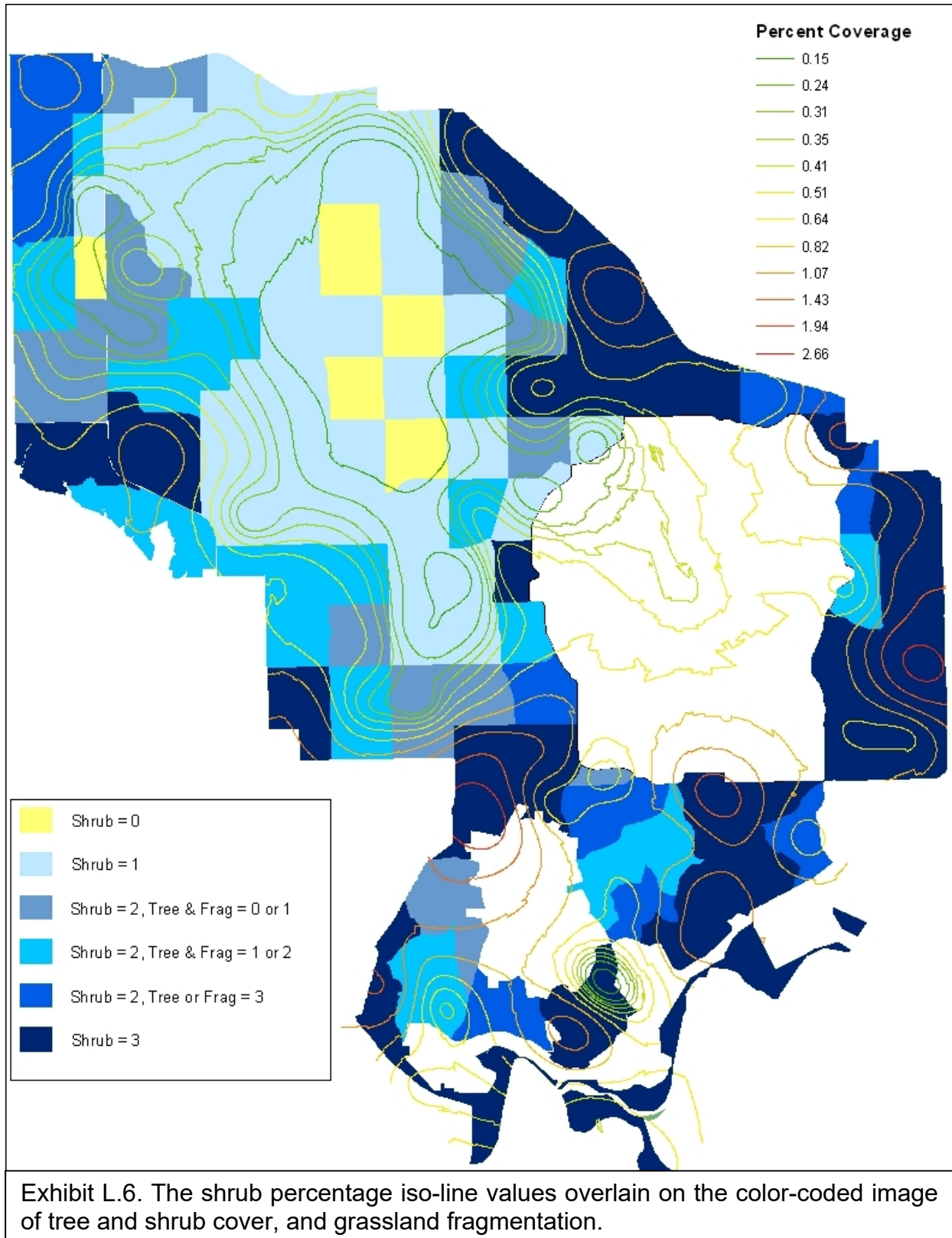


Exhibit L.5. A color-coded image depicting the relative amounts of tree and shrub cover, and grassland fragmentation. A rating of 0 indicates that no representative of that category is present, 1 if that category was present in light quantities, 2 if present in moderate quantities, and 3 if present in heavy quantities.



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**APPENDIX M: SOIL EROSION AND SEDIMENT CONTROL COMPONENT (SESCC)**

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**Landscape Conditions/Geographic Context**

**Soils:** The land on Fort Riley is composed of a diverse variety of soils. According to the U.S. Department of Agriculture 1975 *Soil Survey of Riley County and Part of Geary County* there are approximately 58 types of soils found on the installation (Figure 1). Most of these are considered to be in Capability Classes II, III, or IV by the Natural Resource Conservation Service. Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices. These soils are subject to moderate erosion if they are not protected. Class III soils have severe limitations that reduce the choice of plants, require special conservation practices or both. These soils are subject to severe erosion if they are not protected. Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both. These soils are subject to very severe erosion if they are not protected.

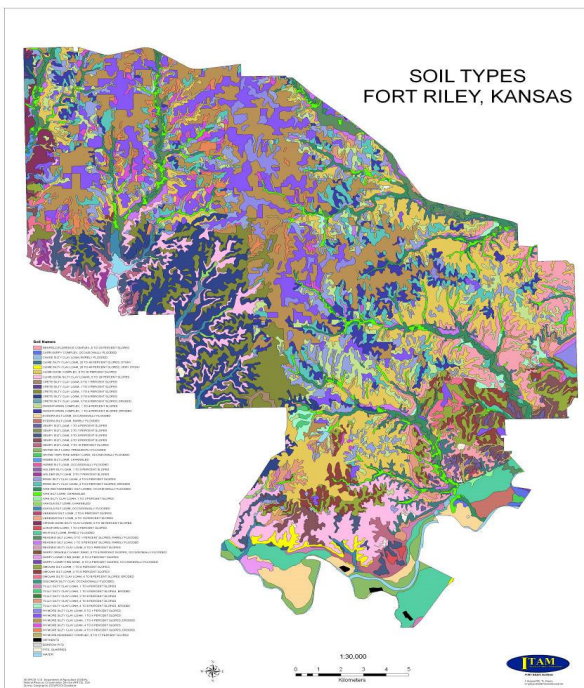


Figure 1: Fort Riley Soil Types

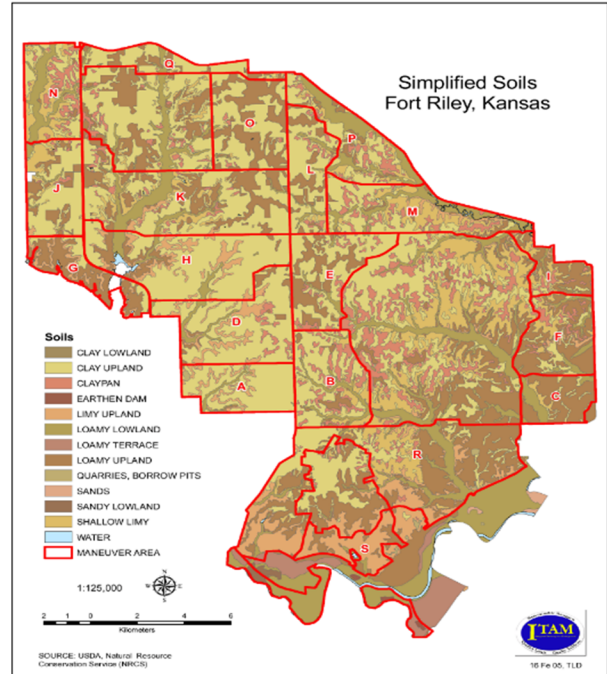
**Simplified Soil Classification**

Fort Riley's Integrated Training Area Management (ITAM) Program regrouped the 58 types of soils found on the installation into 12 simplified Range Site classes (Figure 2) to streamline the decision making process for prioritizing corrective actions for disturbed

land. In this reanalysis, Loamy Upland and Clay Upland soils cover approximately 75% of the maneuver areas on Fort Riley. The East side of the installation is primarily a Loamy Upland Soil that is classified as a Type IV soil and subject to very severe erosion if not protected.

**Landscape Conditions**

Fort Riley’s ITAM Program has identified four soil-related factors that negatively impact the ability of the installation’s training lands to support training. With comprehensive assessment, mitigation and repair practices will minimize impact to training land sustainability and continue to provide quality lands for training. The factors impacting training lands are listed below.



**A. Maneuver Damage:** Maneuver damage occurs in some form during training events. The primary cause of maneuver damage is tactical vehicle traffic; digging (defilades, fox holes), mine plow use and other activities also cause damage. Excessive maneuver damage can create ruts and rills that hinder or restrict training (especially for wheeled vehicles), disturb the native grasses that are useful for preventing erosion, and increase weedy species (less erosion control), which can combine to result in a loss of topsoil. Areas with little native tallgrass prairie vegetation and some amount of rill development are susceptible to increased erosion and gully formation (Figures 3 and 4).

Figure 2 Simplified Soil Types



Figure 3: Aerial image of unusually heavy maneuver damage.



Figure 4: Close up view of maneuver damage.

**B. Gullies:** Gullies are actively eroding channels with nearly vertical walls that range from one foot to greater than ten feet in depth (Figure 5). Over time, a rut erodes

into a gully. If not repaired, gullies usually continue to enlarge upon each storm runoff event. When large gullies dissect training areas, the areas can become inaccessible or unsafe (for people and vehicles).



Figure 5: Gully that formed after military vehicle

**C. Damaged Drainage Ditches:** Troops often use drainage ditches for maneuver training. The ditches offer some level of concealment but can easily be damaged with repeated use (Figure 6). Damaged ditches can quickly washout and can cut off access to training areas. Blocked ditches also can fill with water which can create obstacles to training and can result in the roads being cut. Once a ditch is damaged, troops will often maneuver along the side of the damaged area creating more damaged land. This trend sometimes continues until a large area on either side of the tank trail is damaged.



**Figure 6:** Maneuver damage in a drainage ditch that is eroding away to become a gully



**D. Stream Crossing Damage:** Low-water stream crossings are sites where tactical vehicles frequently ford intermittent and perennial streams. Repeated traffic at these fording sites can form depressions in the stream channel, increase erosion of the stream bank, and increase turbidity and suspended sediment in the stream. When damage becomes severe, these fording sites become impassable, and tactical vehicles are sometimes stuck. Fort Riley has 84 hardened crossings to protect the stream channels. As troops cross the streams and high-flow events impact the hardened structure, some damage occurs (Figure 7). Maintaining these hardened fording sites protects water quality in the stream, provides better access to training areas, lessens damage to tactical vehicles, and reduces lost training time.



**Figure 7:** Stream crossing approach damaged by maneuver traffic.

Troops in mechanized equipment frequently cross low-order stream segments at unhardened locations. Such crossings can be safety hazards with the potential to cause injuries or damage vehicles and equipment. These crossings can also cause damage to the stream's stability. Some of these sites will either need a hardened crossing installed or will need to be blocked off to restrict access.

### **ITAM Program**

***ITAM Mission:*** ITAM's mission is to meet the Senior Commander's training needs for accessibility and sustained use of training lands utilized for military maneuver exercises in preparation of real world missions.

***ITAM Goal:*** ITAM's goal is to ensure training lands have availability, accessibility, and capability to safely support 1<sup>st</sup> Infantry Division, National Guard, and Reserve units' training and maneuver needs at Fort Riley. This is accomplished by 1) Training Land Assessments to identify hazards (safety) and maneuver damage (erosion), 2) Repair and Mitigation of training land concerns, and 3) Post-Project Assessment to monitor land rehabilitation repairs. Past training on the installation has created some areas that are below standards of being safe, causing environmental and training land sustainability concerns.

### **Training Land Assessments - Safety and Mobility**

***Monitoring Objective:*** Training land safety and mobility assessments are conducted for the entire installation on no less than an annual basis. Specific objectives include

- (1) Identifying existing safety hazards (e.g., gullies, improved stream crossing) that require repair,
- (2) Identifying areas with excessive bare soil exposure, and

- (3) Identifying areas susceptible to erosion based on soil type and slope, integrated with vegetation assessments. Assessment results will be used as one information source to identify areas in potential need of land rehabilitation.

**Methods:**

Identify existing safety hazards through periodic field surveys, use of imagery from remote sensing, and from locations provided by units and the Directorate of Public Works Environmental Division (DPW-E), using ancillary data collected during field campaigns for other assessments.

**Training Land Repair and Mitigation**

Work includes repairing maneuver damage; controlling or filling in gullies; installing ditch linings; repair damaged stream crossings including approaches; and closing unauthorized stream crossings. This objective is a coordinated effort between ITAM (project design / funding) and the DPW-E for NEPA process and any permits required to accomplish training land rehabilitation projects. Project designs and practices will come from prior successful ITAM projects and other governmental agencies, such as the U.S. Army Corps of Engineers and U.S. Department of Agriculture – Natural Resources Conservation Service.

**Project Design:** The Land Rehabilitation and Management (LRAM) Coordinator develops the project site design. The project site conditions and objectives of the project help determine the best management practices (BMPs) to stabilize and sustain the site over the long-term.

Based upon the site conditions and BMPs selected, the LRAM Coordinator develops a project plan that contains the following information: design, material considerations, construction/installation specifications, required permits, inspection and maintenance criteria, and estimated project cost.

**NEPA Process:** All ITAM Projects are coordinated with the DPW-E for compliance with National Environmental Policy Act (NEPA), Clean Water Act, endangered species regulations, natural stream flow and cultural resources regulations. When completing a project, the following processes must be completed to ensure regulatory compliance work with DPW-E to write and submit additional environmental regulatory documentation, as required (e.g., wetlands permit application, Stormwater Prevention Plan, Notice of Intent). Once the NEPA review is complete and the REC is signed, work can begin on a project.

**LRAM BMPs**

LRAM BMPs are commonly modified to meet the installation site conditions. The major BMP categories specified by project group are listed below. Some detailed BMPs can be found in the LRAM Technical Resource Library on the Sustainable Range Program Website.

**Maneuver Damage Repair BMP:** Maneuver damage is repaired by leveling the disturbed ground to remove ruts and replanting native tallgrass prairie grasses (seeding and mulching is required) to hold the soil and prevent erosion.

**Gully Repair BMP:** Methods to repair gullies include installing gully checks to provide access across gullies and to prevent further erosion. Sites with small gullies are leveled, regraded, and rock checks are installed to prevent further erosion. The area is then reseeded and mulched as required.

**Ditch Lining BMP:** The ditches are repaired by lining with rock and finish grading so that vehicles can travel over the rock. This project is only done at locations that are repeatedly damaged during training events and not for every trail on post. No repairs will be made to hardened tank trails that are Real Property.

**Repair Damaged Crossings BMP:** Work to repair damaged crossings depends on the type and extent of the damage. Work can range from simply clearing out debris that was deposited in the crossing to rebuilding the hardened structure and re-shaping the approaches to direct water away from the crossing and to prevent gullies from forming. Some sites will require hardened diversions to be installed on or before the crossing approaches to redirect stormwater into the riparian areas. Some crossings will be closed off and new crossings will be installed at the proper locations. Some stream restoration is required because of maneuver damage.

**Closing off Crossings BMP:** Work to close an unhardened crossing includes excavating, hauling and placing rocks in excess of 1 cu meter each across the path. Each site requires a minimum of 6 rocks per side.

### **Post-Project Assessment**

The objective of the Post-Project Assessment is to evaluate completed Projects to determine whether the project was, and continues to be successful, or if more maintenance is needed. Geodatabase layers will be maintained showing locations of completed and future projects.

**Methods:** The methods used in the assessment will vary depending on the Project that is being monitored. Some projects will be monitored using remote sensing. Other projects will be monitored via simple field surveys and terrestrial photography. Aerial photography (e.g., UAS photographs, digital orthophotographs) can also be used to monitor projects (as appropriate).

**Data Management and Analysis:** The ITAM program maintains a geospatially-enabled relational database that allows production of maps showing completed and planned LRAM projects. This database is updated as LRAM assessments are completed and again on a periodic basis to help document project success or failure. Occurrence of repeat projects at the same, or nearby, locations may suggest alternative rehabilitation actions are necessary.

