Final Update

2019-2023

Fort Hood Integrated Natural Resources Management Plan

Directorate of Public Works Environmental Division Fort Hood, Texas

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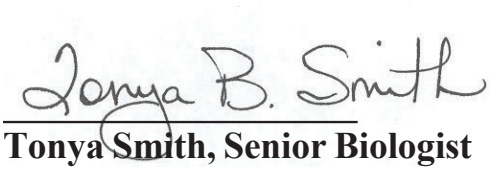

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FORT HOOD INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

PREPARED FOR:

Fort Hood
Directorate of Public Works Environmental Division Natural and Cultural Resources Management Branch

This Integrated Natural Resources Management Plan (INRMP) has been developed by III Corps and Fort Hood, Texas, in cooperation with the U.S. Department of the Interior, Fish and Wildlife Service, and the Texas Parks and Wildlife Department. The signatures below indicate the mutual agreement of the parties concerning the conservation, protection, and management of the installation's natural resources as presented in this plan.

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Executive Summary

This Integrated Natural Resources Management Plan (INRMP) is for Fort Hood and the U.S. Department of the Army in accordance with the Sikes Act Improvement Act, as amended; Department of Defense (DoD) Instruction 4715.03 (*Natural Resources Conservation Program*); Army Regulation (AR) 200-1, (*Environmental Protection and Enhancement*); and the most recent Department of the Army and DoD Sikes Act and INRMP guidance memoranda. The purpose of an INRMP is to provide guidance for the implementation and management of natural resources on Fort Hood during the 5-year period from 2019 through 2023. This INRMP uses an integrated, adaptive, ecosystem management approach for sustainability and consistency with the military missions on Fort Hood. The DoD with the assistance of the U.S. Fish and Wildlife Service (USFWS) and the Texas Parks and Wildlife Department (TPWD) are responsible under the Sikes Act (16 U.S.C. 670a-670f, as amended) for carrying out programs and implementing management strategies to conserve and protect biological resources on Fort Hood lands. INRMP implementation is imperative for increasing mission capabilities, minimizing military training constraints, and maintaining maximum flexibility.

Integrated natural resources management in an ecosystem framework promotes overall environmental quality and provides for recreational uses while protecting biological diversity and allowing military training access to the resources needed to maintain a high degree of combat readiness at Fort Hood. Effective sustainable use of natural resources accomplishes no net loss in the capability of the installation to support the military mission.

This INRMP provides a description of Fort Hood and its surrounding environments and presents various management practices designed to mitigate potential negative impacts and enhance the positive effects of the installation's mission on the regional ecosystem. These management practices complement the requirements of Fort Hood to accomplish mission requirements at the highest possible level of efficiency. To obtain an accurate assessment of Fort Hood's environmental impact, environmental analyses were completed to determine the physical and biotic nature of the installation and to determine the potential impacts of operational activities upon the natural environment.

This INRMP is a practical guide for the management, sustainment, and stewardship of all natural resources present on Fort Hood, thus helping to ensure no net loss in mission capabilities. This INRMP uses an interdisciplinary approach whereby scientific information is compiled from a variety of sources.

This INRMP represents a major revision of the 2013-2017 INRMP, reviews the natural resources activities undertaken at Fort Hood since implementation of the 2013 INRMP, and proposes new projects and initiatives for the years 2019 through 2023. This revised INRMP includes the procedural requirements of the National Environmental Policy Act (NEPA) and DoD Instruction 4715.03 and strives to fully integrate and coordinate the natural resources program with other Fort Hood plans and activities.

This INRMP establishes goals that represent a long-term vision for the health and quality of Fort Hood's natural resources. From these goals, objectives and management actions have been

identified that follow DoD and USFWS guidance. The INRMP goals and management actions are revised over time to reflect changing missions and environmental conditions. Actions proposed in this INRMP are subject to NEPA compliance.

This INRMP undergoes internal, NEPA, and interagency review on a regular basis to ensure compliance and integration with other installation management plans including Army guidance and regulations and State and Federal natural resources conservation plans. This INRMP was developed in cooperation with the USFWS and the TPWD. These agencies are partners with the U.S. Army and Fort Hood for the conservation of the natural resources that occur on Fort Hood. These agencies are stakeholders and signatories for this INRMP along with Installation Command and indicate their consent for the natural resources management program as outlined herein on Fort Hood.

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Chapter 1 Management Overview

1.1 Purpose and Scope

The purpose of this Integrated Natural Resources Management Plan (INRMP) is to guide the natural resources management program at Fort Hood, Texas, from fiscal year (FY) 2019 to 2023, in accordance with the Sikes Act Improvement Act (SAIA), as amended through 2003; Department of Defense (DoD) Instruction 4715.03 (*Natural Resources Conservation Program*, 1996); Army Regulation (AR) 200-1, (*Environmental Protection and Enhancement*, 2007); and the most recent Department of the Army and DoD Sikes Act and INRMP guidance memoranda. This INRMP is the principle guiding document for land management activities on Fort Hood, is a major revision of the 2013-2017 INRMP, and has been restructured based on the INRMP Template issued by the U.S. Army Environmental Command. This INRMP allows Fort Hood to achieve its goal of ensuring the sustainability of desired future conditions while maintaining ecosystem viability. In addition, this INRMP ensures that natural resources conservation measures and Army activities on Fort Hood lands are integrated and consistent with Federal stewardship requirements.

This INRMP addresses the geographic area associated with the contiguous properties of Fort Hood, with particular emphasis on the training areas. It provides management measures that were developed through consideration of various alternatives for meeting resource-specific goals and objectives at Fort Hood. This INRMP also provides rationale for why certain management measures have been selected for implementation and others have not, which are supported by analysis of resource-specific screening criteria. This INRMP is based on the philosophy of ecosystem management with the intent of demonstrating the interdependency between the military mission and natural resources management.

1.2 Management Philosophy

The management measures and strategies that will be implemented at Fort Hood have been developed with consideration for the interrelationships between the individual components of the ecosystem, the requirements of the military mission, and other land use activities. The focus is on maintaining the structure, diversity, and integrity of biological communities, while recognizing that the Soldiers and military mission are a vital component of the ecosystem. An adaptive management strategy has been incorporated into this INRMP to monitor the temporal and spatial dynamics of the ecosystem and to adjust the management measures and strategies based on improved knowledge and data. Monitoring programs will