**Monitoring Schedule:** Projects are monitored as needed depending on the type of project that is being monitored. Grass plantings will typically be monitored annually for 3 years following the treatment to determine success. Certain erosion prevention projects will be monitored after large rain events to ensure they are functioning properly.

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## APPENDIX N: BORROW AREA MANAGEMENT PLAN- 2016

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### **Introduction**

Most needs for borrow materials are associated with Military Construction-Army projects, road construction and other contracted projects on Fort Riley. Depending on the size of the project and the original and final grades, the amount of material needed may range from hundreds to tens of thousands of cubic yards.

**Borrow Materials:** Soil borrow is used for two major purposes on Fort Riley; as fill material and as topsoil. These uses are greatly different and require different materials. Fill material is used to *fill in* a depression or hole in the ground or otherwise artificially change the grade or elevation of real property to establish or restore a site to suitable grade. Fill dirt is usually compactable subsoil (soil from beneath the top soil and underlying parent material) that has little soil organic matter, since organic matter will decompose and create pockets of empty space within the fill that could result in settling. A clay or clay loam material is typically used to provide for proper compaction. Loam or sand can be used for fill in some situations. Fill is obtained from on-site excavation (cut) activities or excavated and hauled from off-site locations.

Topsoil is used to finish construction sites and fill small holes in improved ground areas. Topsoil provides a medium for plant growth, and therefore must possess good tilth and fertility. Topsoil is usually needed in smaller quantities than fill. Most construction projects require fill to build upon, then use topsoil on top of fill to allow grass lawns and other landscaping to be grown. When feasible, top soil is first stripped from the construction site as the first operation, stockpiled on site, then reapplied.

Rock borrow is used to provide material for tank trails, graveled roads and parking areas. Additionally, certain erosion control projects and hardened stream crossings use rock.

**Borrow Areas:** Extraction of soil and rock borrow material from the grounds of Fort Riley can be beneficial as it allows the installation to avoid costs associated with importing materials from the surrounding communities. However, borrow operations also can create negative impacts to the installation, such as loss of training land, unsafe or hazardous slopes, and point source stormwater runoff. Additionally, borrow actions can destroy landscapes and wildlife habitat, disrupt training and cause disturbance such as dust, noise, and traffic. Once vegetative cover is lost, the soils on Fort Riley are susceptible to erosion.

Usually, a borrow area will require access (or haul) roads. Haul roads can present a host of problems themselves, both on and off the actual site. On-site effects are largely noise and dust. Potential off-site effects are:

- Additional vehicles on the roads;
- Damage to roads due to size and number of vehicles using the road;
- Loss of material (particularly rock) from truck beds during hauling;
- Tracking of fill material onto hard surfaced roads;
- Visual intrusion, dust, noise, and vibration;
- Disturbance of habitat; and
- Compaction and settlement.

Borrow activities should occur in locations that are minimally disruptive to the Fort Riley training mission. A satisfactory balance must be sought between the need for borrow material, safeguarding resources, protecting the environment, and the training needs of Soldiers.

***Borrow Area Annual Update:*** In FY 2015, contractors and government operators conducted borrow activities for fill in TA 6-C and TA 6-D. Borrow activities for rock occurred in TA 90, 91 and 103. Available rock in the TA 91 and TA 103 quarries has been exhausted. These sites have been closed and remediated. New locations for extracting rock borrow are needed for projects that will occur in the northern training areas of the installation. To meet this need, the installation intends to expand the TA 91 rock borrow site to the south, and evaluate historic quarries in TA 47 and TA 51 for re-opening. The installation evaluated and determined to forego the expansion of the TA 91 borrow site at this time.

***Purpose:*** The purpose of this Borrow Area Management Plan is to provide instructions so that borrow-related actions occur in a manner that ensures availability of materials, maintains sustainability of resources, meets environmental compliance, and minimizes conflicts with military day-to-day training operations at Fort Riley.

Soil and rock have been borrowed from Fort Riley lands for many years. Historically, this activity was relatively uncontrolled. Borrow areas were selected with convenience being the primary location criterion, without consideration for the useful life of the site, training and environmental impacts, or closure requirements. Often, a site was used for the duration of a project and then abandoned, without effort to reclaim the area or make it safe or otherwise useful. Some inactive borrow areas have sheer rock or soil embankments, making them unsafe for troops and vehicles. Some are highly visible, making them aesthetically undesirable, or have many offer little value for military training.



An abandoned rock borrow area with steep rock embankment following completion of borrow.

This plan is intended to be Fort Riley's standard for the planning, operation and rehabilitation of borrow areas on the installation. It provides a detailed framework to control and direct borrow area locations and actions, and addresses applicable local, state, Army, and federal requirements. All borrow area-related actions are to be in accordance with this plan.

This plan has been prepared on the basis of the best information available, some of which is imprecise. For example, there is limited knowledge of the quality and quantity of workable borrow material at a site. It is also difficult to forecast when certain building projects or construction plans will be funded.

The goal is to make Fort Riley borrow efforts safe and regulatory compliant in a manner that sustains the mission, enhances wildlife habitat, protects the environment and improves the visual appearance of the installation. Adherence to this plan ensures that borrow actions minimally disrupt the training mission, borrow materials are available for construction activities, the environment is protected and appropriate measures are taken to restore a site after borrow actions are complete. The objectives are:

- Provide approximately 60,000 cubic yards (CY) of borrow material per year for Fort Riley's needs over the next 25 years (1.5M CY);
- Minimize disturbance and impact to the training mission;
- Minimize environmental impacts and mitigate those impacts which are unavoidable;
- Protect natural and cultural resources;
- Protect the water environment;
- Ensure borrow areas are safe;
- Restore borrow areas to a beneficial state after use; and

- Provide multiple, concurrent active borrow locations.

### **Assessment**

A well-planned project design can reduce the amount of fill material needed. The design of a project should strive for a balanced amount of earthwork so that the amount of cut is equal to the amount of fill required. More often than not this criterion is not met, and projects have excess cut generated, additional fill required, or sometimes both. It is recommended that as soon as the requirement to acquire borrow material or dispose of spoil is identified, coordination with the Environmental Division, Directorate of Public Works (DPW-E) be initiated to determine if existing sites will meet project needs.

If existing sites do not meet project needs, or if currently identified borrow areas become exhausted, unusable, or impractical, then new borrow areas will be necessary. Generally, criteria for selecting a new borrow site will include:

- Proximity to construction sites;
- Type and amount of material needed;
- Longevity of the site to provide needed material; and
- Objectives listed in Section 2 (Purpose).

Fort Riley established a “Soil and Rock Borrow Working Group” in 2009 that identified potential borrow areas that warranted further study. The group was composed of representatives from DPW, Directorate of Plans, Training, Mobility, and Security (DPTMS), Garrison Safety Office and the U.S. Army Corps of Engineers. A synopsis of those studies follows:

### ***Soil Borrow Report (Professional Engineering Consultants)***

Professional Engineering Consultants (PEC) was contracted to conduct a geotechnical drilling program to estimate in-place soil volumes (Appendix I) that could be used as soil borrow material in the future, based upon the potential borrow areas identified by the Working Group. A project goal was to identify approximately 25 years of borrow demand volume. PEC conducted surveys to assess the suitability of proposed borrow areas. The results of their findings are listed below:

- **TA 6:** The potential borrow of the TA 6 Borrow Area was estimated at approximately 800,000 CY of soil. Borrow actions have taken place at this site since that assessment, and the actual quantity of material remaining is unknown. The soil at this site is desirable for fill material and should work well for the installation’s soil needs.
- **TAs 14 and 15:** PEC concluded that TAs 14 and 15 have little soil volume and do not offer much potential soil borrow.
- **TA 16:** PEC estimated that TA 16 may yield about 1.5 million CY of borrow material. However, testing performed on samples from the uppermost soil found

it to be a heavy clay with limited construction compatibility. Similar testing from deeper soils has not been performed. It is unclear whether deeper materials are more suited for construction needs.

**Rock Borrow Report (Corps of Engineers):** The U.S. Army-Corps of Engineers, Kansas City District (COE) was contracted to assess the suitability and estimate the quantity of potential rock borrow at four sites; Training Areas 6, 37, 80 and 90, based upon the borrow areas identified by the Working Group (Appendix II). A project goal was to identify the general thickness of overburden soils. Consequently, COE conducted soil and rock borings in the designated areas. The results of their findings are listed below:

- **TA 6:** Estimated quantity of limestone=264,851 yd<sup>3</sup>; Rock Quality Designation (RQD) = 61%, Fair rock quality. Drill and blast may be required for excavation. Considered suitable for production of road gravel, ditch check stone, and rock fill; large, rectangular blocks can be produced in limited quantity. However, it contains significant quantities of chert that may impact its suitability for road gravel with wheeled-vehicle traffic. It is not suitable for riprap or concrete aggregate.
- **TA 37:** Poor rock quality. Fifteen feet of soil and thirteen feet of shale overlay the limestone.
- **TA 80:** Estimated quantity of limestone=339,768 yd<sup>3</sup>; RQD=75%, Fair rock quality. It is ripable and considered suitable for production of road gravel, ditch check stone, rock fill, road aggregate and riprap.
- **TA 90:** Estimated quantity of limestone=200,367 yd<sup>3</sup>; RQD=63%, Fair rock quality. It is ripable and considered suitable for production of road gravel, ditch check stone, rock fill, road aggregate and riprap.

## **Planning**

Effective erosion control begins in the planning stages. The first and foremost principle for borrow area activity is to disturb the least amount of ground for the least amount of time.

**NEPA Review:** Environmental review and permitting are integral to the planning process. Before opening a new borrow area or establishing a new spoil storage location, review of potential environmental impacts is required by the National Environmental Policy Act (NEPA). The process for evaluating an area should begin as soon as the need to establish a new site is identified. If new sites need to be activated, the process will involve consultation and permitting. The environmental review process will involve consultation with government entities outside of Fort Riley, which is the responsibility of DPW-E. Consultation and permitting actions often take 90-120 days, but can sometimes be longer or shorter, depending on the complexity of the negotiations.

Often, the DPW-E NEPA Manager participates in planning or scoping meetings and is in position to participate early in the planning process. In the situation where DPW-E is not included in planning/scoping, the DPW Business Operations (DPW-Ops) or Master



Planning (DPW-MP) Divisions will request, either verbally or in writing, evaluation of the potential borrow area through the NEPA Manager.

Based on the NEPA Manager's determination, the proposed site may require evaluation for stormwater concerns, impact on cultural resources, the existence of hazardous waste or contaminated sites, and impact to threatened or endangered species, or migratory birds. The NEPA Manager will coordinate internally with applicable DPW-E media area experts to review potential areas and associated environmental issues. The DPW-E media area experts will review the proposed borrow area with regard to legal and other requirements, and provide the NEPA Manager the results of their review.

If cultural resource issues arise, consultation with the State Historic Preservation Office will be required. If threatened or endangered species, or migratory bird issues arise, consultation with the U.S. Fish & Wildlife Service will likely be required. Either situation will likely delay permitting timelines.

Locations proposed for borrow must be evaluated to identify the best suited use for that area. This evaluation does not preclude, but enhances the requirement for NEPA review and documentation. Using a site for borrow may be just one of various competing uses for a location. To achieve a balance, evaluation is helpful to establish importance of the site and the implications of using the area as a borrow area. The degree of importance of a site may be influenced by a number of factors including:

- proximity of the construction project,
- quality and quantity of borrow material present and needed, and
- Impedance to the training mission.

The NEPA Manager will compile the results of all environmental analyses and has responsibility for determining the appropriate NEPA documentation for the site. The NEPA Manager will consult with the DPW-E Chief on the outcome. The proposal may require NEPA documentation in the form of an Environmental Assessment, a Record of Environmental Consideration, or the site may be covered by a categorical exclusion. If the proposed location cannot be used because of environmental constraints, DPW-E will coordinate with DPW-Ops and DPW-MP to identify alternative sites with similar characteristics.

***Permitting Under the Clean Water Act:*** Borrow sites on Fort Riley are controlled under the National Pollutant Discharge Elimination Program (NPDES) permit #F-KS51-PO02, authorized under the Clean Water Act. Kansas Department of Health and Environment (KDHE) has assigned Outfall Number 005A1 to Active Borrow Management Areas and requires updating this plan annually as well as prior to "placing new borrow areas into active use". Effluent discharge limitations are included on pages 4 and 5 of the NPDES permit.

A Stormwater Pollution Prevention Plan (SWP3) will be developed for each new site that will include an examination to determine locations of concentrated runoff, outfalls, and other areas where sediment control structures may be needed to control erosion and sediment for each borrow site. If use of a new borrow site will disturb ground areas of one acre or larger, a Construction Stormwater Permit for the action at that site must be obtained from the KDHE.<sup>13</sup> The permit application, Notice of Intent (NOI) must be submitted to KDHE no later than 60 days prior to ground disturbance. An annual fee of \$60.00 is required. The DPW-E Water Quality Regulations Compliance Manager will work in collaboration with DPW Engineering Services Division (DPW-ESD) to apply for a Construction Stormwater Permit from KDHE, which can occur in conjunction with the SWP3 development. KDHE regulations require that the SWP3 and the application be developed and signed off by a Professional Engineer licensed in the state of Kansas. The plan must be fully implemented for the life of the borrow area.

**Operation:** Construction projects most often fall under the purview of the Corps of Engineers, the DPW-Ops, the DPW-MP, or the DPTMS Integrated Training Area Management program. During construction planning, the project manager is to coordinate with the DPW-E Division when borrow material is needed, or spoil will be generated. Coordination will include reviewing all aspects of the borrow activities, including haul routes, proximity of construction sites to borrow areas, and the type and amount of borrow material needed. With this information, collaboration between DPW-E and the project manager will occur to identify suitable areas.

The project should be designed to use borrow material from the construction site or previously disturbed locations. If existing sites for borrow and spoils will be used for a project, protocol as outlined in Section 5 (Operation) will be followed. If a new site for borrow or spoil disposal is needed, protocol as described in Sections 4a and 4b will occur prior to following protocol in Section 5.

**Borrow Areas:** The list of sites that are approved for borrow activities, or that are in the process of being approved, is at Table 1. Changes from 2014 are that TA 1-B, TA 47, TA 51 and TA 91-B are added, while TA 91 and TA 103 are removed. Site details and maps for the borrow areas are in Appendix III. The use of a location for borrow other than those in Table 1 requires prior approval from the Director, Public Works, in accordance with the steps laid out in Section 4 (Planning) of this plan.

Borrow Area	Location	Material
Marshall Field (TA 1)	96° 46' 23.08" W Long 39° 2' 22.5" N Lat	Topsoil
Training Area 1-B	96° 46' 21.56" W Long 39° 2' 24.4" N Lat	Topsoil

<sup>13</sup> A Construction Stormwater Permit from KDHE is required prior to initiation of construction. The Clean Water Act authorizes civil penalties of up to \$37,500 per day per violation in addition to possible criminal sanctions.

Campbell Hill (TA 6)	96° 41' 14.68" W 39° 7' 30.66" N	Long Lat	Earth Fill
Training Area 47	96° 53' 8.29" W 39° 9' 20.22" N	Long Lat	Rock
Training Area 49	96° 50' 35.36" W 39° 8' 54.78" N	Long Lat	Topsoil
Training Area 51	96° 51' 55.17" W 39° 10' 30.22" N	Long Lat	Rock
Training Areas 79 and 80	96° 56' 31.97" W 39° 16' 1.52" N	Long Lat	Rock
Training Area 82	96° 56' 26.76" W 39° 16' 56.55" N	Long Lat	Rock
Training Area 90	96° 46' 33.26" W 39° 14' 20.263" N	Long Lat	Rock
Training Area 91-B	96° 46' 20.52" W 39° 13' 20.20" N	Long Lat	Rock

Table 1. Names and locations of approved sites for conducting borrow activities on Fort Riley.

**Excess Cut:** Government Contract Officer Representatives or government project managers of construction projects with excess cut materials from a site must coordinate with DPW-E Borrow Area Manager to determine locations for stockpiling excess material. Excess clay and topsoil should be stockpiled in separate locations. The DPW likes to keep topsoil stockpiled for small fill and reseeding projects in improved and semi-improved grounds areas. Less suitable material can be used where the quality of the fill material is not critical (e.g., under an unpaved parking area), and should be segregated from clay and topsoil piles.

The list of sites that are currently approved for placement of spoil piles is at Table 2. The use of a location for spoil piles other than those listed in Table 2 requires prior approval from the Director, Public Works, in accordance with the steps laid out in Section 4 (Planning) of this plan.

Spoil Placement Area	Location	Material
Williston Point Rd (TA-13)	96° 46' 59.438" W 39° 5' 59.744" N	Long Lat Soil, Rock and mixed
Campbell Hill C/D Landfill (TA-8)	96° 44' 23.62" W 39° 7' 15.927" N	Long Lat Soil, Rock and mixed
CPAC/DPW Spoil Pile	96° 46' 10.72" W 39° 4' 5.171" N	Long Lat Topsoil

Table 2. Names and locations of approved sites for placing spoils material on Fort Riley.

**Protocol and Responsibilities:** DPW-E will coordinate all users of and access to the borrow areas for borrow-related activity. Contract personnel wishing to use borrow

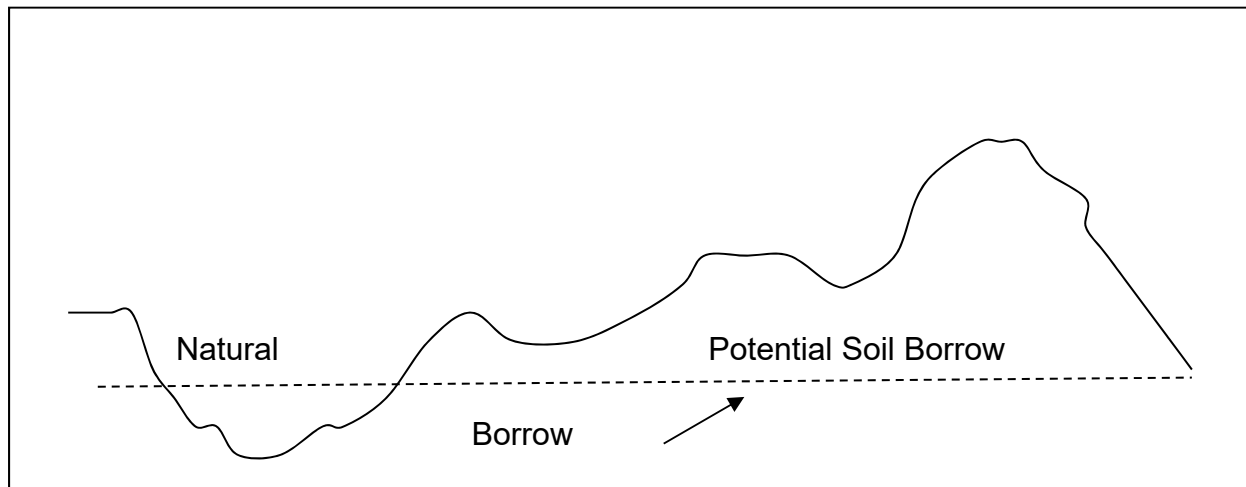
material or dispose of spoils must contact DPW-E through their government representative and abide by the stipulations as provided in the memo received that authorizes use of the sites. Government personnel wishing to use borrow material must contact Mr. Keating prior to their occupation of a borrow area. As practical, users will be staggered across the borrow areas to minimize co-occupation of sites. However, complete autonomy of use cannot be guaranteed to any user of borrow areas, so co-occupation should be anticipated. When training areas with active borrow sites are to be closed due to military training, DPTMS staff will inform the DPW-E Borrow Area POC, who in turn is to relay that information to all users active in the borrow areas during that time frame.

One of the main concerns with use of a borrow area from a permitting perspective is the potential for ground disturbance actions to result in sediment loads entering a nearby stream system. Ground disturbance activities include, but are not limited to, clearing and grubbing, establishing haul roads, establishing pads or buildings, and material extraction actions. The site-specific SWP3 will identify proper erosion and sediment control techniques. Erosion and sediment control practices must be properly installed, operated and maintained to be effective. While each borrow area site may differ, the general sequence of activities to control erosion and sediment is as follows:

- Prior to any ground disturbance, the areas where runoff water would leave the site must be determined from the SWP3 and be protected by installing all required sediment control measures, or determining that those measures already installed still are functional. Erosion on the site that results in concentrated sediment-laden runoff must be captured in a sediment detention structure. Structures may include silt fences, hay bale barriers, rock dams, grass filter strips, or sediment basins.
- Clean water that would normally enter the borrow area site from upstream drainage should remain clean. This can be accomplished by DPW-Ops constructing diversions where needed to direct clean runoff water around any disturbed borrow areas, and mulching the diversions.
- The initial establishment of the borrow areas may include construction-type activities such as clearing, grubbing, removal of downed trees and rocks, and stripping of topsoil.
- Cleared and grubbed material will be incorporated into an erosion control structure such as a windrow whenever possible. Otherwise, it will be piled on site or disposed of at the tree disposal area across from the Campbell Hill Construction and Demolition Landfill, as appropriate.
- Topsoil from fill and rock borrow areas will be stockpiled on site to restore vegetation to the site once the borrow activities are complete. Stockpiled topsoil will be fenced or otherwise surrounded with an engineering technique that will keep sediment from leaving the site.
- Borrow areas should be managed to collect and retain runoff water in an area where borrowing has been completed, rather than allowing sediment-laden water to leave the site. DPW-Ops installs sediment control structures for proper

detention of runoff water at the outfall for the borrow area, and installs sediment control barriers (silt fences, hay bales, etc.) where necessary. Borrow areas that allow runoff to bypass an outfall sediment control structure shall have silt fence barriers or other appropriate structures installed to control sediment.

- DPW-E inspects the sites quarterly for compliance with NPDES Permit requirements and the written SWP3. Also, the Division will monitor sediment accumulation in silt fences or sediment basins. DPW-E shall notify DPW-Ops when silt must be removed to provide original design capacity and the silt shall be properly spread in locations to be seeded.
- When Fort Riley is the permittee for construction of a borrow area, the DPW Divisions are responsible for designing, installing, monitoring and maintaining all stormwater control devices.
- The natural drainage pattern of the borrow area is the major consideration for depth to which borrow material may be removed. Excavation should not exceed the low areas that provide natural drainage. Figure 2 depicts the general approach for material removal at a borrow area.



**Figure 2.** Generalized concept for maximum depth of material removal at borrow locations.

- While a borrow area is in use, extraction activities sometimes leave a steep cut bank that approaches a 90 degree slope angle. To minimize potential safety hazards, whenever borrow actions will cease for a period that exceeds 14 days, the entity performing the borrow action must grade the cut bank to a slope of less than 2:1 at completion of the borrow action prior to the down time. Alternately, the entity performing the borrow may ensure the top side of the cut bank is clearly marked with reflective barrier materials that are visible to operators of vehicles approaching from the topside of the excavation, and warn of the presence of the cut bank.



- Slopes on topsoil stockpiles should be maintained at a 2:1 grade, with silt fences installed around the perimeter.
- In locations where spoil piles are placed and are not intended to be reused, spoil piles are to be leveled and compacted at the end of the project, or whenever stockpile actions will cease for a period that exceeds 14 days.
- Any area that has bare soil exposed to direct rainfall has the potential to erode and move sediment with runoff water. One of the most cost effective methods to stop sediment at the source is to cover the exposed area with mulch. However, the mulch must be removed or recycled when use of the site resumes.
- DPW-E Compliance Inspectors will monitor the borrow areas on at least a quarterly basis and after every rain event of more than one-half inch for the effectiveness of erosion and sediment control structures, to ensure environmental compliance, to identify illegal dumping, and to identify chemical spills. Erosion that does occur should be promptly corrected. DPW-E shall coordinate with DPW-Ops and DPW-ESD regarding additional practices that may be needed if those originally installed are not effective. Any potential safety issues will be reported to the Garrison Safety Office.

### **Rehabilitation**

***Non-Active Borrow Areas:*** Fort Riley has former borrow areas that are not currently authorized for use (Figure 3). These sites are ones that were used for borrow activities in the past but were not closed and reclaimed as usable space within the training areas. Actions described in Section 6 (Borrow Area Reclamation) need to be accomplished in these non-active borrow areas.

***Borrow Area Reclamation:*** Once a borrow area is devoid of useful material, the site needs to be returned to beneficial use for the installation. Exhausted borrow areas have potential for a number of uses. Frequently returning them to suitable use for military training is the most cost effective. Other areas may have use as construction and demolition landfills or disposal for excess compost, biosolids, lime sludge, remediated soil, spoil, or wood chips. Other potential uses are habitat for reptile, amphibian and other wildlife species.

- Slopes must be graded to a trafficable slope of approximately 3:1 or less.
- Adequate drainage must be established to prevent large-scale ponding. When located on a hillside, attention must be given to preventing erosion when reestablishing drainage. Routing outflow to a well vegetated natural drainage path or establishing stormwater diversions will help prevent erosion.
- Once borrow activities cease, evaluation of the site will occur to determine the best suited reclamation plan. When reestablishing vegetation at the site is desired to reclaim the area, topsoil that has been stockpiled will be spread back across the site, followed by reseeding. At other times, maintaining the rocky substrate with scattered loose rocks may be the desired end state to provide reptile habitat. In

these instances, once safe slopes are established and protective erosion measures are enacted, the site will be left to re-vegetate naturally.

- Any windrows should be removed as one of the last tasks prior to reestablishing vegetation on the site.
- When returning an area to native prairie, temporary seeding and or mulching may be required until permanent planting dates can be met. Some cover crops are oats, winter wheat, and western wheatgrass. Cover crops can be seeded along with native seed mixtures. Seed mixture and seeding rate should be selected based on site characteristics.

### **Points of Contact**

For questions or more information about Borrow Sites on Fort Riley contact the DPW Borrow Area Manager. The current Point of Contact for borrow area use is Mr. Josh Pease (telephone 785-239-8663; email [joshua.pease.civ@mail.mil](mailto:joshua.pease.civ@mail.mil)).



## BORROW AREA MANAGEMENT REPORT

FORT RILEY, KANSAS  
PEC Project No. 35-10446-6780

DRAFT REPORT  
JANUARY 2011

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## **Borrow Area Management Report for Fort Riley, Kansas Draft Report**

### **INTRODUCTION**

On behalf of Ft. Riley, GLMV retained Professional Engineering Consultants, PA (PEC) to prepare a borrow study report of the amount of potential soil volume in certain Training Areas around the Base that could be used for imported fill on construction projects. Two active TA's Nos. 6 and 24 currently serve as borrow sites, the locations are depicted on the enclosed Map No. 1. Base staff identified TAs 14, 15 and 16 as other possible areas in which excavated borrow material could be obtained that is in reasonable close proximity to the Custer Hill Area, also shown on Map No. 1.

PEC conducted a geotechnical drilling program and drilled exploratory holes throughout these areas for the purpose to estimate in-place soil volumes that could be used as borrow material in the future. A project goal was to identify approximately 25 years of borrow demand volume. Annually the Base needs about 100,000 cubic yards (CY) of borrow material for its projects. Consequently finding approximately 2.5 million CY of suitable borrow material was the goal of this study.

### **FIELD PROGRAM**

A field reconnaissance trip was conducted by PEC and BASE Staff on November 2, 2010, to investigate the feasibility for drill rig access into Training Areas 6, 14, 15, 16 and 24. TA 6A-6E was planned to be drilled during the first of two drilling programs such that enough data could be collected to estimate the potential borrow volume from the area. Excavation at TA 6 has only recently begun and there is believed to be a significant volume of suitable borrow material. Training Areas 14, 15 and 16 were considered as potential borrow sites due to their close proximity to the Custer Hill area. A drilling plan was prepared that could preliminarily estimate borrow volume potential. TA 24 was reviewed and would be drilled more relative to confirming little remaining borrow volume potential. All drill holes were planned to terminate at a depth of 20 feet or when a confining rock layer was encountered.

After the field reconnaissance, maps of the Training Areas were prepared that indicated where probable drill holes could be conducted. Figures 1, 2, 3 and 4 are included in the Appendix, which includes the approximate boring locations. Additional tree coverage area of TA 16 was considered in the positioning of potential drill holes. These maps were submitted to Base Staff and approved. After staff approval, these maps were submitted to the Fort Riley Dig Safe Office and Kansas One Call to secure drilling permits.

Upon receipt of drilling clearance on November 30, 2010, the first phase drilling program began on December 6, 2010. Forty-four (44) drill holes were accomplished in the five TA's as displayed on Table 1 and Map No. 1. Hole depths and the GPS longitude and latitude location and ground elevations are provided. A complete copy of Allied Laboratories geotechnical report is included in Appendix A and explains the suitability of the soils encountered.

## **BORROW VOLUME ESTIMATION METHODOLOGY**

The drilling hole Global Positioning System (GPS) data was obtained by using a hand-held unit manufactured by Garmin, Model eTrex Vista HCx. The unit has at least a precision of 10 meter horizontal accuracy. The horizontal precision of the GPS unit is satisfactory for this volume estimation study given the large planer area of the borrow sites and the limited number of drill holes that were budgeted and that could be accessed and developed.

GPS longitude/latitude data was converted using the Verscon software into Kansas State Plane Coordinates. The Base's mapping system is based on state plane coordinates and this allowed the plotting of the drill holes on the topographic mapping. PEC had current 2010 aerial photographic mapping of the BASE and this was used with the topography to produce Map No. 1. This map displays the Base's five-foot contour interval topographic mapping; drill holes and the potential borrow areas that were investigated.

The drill hole locations plotted on the topographic mapping provided an approximate ground elevation at each hole. The vertical depth of the drill hole was used as a distance from the ground elevation to determine the elevation of the rock layer. The effective hole depth for recoverable borrow material in open areas was discounted 8" for upper organic material and 12" above the apparent rock layer. The effective hole depth for recoverable borrow material in tree covered areas was discounted 18" for upper organic material and 12" above the apparent rock layer.

For soil volume estimation purposes, the Base's topographic mapping was converted into an irregular shaped computerized surface by the Base's GIS staff. A computerized surface of the underlying rock layer that was encountered by the drill holes was created by PEC from hole locations and the discounted boring depths. This rock surface was extended to the limits of the potential borrow site at a construction slope angle of 3:1. We recommend a resulting maximum slope height along the perimeter of a borrow site to not exceed 20 feet. With a 3:1 slope angle and intermittent terraces of 5 feet in width, the resultant limits of the borrow sites will have adequate slope stability. The drilling depths generally encountered were less than 20 feet. However some depth in TA 6 may exceed 30 feet and the borrow operation in this area may have to plan for the boundary slopes of the borrow site as described above.

These two irregular computerized surfaces were modeled as such and were used to compute the volume between them within a specified horizontal area that would be a practical area to excavate. ArcGIS 3D Analyst version 10 computer program was used. Computerized printouts of determined in-place soil volumes are enclosed in Appendix B. Figures 6 through 9 are included showing the land area used in the volume computation for each of the potential borrow sites.

From this drilling data and the computerized surfaces, estimates of borrow volume from each area were calculated and displayed in Table 2. Data from this study is limited to only a relatively small number of drill holes over a large total area of 505 acres. Consequently the accuracy of the soil volume estimates in this report is based on this limited information. The practical amounts

of excavated acreage in TAs 14, 15 and 16 were reduced to only within the limits of bedrock outcropping along hillsides from the drilling data.

As a verification of the computation of the in-place soil volumes, an estimate was performed using average hole depths over the same borrow site area to cross check the validity of the volume estimated between the two computerized surfaces. Average discounted depths of drill holes were computed within a particular TA. That average discounted depth multiplied by the surface area of the potential borrow area limits computed a theoretical maximum in place overburden that could be used. Table 2 displays these results. The average depth method produces a smaller in-place soil volume than the computerized method since the limits of the borrow site do not address the variability of the existing ground elevation as does the computerized surface method.

These two independent computational methods produced different estimations of in-place volumes, and this check of the computerized theoretical volume indicated similar results. Some limitations of this theoretical volume calculations are in order. It is estimated that only perhaps 90% of this theoretical volume is physically able to be excavated due to variations in the bedrock. Current borrow site TA 6 was investigated with 18 holes and found to have approximately 829,000 CY of in-place material that could be excavated, reference Table 2. So the balance of the desired soil borrow volume would have to be identified in the other training areas.

#### TA's 14 and 15:

TA's 14 and 15 have little soil volume and are more prairie-like. We estimate a total of 546,719 CY in these areas. Both TAs 14 and 15 have relatively shallow bedrock depths and do not offer much potential borrow volume. They are not recommended to be further evaluated.

#### TA 16:

This collected data suggests that of the three TAs 14, 15 and 16, TA 16 has the most probable in-place soil volume that could be excavated. Table 2 displays that TAs 14A, 14B, 15 and 16 have approximately 2.1 million CY when applying a 90% recovery factor. TA 16 alone can yield about 1.5 million CY of the desired volume of borrow material over the next 25 years, however the quality of the soil is questionable, being a heavy clay.

TA 16 is a more preferred borrow site in that there is much less native Kansas prairie land to be affected and soil available. However its heavy clay makeup may discount its usefulness to serve as the necessary compliment to TA 6 in order to meet the BASE's construction borrow material volume requirements.

Referring to the preliminary geotechnical report by Allied Laboratories in Appendix A, soils in TA 16 are classified as a heavy clay, whereas TA 6 soils are a lean clay. A second drilling program in TA 16 is recommended to be delayed until the BASE staff has had the opportunity to read this report. More drilling in TA 16 may better estimate in-place borrow volume, but will not change the conclusion that the material at this site is a heavy clay with limited construction applicability.

TA 24:

TA 24 was estimated to have only approximately 12,436 CY of borrow material left. Such a small volume and the fact that recently unsuitable material has been found at the limits of its current excavation, TA 24 should be closed to operation.

**TA24 RECLAMATION PLAN**

TA 24 has little usable borrow material. Recent excavations have been encountering shale material. It is recommended to be reclaimed as a training area. Photographs of TA24 were taken to display the steep banks at the limits of the borrow area and are enclosed in the Appendix C. These banks should be graded down to a bank slope of 3:1 horizontal to vertical. The bank slopes and flat areas of the former borrow site should be covered with topsoil and seeded. Figure 5 displays this concept.

TA 24 fortunately produces runoff that the BASE has directed to an existing sedimentation pond. No further runoff control improvements are necessary at this borrow site.

Other future borrow site reclamation plans should consider that the overall area be graded to positively drain into a sedimentation pond for control of erosion offsite. Steep side slopes should be regraded as per Figure 5. Suggested seeding specifications are enclosed in Appendix E.

**BORROW SITE OPERATION PLAN**

Each borrow site should have day to day operational procedures that will allow the BASE management staff to control excavation contractors and the operation of the site. Excavation should start at a predetermined location by Base staff and proceed in a specified direction and width until marked boundary limits of the borrow site are reached. The current operation of site TA 6B is a good example of this concept. Then a subsequent phase of excavation can start from a Base determined location and proceed in a direction and width until another marked boundary limit is reached.

Base staff has marked TA 6B with signage to control its operation. This method is working satisfactorily and should be continued on the other borrow sites in this study.

Once the length and width limits of the borrow site has been fully excavated, BASE staff can determine that excavation operations should cease. At that time the site should be considered to be discontinued and a reclamation plan prepared.

We recommend a resulting maximum slope height along the perimeter of a borrow site to not exceed 20 feet. With a 3:1 slope angle and intermittent terraces of 5 feet in width if the borrow site is deeper than 20 feet, the resultant limits of the borrow sites will have adequate slope stability. Contractors should be directed to leave a borrow site's terminating slopes in such configurations to eliminate the need for final site grading.

It is recommended that the BASE periodically have aerial photography produced of the borrow sites to show the limits of excavation. Annual mapping would be an adequate frequency.

Borrow sites should have a stormwater management plan in which runoff from the facility drains into a sedimentation basin designed to contain and attenuate the 25-year precipitation event. TA 6A has no recognizable stormwater management system in place however TA 6B currently does collect runoff water at the entrance to the borrow site.

A stand-alone portable generator is recommended only to be operated as needed.

Follow the general site good housekeeping requirements of the Kansas Department of Health and Environment (KDHE) under its Notice of Intent (NOI) permitting regulations. Copy of these requirements is included in Appendix D.

## **BORROW SITE IDENTIFICATION PLAN**

Viewing the suggested borrow sites from perimeter roadways is difficult due to the dense tree cover and the distance involved. It is believed that it would be helpful to the BASE staff to know points along the roadways that describe the limits of the borrow sites. Limits of the planned borrow sites were drawn on the aerial mapping (Map No. 1) as straight lines as much as possible over the expected area of soil borrow volume, throughout the drilling hole pattern and in between the known roadways. The direction of these limit lines were extended along an azimuth compass direction to calculate a GPS location on a roadway. Roadway GPS coordinate points and azimuth direction information is included in Table 3. Traversing these azimuth compass direction lines from the roadway GPS points would trace out the borrow site limits.

These GPS roadway points are also shown on Map No. 1 along with a distance in miles from the nearest road intersection. This location analysis is limited to TA 6 since it is the only borrow site well defined at this point in time. These points can be driven to along roadways from a known intersection and then a GPS unit can be used to more accurately find the reference point in the roadway. Viewing in the azimuth direction from the roadway is the location of the boundary of borrow sites. After some initial site clearing is performed to establish access into the borrow sites, site limit signs can be set by BASE staff from the information in Table 3. Setting borrow site limit signs can be performed as necessary when the BASE staff will begin to authorize excavation from any particular borrow site. Borrow site limits signs can be adjusted by BASE staff as necessary after a borrow site becomes active and visible after the tree cover is removed.

## **CONCLUSION**

The borrow volume estimates provided within this study suggest that TA 6 and TA 16 can produce an approximate amount of 2,359,625 CY of fill material. This volume does not meet the 2.5 million CY goal of this study, although this estimated volume is close to the volume goal. The quality of material found in TA 16 is not as good as TA 6 which may limit its construction uses and be more difficult to manipulate. Another environmentally approved site should be suggested for a similar borrow analysis to supplement this volume shortfall. TA 14 and TA 15 are less tree covered and more natural prairie like and should not be considered as borrow areas. TA 24 should be reclaimed as a training area and discontinued for borrow excavation.

CENWK-ED-GG

07 September 2010

## ASSESSMENT OF POTENTIAL TRAINING AREA ROCK BORROW SITES, FT. RILEY, KANSAS

### Introduction

Environmental Division of the Ft. Riley Directorate of Public Works asked the Geology Section to assess the suitability of potential rock borrow areas at four sites in the Range Training Areas (TA), TA-6, TA-37, TA-80, and TA-90. The request identified the desire for soil and rock borings to confirm rock ledge thickness and extent at each site. Environmental Division, DPW expressed primary interest in estimations of the quantity of suitable limestone rock at each site. The Environmental Division, DPW requirements as understood by the Geology Section are:

- Complete the investigation and report findings within 30 to 90 days
- Identify the thickness and estimate available quantity of limestone beneath each site
- Assess the suitability of limestone at each site for use as aggregate and riprap
- Rippable limestone units that can be excavated with an excavator are desirable
- Limestone ledges that require drill and blast to excavate are less desirable
- Deep excavation to expose and exploit a limestone ledge is not desirable
- Report the general thickness of overburden soils

Environmental Division, DPW provided site maps with designated areas to investigate and the associated acreage for each site from which borrow quantities were calculated.

### Methodology

Each site was visited at the on-set of the investigation to assess equipment access and identify the locations of nearby rock outcrops. Aerial photography was used to identify additional potential rock outcrops and their spatial relationship to each site. Two to three borings were completed at each site. Geology Section files were reviewed to assess applicable existing information on file for each site. Field work consisted of geologic reconnaissance and borehole drilling. Ten borings, A-10-21 through AC-10-30, were completed into limestone bedrock by Kansas City District drill crews. Boring depths ranged from 13 ft in AC-10-29 to 51.9' in AC-10-23. Soil overburden was field classified from auger cuttings. Bedrock was drilled and sampled by 4-inch diameter, double-tube, diamond-bit core barrel. The rock core was logged, photographed, placed in wooden core boxes and returned to the Kansas City District office. Detailed examination of outcrops with measured sections was completed at TA-6, TA-80, and TA-90. No outcrops large enough to measure were identified adjacent to TA-37. The closest measureable outcrop to the TA-37 site was a road cut 3,955 feet south of boring AC-10-21 and was considered too far away to compare specific lithologic features but close enough to provide stratigraphic correlation.

### Discussion

Boring logs, measured sections of outcrops, limestone unit thicknesses, soil overburden thicknesses, rock quality designation, index strength tests, estimated elevation range of bedrock units were considered in the assessment of each site. The completed drill logs and measured sections were reviewed, entered into the boring log database, and submitted to a series of quality control checks. The rock quality designation (RQD) was determined for bedrock encountered in each boring. The RQD is a measure of the frequency of lithologic discontinuities like bedding planes, joints, and fractures. The RQD was used to assess the relative ease with which the limestone bedrock might be excavated. High RQD values indicate intact or thickly bedded rock whereas low RQD values indicate thinly bedded or extensively broken rock. The thickness of each limestone unit and overlying soil were determined from each boring and correlated to the applicable measured section. Schmidt-type rebound hammer index strength measurements were conducted on selected samples of rock core from each boring except AC-10-21. AC-10-21 did not produce a sufficiently large specimen to conduct the test. Index strength tests are not laboratory tests and are inherently less reliable than lab tests but are useful for quickly establishing the relative strength range of rock. No seismic velocity measurements were made as part of this investigation. Consequently, rippability estimations are therefore qualitative and based on RQD, index strength tests, and professional judgment.

### Results

#### Assessment Criteria:

ETL 1110-2-182 Rock Mass Classification Data Requirements for Rippability  
Tech Report GL-85-3 Geotechnical Descriptions of Rock and Rock Masses  
GL-89-1 Rock Quality Designation after Twenty Years

Several assumptions were made in estimating the quantities for each site: a) One foot of limestone was assumed to be left after excavation to serve as a floor for the quarrying operation; b) Ten percent of the total area of the site was assumed to be unavailable for rock excavation due to overburden soil slope and access road construction; and c) A typical thickness of limestone at each site was intuitively selected to represent the thickness at that site and was used in estimation of quantities.

#### TA- 6 7.14 acres

Thickness of soil overburden = 1.5ft to 3.5ft of soil remains at active borrow site  
Thickness of limestone bedrock = 19.3ft to 28 ft (used 23ft)  
Maximum estimated depth of excavation = 31.0ft  
Estimated quantity of limestone = 264,851 cubic yards (assumes 7.14 acres)  
Quantity of limestone per acre = 37,094 cubic yards  
Estimated quantity of soil overburden = 46,061 cubic yards  
Controlling limestone discontinuity spacing = Thin to thick bedded = 0.2ft to 2ft  
RQD Average = 61% Fair rock quality

Index strength (correlated to unconfined compressive strength) = 6,250 psi to 2,700psi correlates to hard/very hard rock based on ETL 1110-2-282 Figure 2.

Assessment of suitability of limestone at TA-6 for mechanical excavation: Based on bedding thickness up to 2 ft, fracture spacing up to 10 ft, RQD, and index strength tests, the Florence Limestone is qualitatively considered not rippable. Drill and blast is likely to be the only cost effective means of rock excavation as mechanical production is anticipated to be extremely slow.

Assessment of suitability of limestone for production of road gravel, ditch check stone, and rock fill: Large rectangular blocks of Florence Limestone can be produced in limited quantity mechanically and to a lesser extent through blasting. The Florence LS generally has poor freeze-thaw durability and is not suitable for riprap. Blasting may produce a wide range of particle sizes. Standard quarry methods can be employed to produce a variety of smaller rock products such as road aggregate and ditch check. The Florence LS contains a significant percentage of chert making it unsuitable for concrete aggregate. The chert may produce very sharp and abrasive aggregate.

TA-37 two sites, 35 acres and 8 acres = 43 acres

Thickness of soil overburden = 14.4ft to 28.6ft

Thickness of limestone bedrock = 11.6ft to 17.2ft, average = 14.9ft (used 14ft)

Maximum estimate depth of excavation = 44.5ft

Estimated quantity of limestone = 874,104 cubic yards

Quantity of limestone per acre = 20,328 cubic yards

Estimated quantity of soil overburden = 1,373,592 cubic yards

Controlling limestone discontinuity spacing = Thin to thick bedded = 0.2ft to 2ft, predominantly thin bedded

RQD Average = 34% Poor rock quality

Index strength (correlated to unconfined compressive strength) = 2,800psi to 3,900psi correlates to hard/very hard rock based on ETL 1110-2-282 Figure 2.

Assessment of suitability of limestone at TA-37 for mechanical excavation: The Ft. Riley Limestone underlies TA-37. Based on bedding thickness predominantly 0.5 ft, RQD, and index strength tests the upper Ft. Riley Limestone is qualitatively considered to be rippable. The extent of weathering, the spacing of vertical joints and fractures, and local bedding thickness will control the relative ease the upper Ft. Riley can be excavated by mechanical means. Large areas may be excavated mechanically after ripping by a dozer equipped with a single shank ripper tooth. Some areas may resist ripping by dozer and locally require employment of a hydraulic-hammer attached to an excavator arm to loosen. Locally, where bedding is thin, and joints and fractures are closely spaced, mechanical excavation with a large excavator may be possible on a limited basis.

Assessment of suitability of limestone for production of road gravel, ditch check stone, and rock fill: The upper Ft. Riley Limestone varies from thin to thick bedded. Thin and medium



bedded zones may be conducive to the mechanical production of road aggregate and small ditch check rock. The thick bedded zones may be conducive to the mechanical production of large ditch check rock, riprap, and rock fill. Some zones may contain shale partings and beds that may only be useful as rock fill. The overburden at this site may exceed 22.5' over much of the southern site. Fifteen feet of soil and about 13 feet of shale may overlie limestone beneath the northern site. The excavation of thick overburden at TA-37 solely to access the underlying limestone may be cost prohibitive. However, if the TA-37 sites were used as soil and random backfill borrow sites for construction projects at Ft. Riley, eventually the limestone could be accessed economically.

#### TA-80 18 acres

Thickness of soil overburden = 3.5ft to 20ft

Thickness of limestone bedrock = 13 to 14.4ft (used 13ft)

Maximum estimated depth of excavation = 33ft

Estimated quantity of limestone = 339,768 cubic yards

Quantity of limestone per acre = 18,876 cubic yards

Estimated quantity of soil overburden = 287,496 cubic yards

Controlling limestone discontinuity spacing = vertical fractures 0.75ft apart

thin to thick bedded = 0.2ft to 2ft, predominantly thin bedded

RQD Average = 75% Fair rock quality

Index strength (correlated to unconfined compressive strength) = 2,500psi to 4,700psi  
correlates to hard/very hard rock based on ETL 1110-2-282 Figure 2.

Assessment of suitability of limestone at TA-80 for mechanical excavation: The Towanda Limestone is currently being mechanically excavated along the western boundary of the TA-80 investigation site. Based on vertical fracture spacing of 0.75ft, bedding thickness predominantly 0.5 ft, RQD, and index strength tests; the Towanda Limestone beneath the investigation site is qualitatively considered to be rippable. The extent of weathering, the spacing of vertical joints and fractures, and local bedding thickness will control the relative ease the Towanda Limestone can be excavated by mechanical means. Large areas may be excavated mechanically after ripping by a dozer equipped with a single shank ripper tooth. Locally, where bedding is thin, and joints and fractures are closely spaced, mechanical excavation with a large excavator may be possible.

Assessment of suitability of limestone for production of road gravel, ditch check stone, and rock fill: The Towanda Limestone varies from thin to thick bedded with vertical fractures spaced 0.75ft to 1.0ft apart. Thin and medium bedded zones may be conducive to the mechanical production of road aggregate and small ditch check rock. The thick bedded zones may be conducive to the mechanical production of large ditch check rock, riprap, and rock fill, however the closely spaced vertical fractures may limit the maximum rock size that can be consistently produced.

#### TA-90 23 acres

Thickness of soil overburden = 2.8ft to 12.0ft  
Thickness of limestone bedrock = 6.0ft to 8.3ft (used 7ft)  
Maximum estimated depth of excavation = 20ft  
Estimated quantity of limestone = 200,367 cubic yards  
Quantity of limestone per acre = 8,712 cubic yards  
Estimated quantity of soil overburden = 83,490 cubic yards  
Controlling limestone discontinuity spacing = vertical fractures 0.75ft apart  
thin to medium bedded = 0.2ft to 1.0ft  
RQD Average = 63% Fair rock quality  
Index strength (correlated to unconfined compressive strength) = 3,700psi to 5,200psi  
correlates to hard/very hard rock based on ETL 1110-2-282 Figure 2.

Assessment of suitability of limestone at TA-90 for mechanical excavation: The Towanda Limestone is currently being mechanically excavated along the eastern boundary of the TA-90 investigation site. Based on vertical fracture spacing of 0.75ft, bedding thickness predominantly 0.2 ft to 1.0ft, RQD, and index strength tests; the Towanda Limestone beneath the investigation site is qualitatively considered to be rippable. The extent of weathering, the spacing of vertical joints and fractures, and local bedding thickness will control the relative ease the Towanda Limestone can be excavated by mechanical means. Large areas may be excavated mechanically after ripping by a dozer equipped with a single shank ripper tooth. Locally, where bedding is thin, and joints and fractures are closely spaced, mechanical excavation with a large excavator may be possible.

Assessment of suitability of limestone for production of road gravel, ditch check stone, and rock fill: The Towanda Limestone varies from thin to thick bedded with vertical fractures spaced 0.75ft to 1.0ft apart. Thin and medium bedded zones may be conducive to the mechanical production of road aggregate and small ditch check rock. The thick bedded zones may be conducive to the mechanical production of large ditch check rock, riprap, and rock fill, however the closely spaced vertical fractures may limit the maximum rock size that can be consistently produced.

## Conclusions

Proposed borrow areas TA-80 and TA-90 are the best candidate sites for development of rock borrow material. The soil overburden thickness at these sites is not excessive and Towanda Limestone is present in sufficient quantity to be economically feasible to exploit. Numerous sites at Ft. Riley have demonstrated the Towanda Limestone can be excavated mechanically with large excavators and the rock material produced from those sites is adequate for use in range road maintenance.

Proposed borrow area TA-37 is underlain by the Ft. Riley Limestone rather than the Towanda Limestone. Although the properties of the upper Ft. Riley Limestone appear to be similar to those of the Towanda LS, the Ft. Riley Limestone does not have the history of excavation by track-hoe that the Towanda LS has and the Ft. Riley LS at TA-37 is overlain by a relatively thick mantle of soil overburden that reduces the desirability of TA-37 for rock borrow


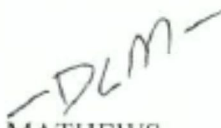
development. If the proposed TA-37 sites were first used as soil and random borrow material, the underlying limestone could subsequently be economically exploited.

Proposed borrow area TA-6 is an active soil borrow site within the construction/demolition landfill. Most of the overburden soil has already been removed from the area designated on the site plan provided by Environmental Division, DPW for drilling. The northern portion of the area designated TA-6A has not been stripped or borrowed and was not investigated for this report. Although a large quantity of limestone (Florence Limestone) is present beneath the TA-6 site, the fact that the rock will likely require drill and blast excavation methods reduces the site desirability solely for rock production. The high chert content in the Florence Limestone reduces the suitability of the rock for aggregate and riprap applications. However, the extra effort and expense required to exploit the limestone at TA-6 may be acceptable if additional landfill space is needed.

Based on a geologic section of the proposed TA-6 site, it appears as though the Florence Limestone dips gently to the southwest. Consequently, it is anticipated to occur at progressively higher elevations in a northeasterly direction. The topography of the northern extension of the TA-6A site decreases to the north. As a result, the Florence Limestone present beneath that portion of TA-6 is anticipated to be thinner due erosion.

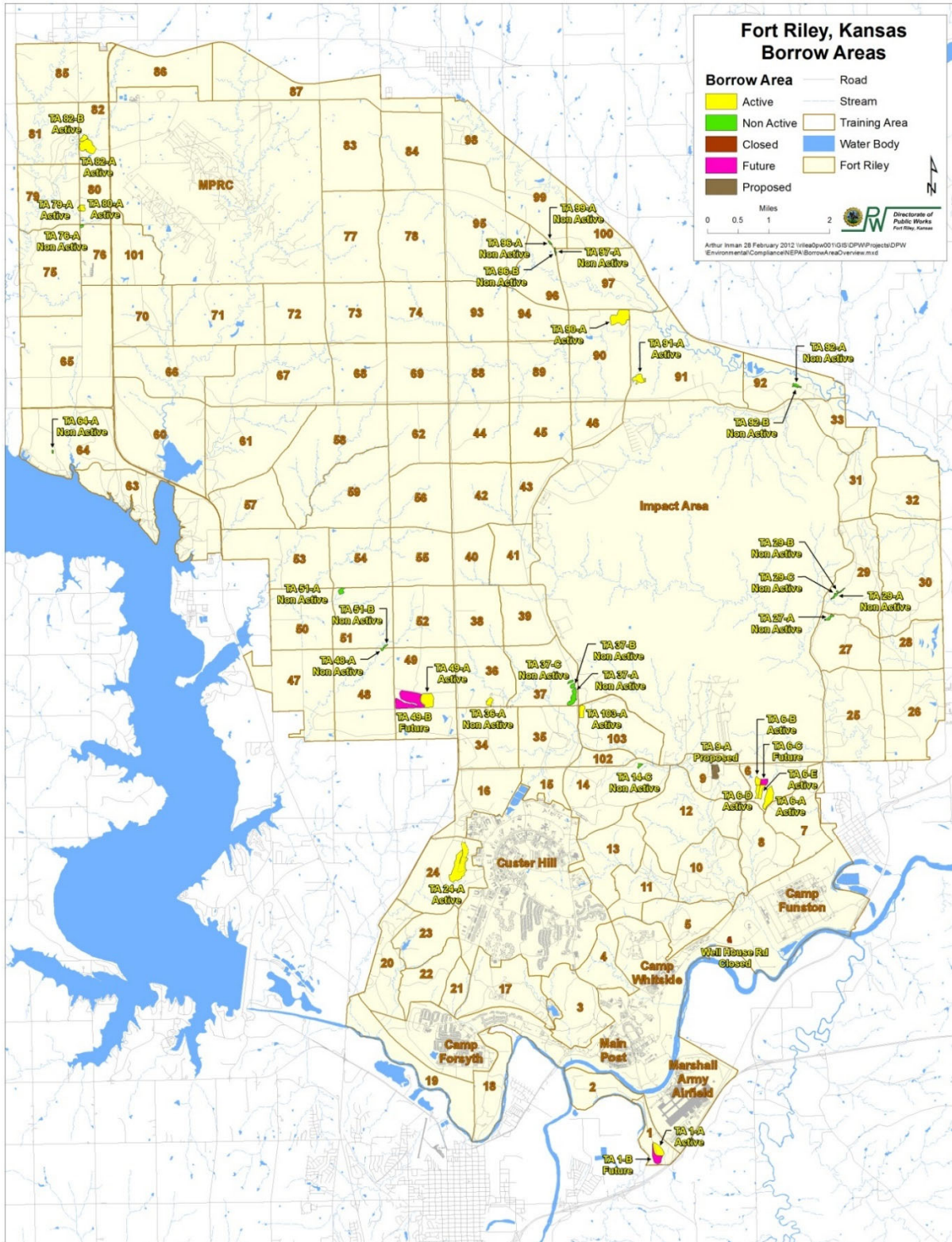
  
STEVEN J. JIROUSEK, RG  
ED-GG Geologist

  
HARMON  
PEER REVIEW

  
OLDER  
ED-GG  
  
MATHEWS  
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Appendix III. Site details and maps for the active borrow areas.

Appendix III, Map 1. General locations of Borrow Areas on Fort Riley.



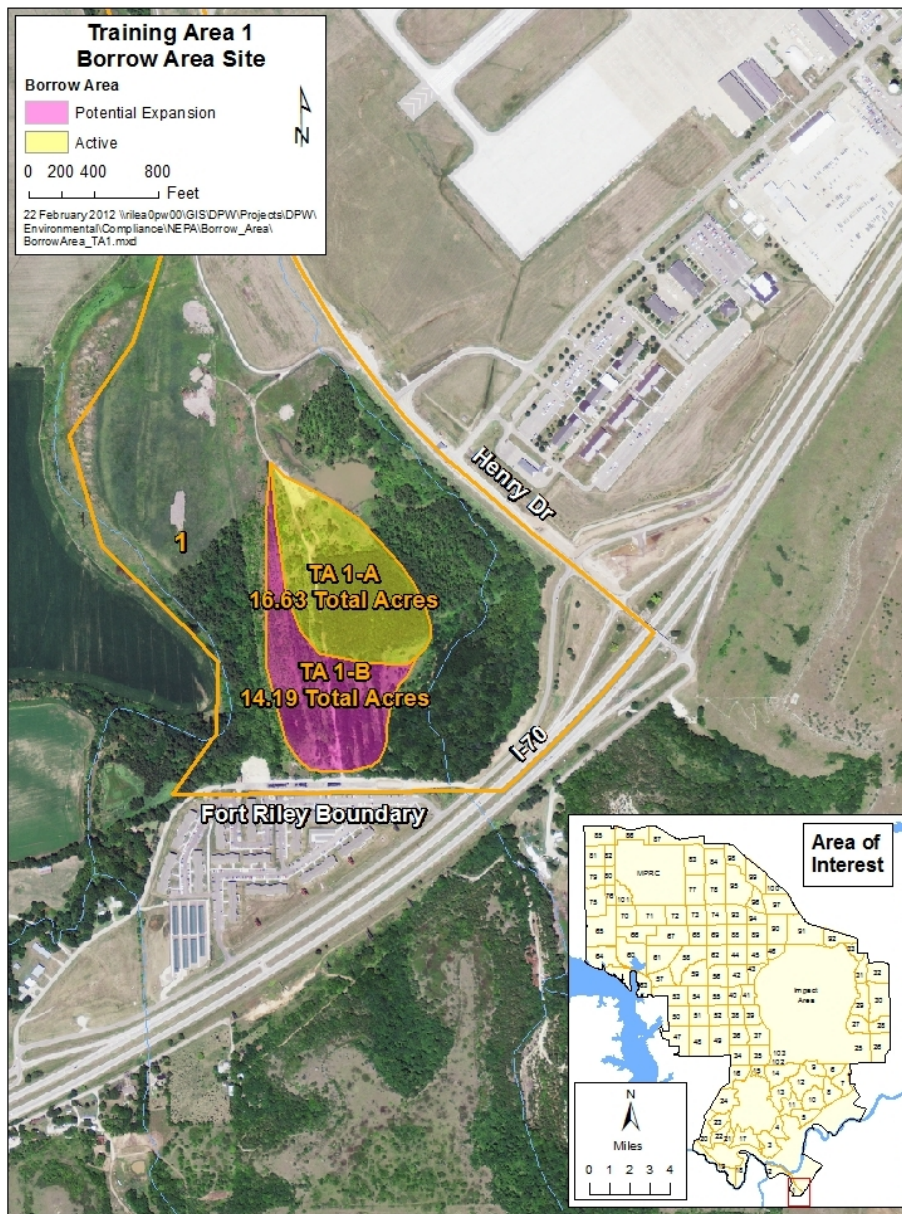
Appendix III, Map 2. Henry Drive Borrow Area (TA-1)

The Henry Drive Borrow Area (TA-1) was used to obtain topsoil material during construction projects at Marshall Air Field. How much useable material remains is not known. Much of the site is overgrown with grass and trees, including an agro-forestry planting established in the mid-1990's.

The soils in this area are represented by the Muir Series. Muir soils consist of very deep, nearly level, well drained material that formed in silty alluvium and colluvium. These soils occur on terraces of major rivers and creeks. The Muir soils are silt loam to silty clay loam, have a very high water retention capacity, and are moderately permeable. Flooding is a hazard. The site is relatively flat.

This location is outside of the perimeter access gate for Fort Riley. There is a gate in the perimeter fence that may be used; however, access through that gate must be coordinated with the Provost Marshall Office.

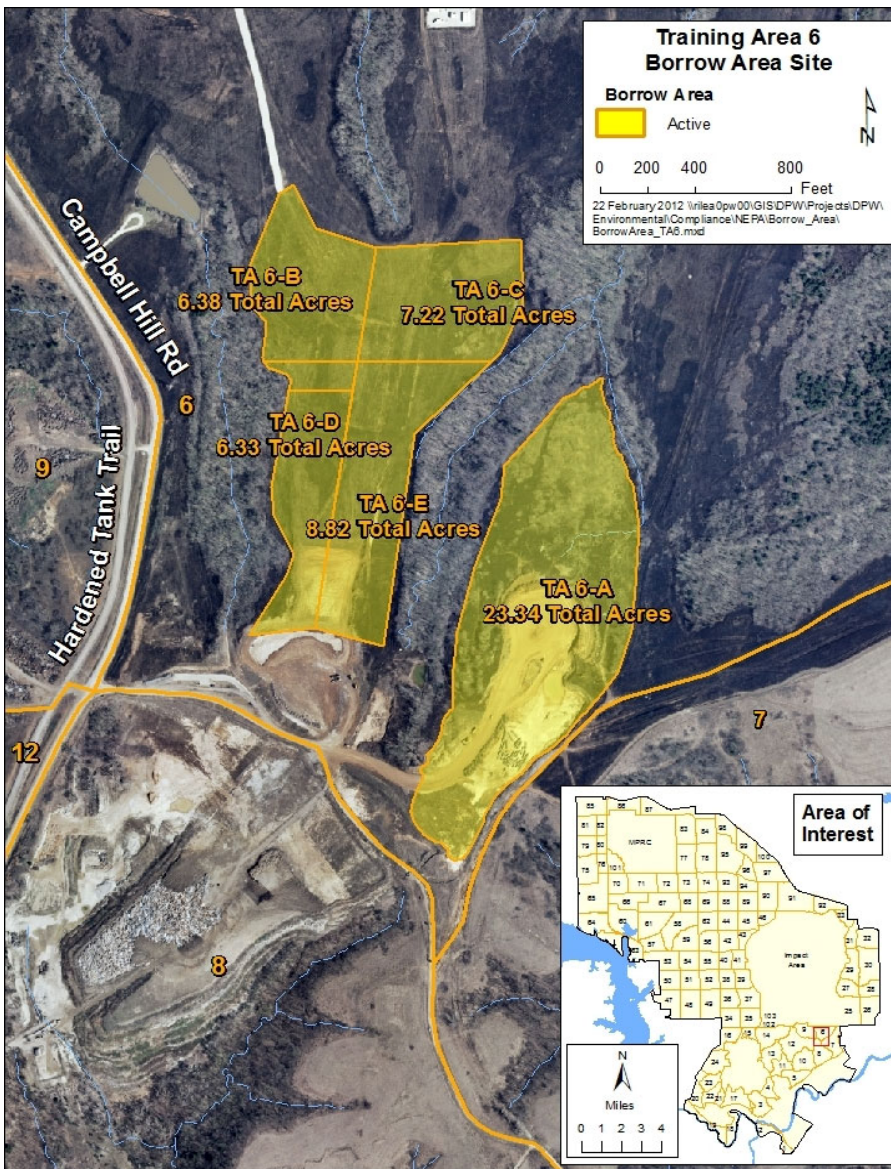
No borrow action will occur within the potential expansion area until the NEPA and SWP3 coordination as described in Section 4 of this plan are completed.



Appendix III, Map 3. Campbell Hill Borrow Area (TA-6)

The Campbell Hill Borrow Area (TA-6) is used to mine clay material. Borrow material should be removed from the active portion of the site until reaching the depth limits at the site.

The soils in this area are represented by the Smolan-Geary soil association that consists of deep, gently sloping and sloping soils on high terraces and uplands. These soils formed in loess. The soils are silt loam to silty clay loam and are moderately well drained to well-drained. Soil management of this soil association is concerned mainly with controlling water erosion. The drainage at the site is generally to the north and east to Dry Branch Creek.

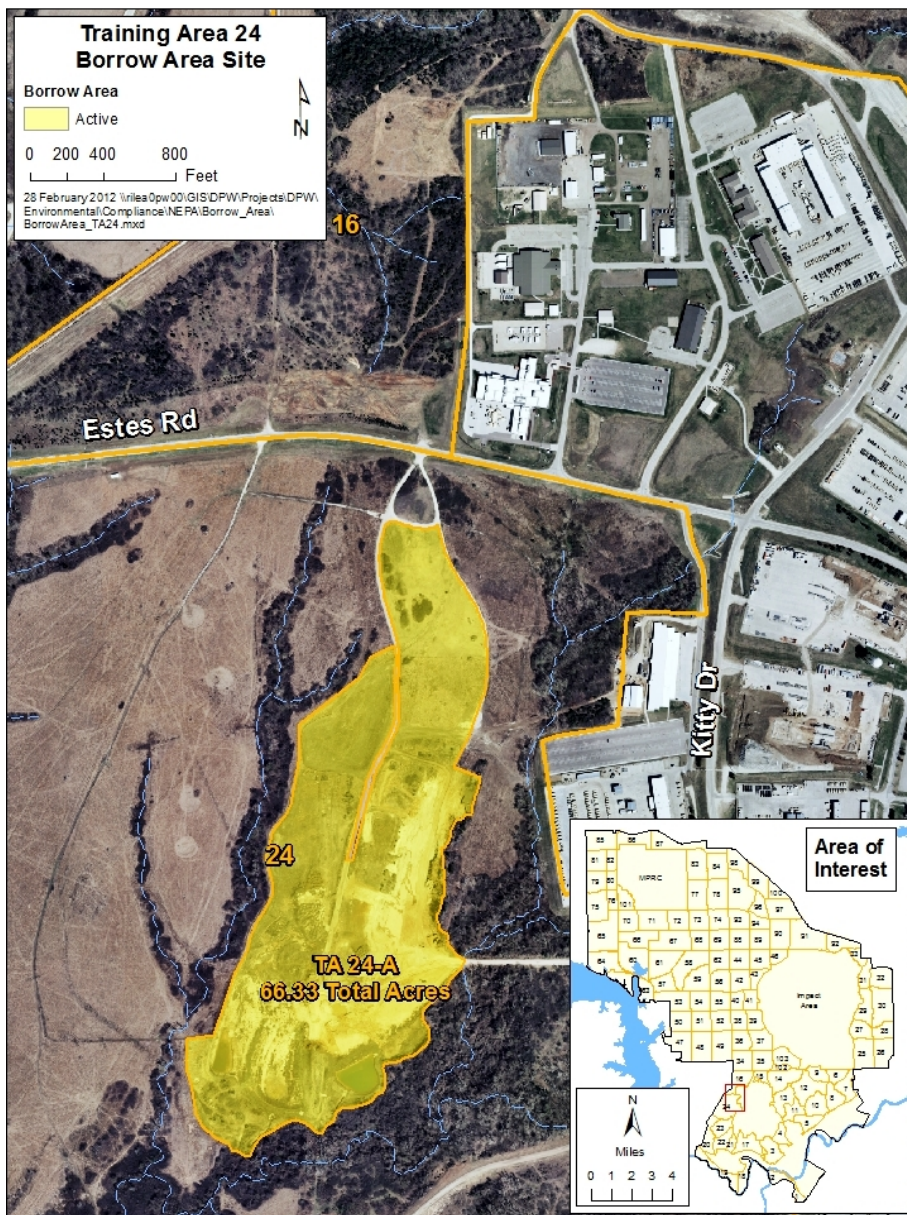


Permanent storm-water structures include diversions to channel any stormwater coming off the site to a sedimentation pond. The sedimentation pond acts as a basin to collect sediment laden runoff. Silt fencing will be used around soil storage pile that are placed outside the confines of the borrow area.

Appendix III, Map 4. Custer Hill Borrow Area (TA-24)

The Custer Hill Borrow Area (TA-24) was used to mine clay fill borrow. A survey conducted in 2011 by Professional Engineering Consultants (PEC) found that TA 24 has little usable borrow material remaining. Recent excavations have been encountering shale material. The site is closed for borrow and has been reshaped to remove hazardous slopes.

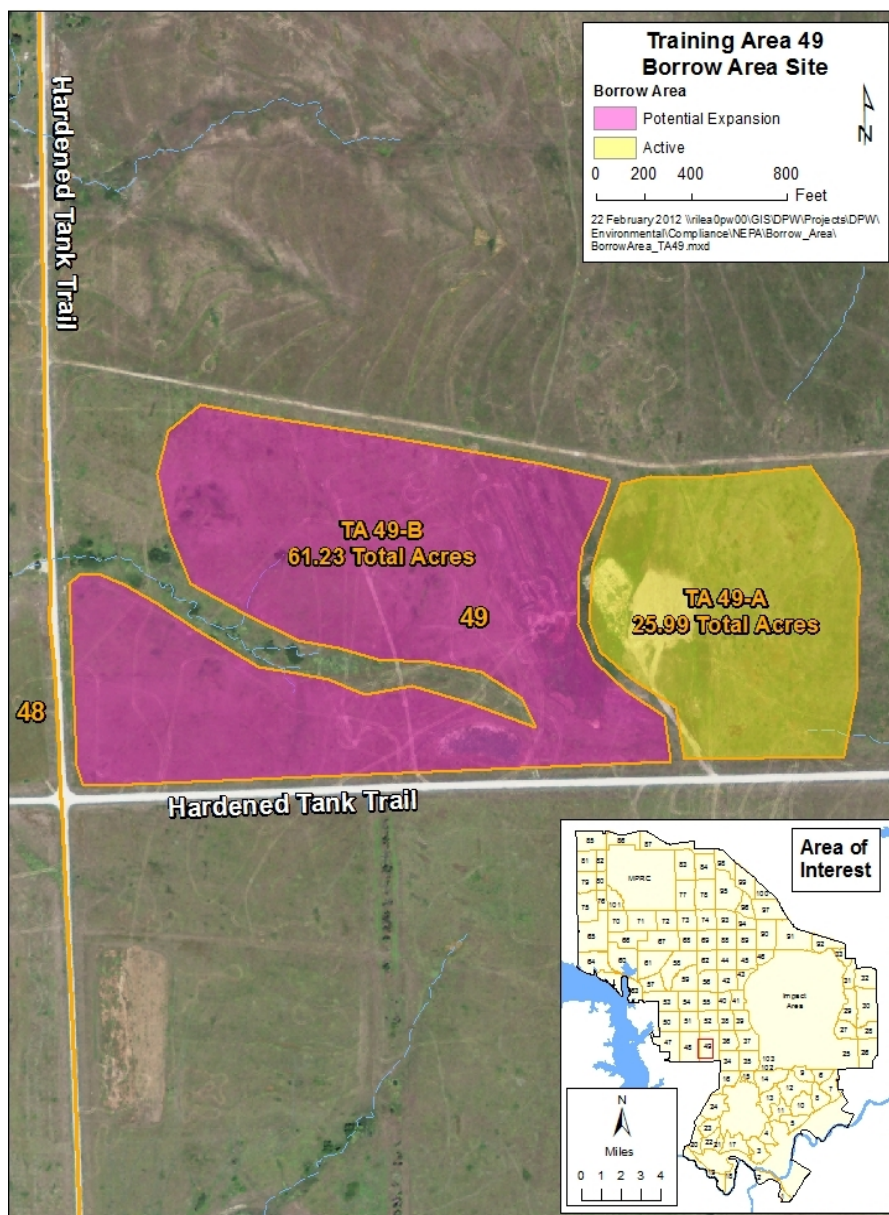
Soil management of this soil series is concerned mainly with controlling water erosion. The drainage at the site is generally to the south and southwest to Fourmile Creek. This site has sedimentation ponds to capture stormwater runoff leaving the site. The sedimentation ponds act as basins to collect sediment from the runoff and allow the water to percolate into the ground.



**Appendix III, Map 5. Training Area 49 Borrow Area**

The Training Area 49 Borrow Area is used to mine top soil. Borrow material will be removed from the active portion of the site until there is no longer any useable material remaining. No borrow action will occur within the potential expansion area until the NEPA and SWP3 coordination as described in Section 4 of this plan are completed.

The soils in this area are represented by the Crete soil series. The Crete series consists of deep, nearly level to undulating soils that developed in loess. Crete soils are silty clay loam, have slow runoff and are slowly permeable in the subsoil; wetness can be a problem during excess moisture. However, in hot, dry summers the soils tend to be droughty. Soil management of this soil series is concerned mainly with controlling water erosion. The drainage at the site is generally to the west to Rush Creek.



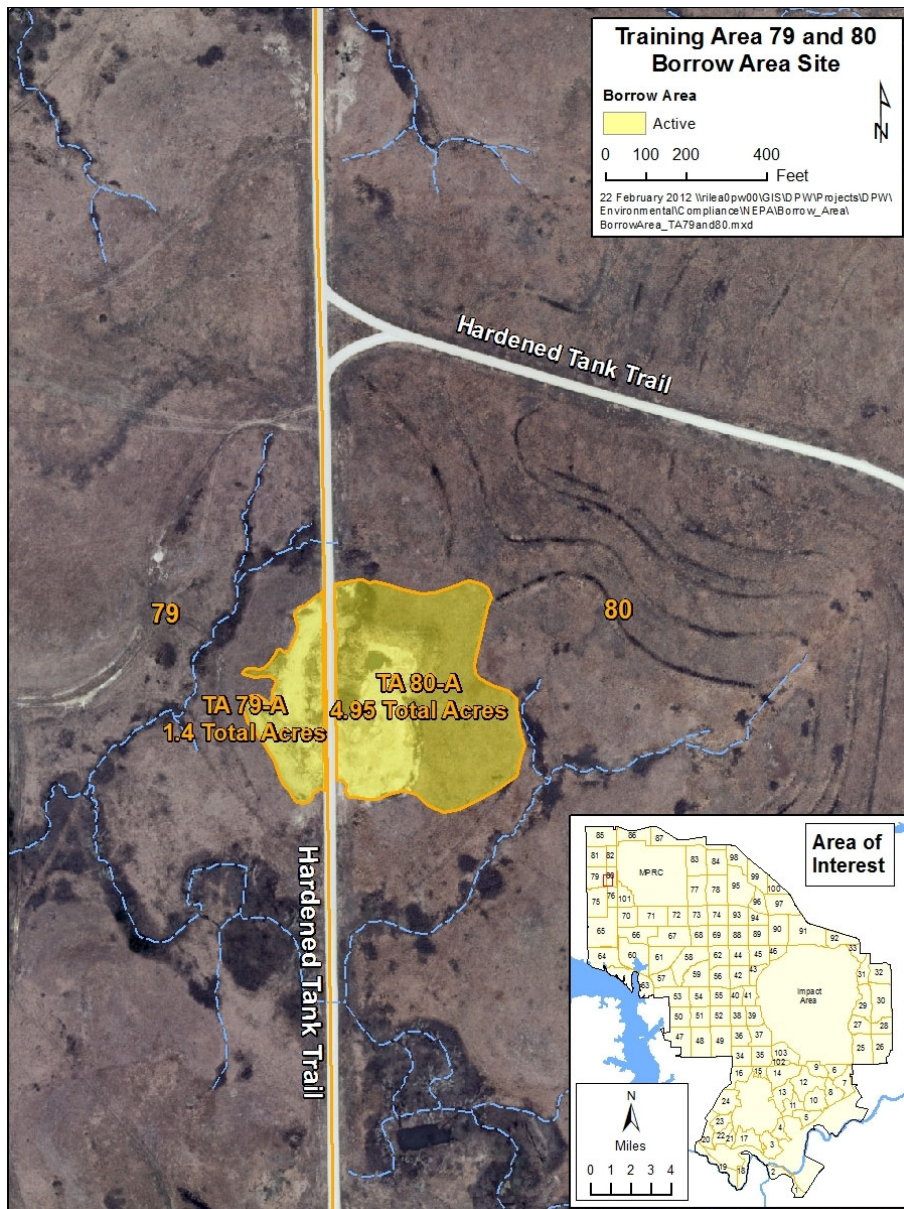
This location is relatively level, and has remnant terraces from prior crop production that provide an existing mechanism to slow runoff. The terraces divert runoff to either the natural drainage that is densely vegetated, or a road side ditch, which also is vegetated. Preservation of the outermost terraces precludes installation of new diversion structures. In the event terraces are leveled, permanent stormwater structures, including diversions and sedimentation ponds, will be installed. Silt fencing will be used around soil storage piles that are placed outside the confines of the borrow area.



**Appendix III, Map 6. Training Areas 79 and 80 Borrow Areas**

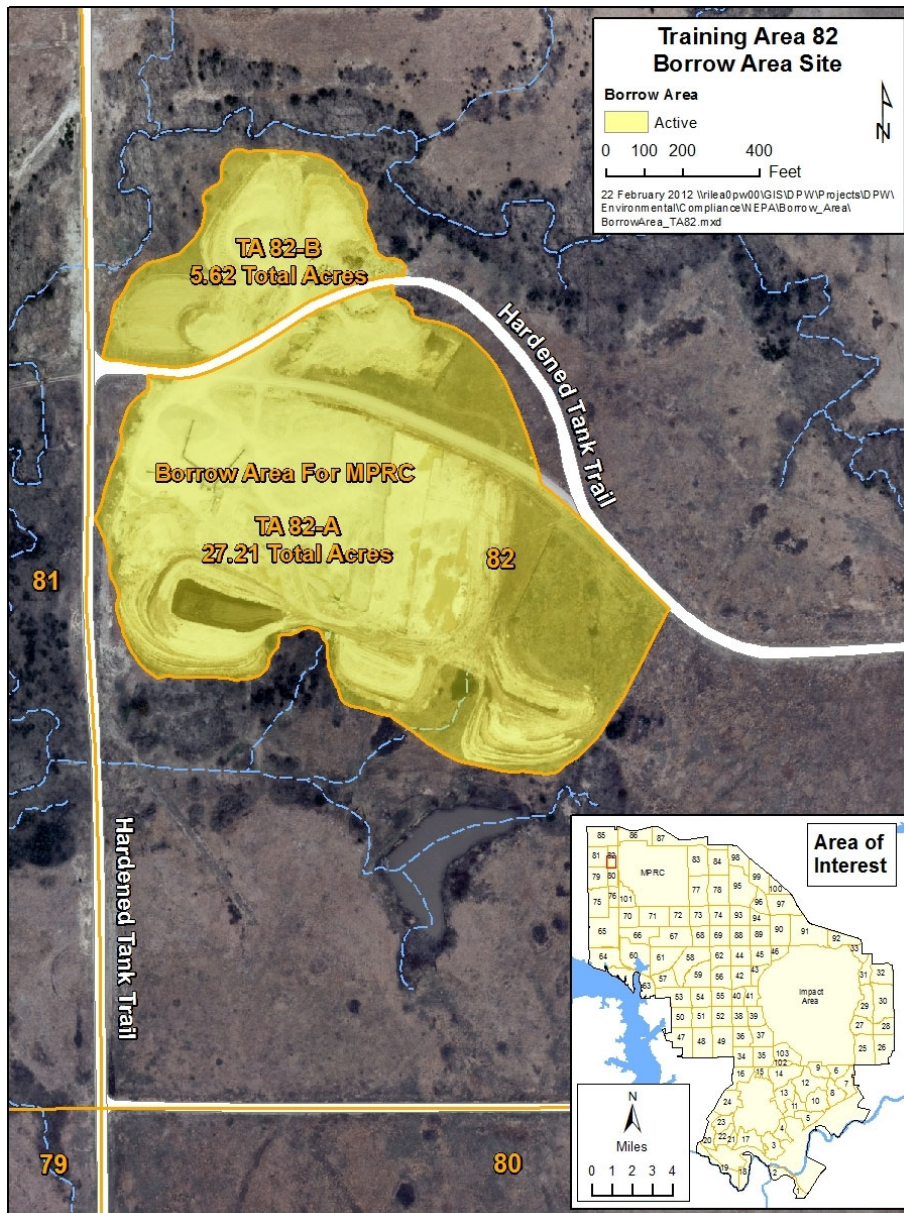
The areas in TAs 79 and 80 are used for rock borrow. The soils in this area are primarily in the Clime-Sogn and the Dwight-Irwin Complexes. Both soil types are susceptible to erosion when the surface is unprotected. Most of the soil in this area has been removed to expose the limestone layers beneath and is stockpiled in TA 80.

Drainage in the area is generally towards the south and west, to an unnamed tributary of Timber Creek. Stormwater protection is provided by graded berms surrounding the site. The TA 79 site has a sharply cut face ranging from 4-9 ft. that may pose a safety hazard to vehicles and foot traffic, especially at night and because of the proximity to the road.



Appendix III, Map 7. Training Area 82 Borrow Area

The area in TA 82 is primarily being used for rock borrow for construction projects at the Douthitt Gunnery Complex. The soils in this area are primarily in the Clime-Sogn and the Dwight-Irwin Complexes. Both soil types are susceptible to erosion when the surface is un-protected. Most of the soil in this area has been removed to expose the limestone layers beneath and does not appear stockpiled on-site.

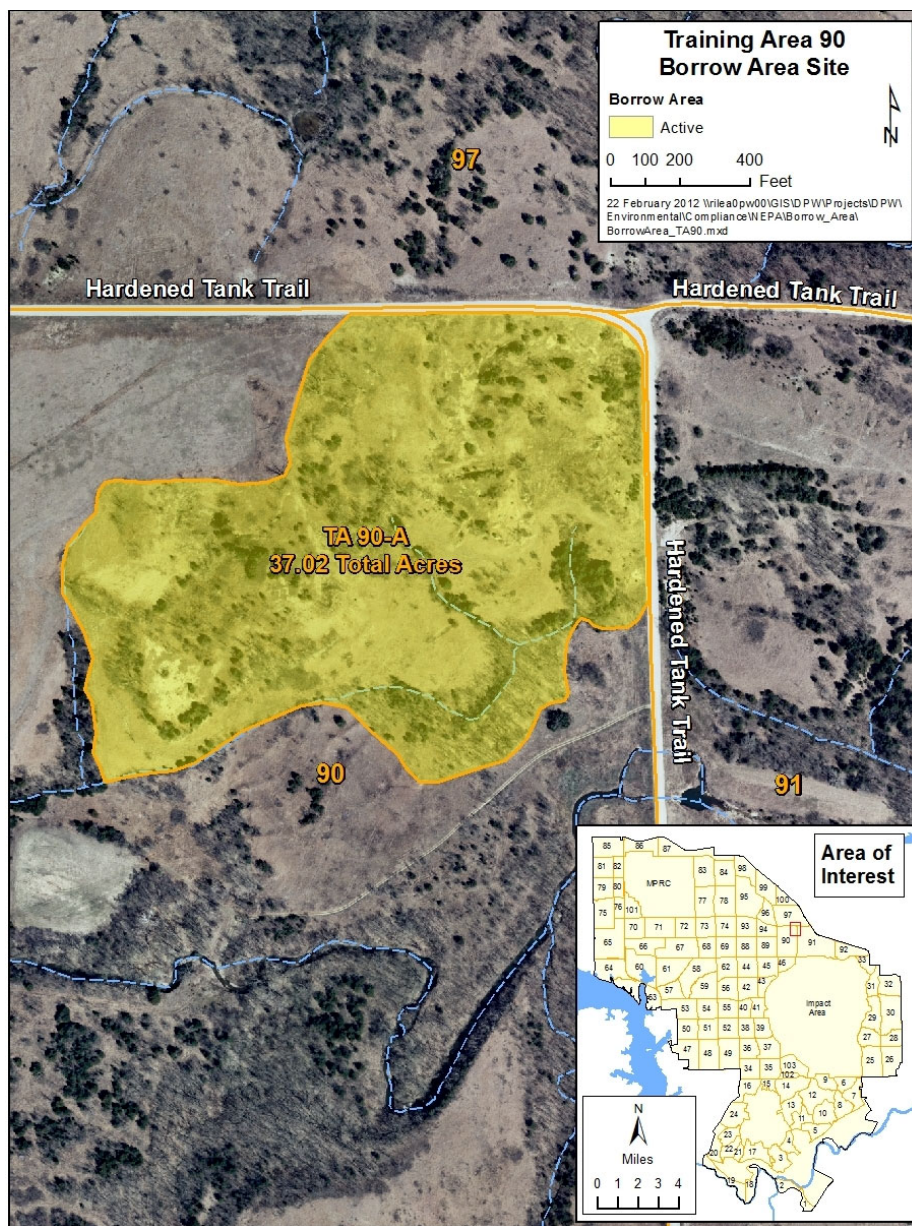


Drainage in the area is primarily towards the west of the site. Stormwater protection is provided by graded diversions surrounding the site and check dams as necessary within the active borrow area.

**Appendix III, Map 8. Training Area 90 Borrow Area**

The site in TA 90 is an old rock quarry site that was re-activated in 2010 when ITAM began borrowing rock from the site. Most of the soil had been removed by previous quarrying efforts, with some or most of it stockpiled on-site. The soils in this area are primarily in the Clime-Sogn and Complex which are susceptible to erosion when the surface is un-protected.

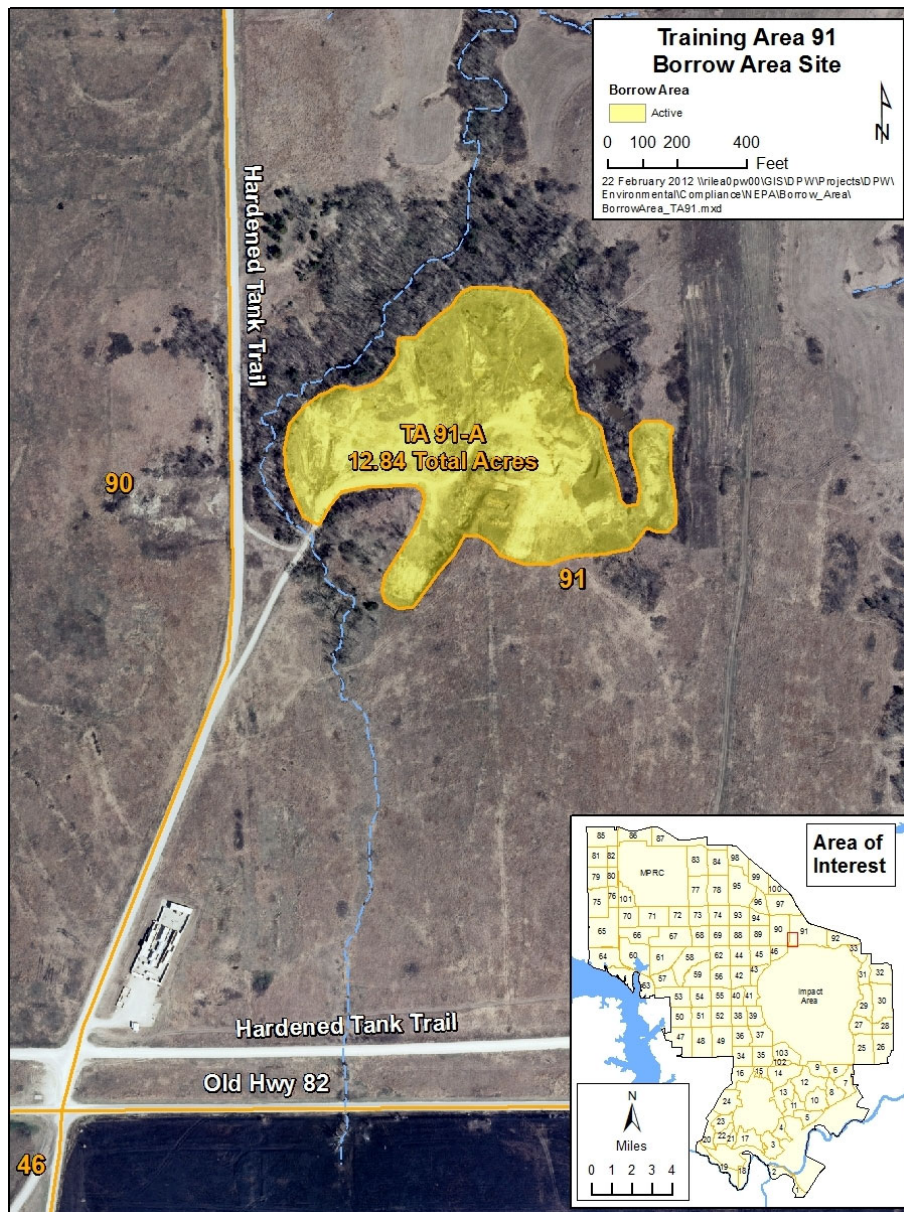
**Drainage at the site primarily is to the southeast corner towards Wind Creek, a stream with the endangered Topeka shiner. Stormwater protection is provided by graded diversions surrounding the site and a small sedimentation pond in the southeast corner of the site.**



**Appendix III, Map 9. Training Area 91 Borrow Area**

The site in TA 91 is currently being used for rock borrow by the DPW for road work and construction projects. The soils in this area are primarily in the Clime-Sogn Complex and Wymore Silty Clay Loam. Both soil types are susceptible to erosion when the surface is un-protected. Most of the soil in this area has been removed to expose the limestone layers, but remains stockpiled at the site.

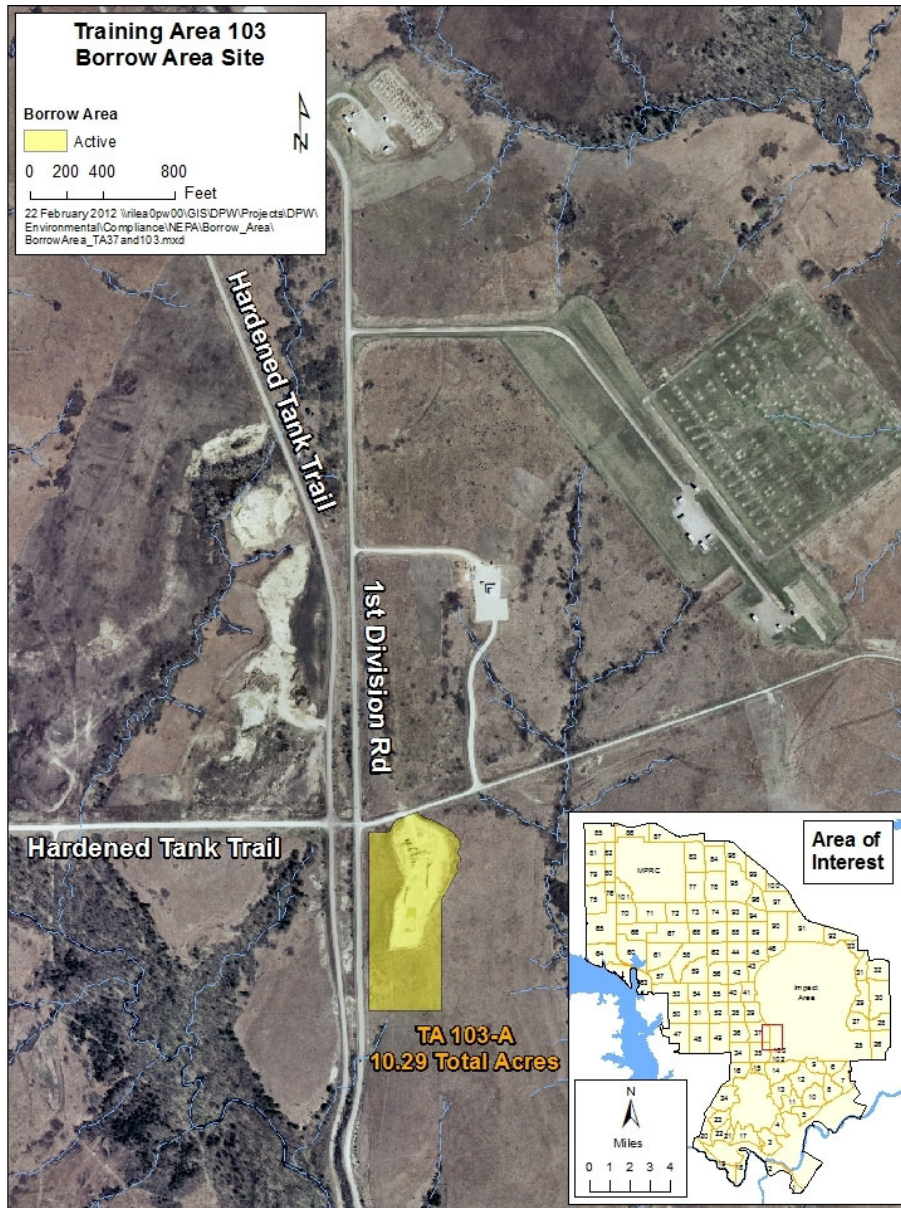
Drainage at the site primarily is to the northwest side towards Wind Creek, a stream with the **endangered Topeka shiner**. Stormwater protection is provided by graded diversions surrounding the site.



Appendix III, Map 10. Training Area 103 Borrow Area

The site in TA 103 has been used for rock borrow by the DPW and ITAM for tank trail repairs, range construction projects, and LRAM projects. The soils in this area are primarily in the Clime-Sogn Complex and Irwin Silty Clay Loam. Both soil types are susceptible to erosion. Most of the soil in this area has been removed to expose the limestone layers beneath. Little usable borrow material remains.

Drainage at the site is primarily towards the west towards Threemile Creek. Stormwater protection is provided by graded diversions surrounding the site.



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**APPENDIX O: CONSERVATION LAW ENFORCEMENT SOP**

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DEPARTMENT OF THE ARMY  
HEADQUARTERS, UNITED STATES ARMY GARRISON, FORT RILEY  
500 HUEBNER ROAD  
FORT RILEY KANSAS 66442-7000

IMRL-ESP

22 June 2016

SUBJECT: SOP #74—Conservation Law Enforcement Program

1. **PURPOSE:** To outline policies and procedures for members of the Conservation Law Enforcement Program (Game Warden) assigned to the Directorate of Emergency Services (DES), Fort Riley, Kansas.
2. **APPLICABILITY:** This Standard Operating Procedure (SOP) applies to all Department of the Army civilian employees and members of the United States Armed Forces who are stationed, assigned, or attached to the DES, Fort Riley, Kansas.
3. **REFERENCES:**
  - a. The Sikes Act, 16 USC 670.
  - b. DODD 4700.4.
  - c. CFR, Title 32.
  - d. AR 190-56
4. **GENERAL:**
  - a. The mission of the Fort Riley Game Warden Section is to ensure the sustained use of military land for readiness training by the enforcement of applicable Federal, State, and installation laws and regulations regarding natural and cultural resources.
  - b. Game Wardens will conduct a range of complex law enforcement activities to enforce natural and cultural resource laws such as investigating fish, wildlife, and archeological crimes, patrolling, surveillance, interviewing witnesses, interviewing suspects, securing evidence and searching for physical evidence and clues.
  - c. Game Wardens may also be involved in conducting seizure of wildlife or archeological contraband, equipment and vehicles, securing and serving warrants, making apprehensions, and testifying in Federal and State courts.
  - d. Game Wardens will follow the Department of the Army policy on criminal investigation activities including the utilization, control and investigative authority and responsibilities of all law enforcement personnel assigned to the Fort Riley Police Department.

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e. Game Wardens will operate under the authority and jurisdiction guidelines listed in AR 190-56. Any assistance to outside natural resource agencies must first be reviewed and approved by the servicing SJA.

5. RESPONSIBILITIES:

a. Fort Riley Game Wardens patrol over 100,000 acres of publicly accessible land to check for compliance with natural, cultural, environmental, and force protection laws and regulations.

b. Officers of the section investigate violations of natural and cultural resource laws and apprehend and/or cite subjects responsible for the violations.

c. Game Wardens adhere to the following responsibilities:

(1) Respond to all big game (deer, turkey, and elk) traffic accidents and are responsible for the disposal of the animal's carcass.

(2) Resolution of conflicts with nuisance or dangerous wild animals.

(3) Respond to incidents that occur in the Training Areas based on the Game Warden's knowledge of the area.

(4) Teach at Hunter Education classes, schools and educational events.

6. OBJECTIVES: The operational procedures of the Game Warden Section will be directed toward the following objectives:

a. Support the military mission by providing security for natural and cultural resources.

b. Assure installation compliance with Sikes Act requirements.

c. Protect troops, hunters, anglers, trappers, and other outdoor recreation enthusiasts from the dangers involved in illegal activities.

d. Enhance the professionalism, quality, and effectiveness of conservation law enforcement.

e. Provide quality of life opportunities for soldiers by helping to provide a safe, quality area for outdoor pursuits.

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f. Work to resolve conflicts between wildlife and people.

g. Educate those encountered about the importance of natural and cultural resource conservation and regulation compliance.

7. TRAINING: The effectiveness and professionalism of conservation law enforcement is directly related to its training program. Effective program development and sustained effectiveness relies upon initial hiring standards and subsequent "in service" and refresher training.

a. Each officer assigned to the Game Warden Section will be trained as a law enforcement officer.

(1) Additionally, each officer should receive no less than 40 hours of conservation related in-service training and 20 hours of law enforcement training per year.

(2) This training may be provided by the U.S. Fish and Wildlife Service (USFWS), the National Military Fish and Wildlife Association (NMFWA), the Federal Law Enforcement Training Center (FLETC), the Kansas Law Enforcement Center (KLETC), state agencies, or opportunities provided locally.

b. Each officer will comply with the training requirements outlined in AR 190-56.

c. Each officer will be trained in the use of four-wheel drive vehicles, ATVs, water craft and electric winches prior to their use.

d. Medical Evacuation Training.

(1) Each officer assigned to the Game Warden Section will receive, at a minimum, CPR and First Aid training.

(2) Officers in the Game Warden Section will provide patrols, Emergency medical personnel, and members of the Fire Department with familiarization training and maps of remote areas of post.

(3) In the event of an injury accident of any kind in remote areas of post, the on-duty Game Warden will adhere to the following responsibilities:

(a) Collect all pertinent information from dispatch and relay information to dispatch as it is gathered on scene.



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(b) Given their knowledge of the areas, assist all other responding units while safely arriving on scene in a timely manner.

(c) Assist patrols, Emergency Medical personnel, and the Fire Department with controlling the scene.

8. UNIFORM:

a. It is important that civilian Game Wardens wear uniforms that are consistent with their state and federal counterparts in order to be readily recognized as an authority figure.

b. Uniforms will be clean and serviceable. Worn and faded uniform clothing will be replaced by the officer by utilizing their allotted uniform allowance.

c. Military Police assigned to the Game Warden Section will wear military uniforms consistent with requirements and regulations pertinent to working the road.

d. Uniform requirements may be modified for specific missions as approved by the Chief of Police.

e. The uniform will be of the same configuration for both male and female officers.

(1) Shirts will be either long or short sleeved "button up" type or "polo" type and will be tan in color. "Polo" type shirts will only be worn under an outer vest carrier or during boating and other special operations. "Button up" type shirts will be worn in formal settings or as directed by management.

(2) Fort Riley Conservation Officer patches will be sewn to the sleeves in accordance with regulations on their placement.

(3) A badge and name plate will be worn on the appropriate part of the shirt when "button up" type shirts are worn. A sewn-on badge and name plate is authorized for "polo" type shirts only.

(4) Long trousers will be worn by the Game Wardens. These trousers may be of a "cargo" type. The trousers will be green in color.

(5) Head gear is optional in the Game Warden Section.

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(6) Boots will be of a sturdy construction consisting of leather and/or man-made materials.

(7) During major hunting seasons, game wardens will wear at least one article of blaze orange clothing when entering a training area on foot.

9. EQUIPMENT: Equipment supplied to each officer will consist of the following:

- a. Four-wheel drive vehicles equipped with radio communications.
- b. ATV's and UTV's will be available as needed.
- c. Electric winches.
- d. Binoculars and spotting scopes.
- e. Digital cameras and video cameras.
- f. Handheld GPS Unit.
- g. Maps.
- h. Duty belt consistent with requirements in AR 190-56.
- i. A 9 mm hand gun and other department issued firearms.
- j. Access to water craft.
- k. Wildlife capture equipment and bite gloves.

10. AREA PATROL: Game Warden patrols are often one person patrols. During times of peak activity in the field or when a mission is considered to be more dangerous than average, two person patrols should be used.

- a. Each patrol must contact dispatch and inform them that they are "active" or "in service" prior to going on patrol.
- b. Each patrol must then make contact with dispatch every two hours, at a minimum, to assure dispatch of the patrol's safety.

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c. A daily patrol sheet must be filled out by each patrol stating all activities performed by that patrol during the shift.

d. Game Warden vehicles should travel on either improved roads or established trails whenever possible. Off road travel is often required and will be performed in such a manner as to minimize the chance of vehicle damage or injury to passengers.

11. FISHING: When patrolling Fort Riley's rivers, streams, lakes, or ponds, the following procedures will be followed:

a. Check individuals for licenses (state), creel limits, and fish lengths. The individuals' identification card will be checked to verify the license's ownership.

b. Ensure that the area is open for fishing by utilizing the Fort Riley iSportsman website.

c. Ensure that FR 210-15 and any other regulations are complied with by the individual.

12. HUNTING: When checking hunters on Fort Riley land, the following procedures will be followed:

a. DO NOT enter the hunting area except for exceptional or emergency reasons. Personnel will be checked either upon entering or departing the hunting area.

b. YOU MUST have probable cause to search a vehicle or containers. Request instructions from the Watch Commander or the Game Warden Section supervisor if questions arise regarding this.

c. ALL CHECK POINTS OR DECOY MISSIONS will be coordinated with the Chief of Police.

d. Request the following items from each individual(s) that are checked for compliance with hunting regulations:

(1) State hunting license.

(2) Big game permits (if applicable).

(3) Hunter education/safety cards (if applicable).

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- (4) Firearms registration.
- (5) iSportsman compliance.
- (6) Recreation motor vehicle passes.
- (7) Area assignment cards (if applicable).
- (8) Identification cards and any other required documents.
- (9) Fort Riley Access Pass or Badge (if applicable)
- e. Check for unauthorized weapons, ammunition, and game.
- f. Ensure the area is open for hunting.
- g. Check for unlawful taking of game.
- h. Ensure that the individual(s) is in compliance with FR 210-15 with regard to their specific outdoor pursuit.

13. PROCESSING OF VIOLATORS: Violators will be processed as follows:

- a. Initiate DA Form 3975, CVB Notice or 1408, whichever is appropriate, at the scene. The subject may have fishing or hunting privileges revoked on the installation immediately according to FR 210-15. If this applies, the subject will be informed of this status.
- b. A DA Form 4137 will be completed listing all game/fish or equipment confiscated by the officer. Confiscation should occur when evidence essential to the character of the charge is needed.
- c. Game or fish will be preserved or disposed of at the officer's discretion. Evidence will be preserved in accordance with AR 195-5.
- d. Dependent children will be released to parents or legal guardians. All other violators will be released at the scene or apprehended and released from the Police Station based on the officer's discretion.
- e. Fish and Wildlife cases may be referred to the USFWS or KDWP based on the opinion rendered by SJA.

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14. SEARCH AND RESCUE: Search and rescue missions will be conducted as follows:

a. Patrols will obtain as much information as possible from witnesses or other victims to obtain a start point.

b. Game Wardens will assist patrols, military troops, and the Fire Department in beginning a ground search with available assets. Assistance from outside agencies may be coordinated with the Chief of Police.

c. A request for assistance from aircraft, either military or commercial, will be coordinated with the Chief of Police.

d. Use contract aircraft (if available).

15. USE OF POST HELICOPTERS.

a. Officers in the Game Warden Section may, in the course of their duties, request the use of post helicopters for special operations or observation purposes.

b. All requests for the use of helicopters will be coordinated with the Law Enforcement (LE) Chief and the MPDO.

c. All officers with the Game Warden Section participating in the use of post helicopters for any purpose will:

(1) Receive a mandatory safety brief from the flight crew before the flight.

(2) Strictly adhere to all instructions given by the crew at all times.

(3) Refrain from any activity that might interrupt the military training mission.

16. DISPOSITION OF ROAD-KILLED GAME:

a. Game Wardens respond to all big game traffic accidents. It is the responsibility of the Game Warden to transport the animal's carcass away from the scene of the accident.

b. Based on the officer's discretion, the animal may be released to the driver of the vehicle involved in the accident, a recipient on the Road Kill List, or disposed of at a designated area. If the animal is released to an individual, a Kansas salvage tag must be issued and a release of liability must be completed.

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c. All other road-killed animals, either domestic or wild, will be handled through a Public Works service order.

#### 17. HANDLING OF LIVE ANIMALS:

a. When handling live or injured animals, appropriate catch poles, gloves, or other protective equipment will be used.

b. Injured wild animals determined not to be able to be rehabilitated may be euthanized at the discretion of the officer.

c. If it is determined that an animal should be euthanized by shooting it, the officer will contact Fort Riley Dispatch and advise them that they will be expending a duty round.

(1) Before expending a duty round to euthanize an injured animal, all officers at the scene will clear the immediate area and inspect the area for bystanders or buildings within the weapon's effective range. The possibility of the round ricocheting will be considered and the danger area will be modified to meet this potential danger.

(2) The animal will be killed with a shot to the chest. Shots to the head should be avoided since they often fail to kill the animal and the head is a smaller, more mobile target.

(3) The expended brass from the round will be collected and the officer will prepare a DA Form 2823 for the incident. One copy of this DA Form 2823 will go to the Desk Sergeant or Watch Commander and one copy will be provided to the Deputy Chief of Police along with the brass from the expended round.

c. Under no circumstances will a weapon be fired in close proximity to houses, troop billeting, or business areas for the purpose of euthanizing an animal.

d. Endangered species or raptors found injured on the installation will be transported to the Kansas State University Small Animal emergency room for treatment and further release to a civilian rehabilitation program. The remains of an endangered species or raptor will be dealt with on a case-by-case basis.

18. NUISANCE WILDLIFE: The Game Warden Section has the responsibility to respond to complaints that require immediate action and assist the Wildlife Specialist, U.S. Department of Agriculture (USDA) that is stationed at Fort Riley with the removal of wildlife that is determined to be a nuisance on the installation. In the event Game

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Warden personnel are unavailable for initial response, road patrols will respond and make initial contact with the complainant and refer action to the Game Warden Section or Wildlife Specialist. The following guidelines will be followed:

- a. Non-emergent nuisance animal complaints within the Corvias Military Housing footprint will be handled by a licensed contractor employed by Corvias Military Housing.
- b. Non-emergent nuisance animal complaints in or around government buildings will be handled by the USDA wildlife specialist or Public Works representative by calling the Public Works Help Desk and requesting a service order.
- c. Road patrols will not injure, maim, or kill any wild animal. The intent is to encourage the animal to relocate on its own.
- d. Advice should be given to the complainant to discourage the animal's presence. If the problem persists, coordination should be made with the USDA Wildlife Specialist to remove the animal by trapping or other means.

19. USE OF POST VETERINARY SERVICES: The Game Warden Section will work with the post veterinary (vet) services for the following:

- a. If an animal scratches or bites a person, that animal shall be turned over to the veterinary facility. Veterinary staff shall determine appropriate disease testing of the animal.
- b. Officers shall coordinate with veterinary services regarding animals that are candidates for disease and document locations from which they were recovered.
- c. Officers shall attend all applicable training or working group meetings hosted by veterinary services.

20. Point of contact for this SOP is the Supervisory Game Warden, 239-8940.

WILLIAM S. PASKOW  
Chief of Police

## ACRONYMS

ACUB	Army Compatible Use Buffer
AGL	Above Ground Level
APHIS	Animal and Plant Health Inspection Service
AR	Army regulation
ATV	All-terrain vehicle
BCC	Birds of Conservation Concern
BRAC	Base Realignment and Closure
CACTF	Combined Arms Collective Training Facility
CEC	Commission for Environmental Cooperation
CERL	United States Army Construction and Engineering Research Laboratory
CO-OP Unit	Cooperative Fish and Wildlife Research Unit
CVB	Central Violation Bureau
DES	Directorate of Emergency Services
DMPRC	Digital Multipurpose Range Complex
DMPTR	Digital Multipurpose Training Range
DPTMS	Directorate of Planning, Training, Mobilization and Scheduling
DPW	Directorate of Public Works
DoD	Department of Defense
EO	Executive Order
FORSCOM	U. S. Army Forces Command
FR	Fort Riley Regulation
GIS	Geographic Information System
gpm	Gallons per minute
ha	Hectares
IAW	In Accordance With
ICRMP	Integrated Cultural Resources Management Plan
ICT4	Incident Commanders Type IV
IMCOM	Installation Management Command
INRMP	Integrated Natural Resources Management Plan
IPM	Integrated Pest Management
IPMP	Fort Riley's Integrated Pest Management Plan
ITAM	Integrated Training Area Management
KBS	Kansas Biological Survey
KDHE	Kansas Department of Health and the Environment
KDWP	Kansas Department of Wildlife and Parks
KSU	Kansas State University
LURs	Land Use Regulations
LIDAR	Light Detection and Ranging
LMP	Landscape Master Plan
LRAM	Land Rehabilitation and Maintenance
MAAF	Marshall Army Airfield
MEDDAC	Medical Activity
mgd	Million gallons per day



MOU	Memorandum of understanding
NCO	Non-commissioned Officer
NEPA	National Environmental
NM	Nautical Miles
NOTAM	Notice to Airmen
NRCS	Natural Resources Conservation Service
OMA	Operation, Management and Administration
ORISE	Oak Ridge Institute for Science and Education
PA	Programmatic Agreement
P.L.	Public Law
PLS	Planning Level Survey
RMEF	Rocky Mountain Elk Foundation
RTLA	Range and Training Land Assessment
RxB2	Burn Boss Type II
SAR	Fort Riley Species at Risk
SERDP	Strategic Environmental Research and Development Program
SHPO	Kansas' State Historic Preservation Officer
SINC	Species in Need of Conservation
SOP	Standard Operating Procedure
SRA	Sustainable Range Awareness
T&E	Threatened & Endangered
TRI	Training Requirements Integration
TSI	Timber stand improvement
UCMJ	Uniform Code of Military Justice
USAEC	United States Army Environmental Command
UNL	University of Nebraska-Lincoln
U.S.C.	United States Code
USDA	United States Department of Agriculture
USFWS	U.S. Fish & Wildlife Service
WDC	Wildlife Damage Control
WNS	White-nose Syndrome
WWTP	Wastewater treatment plant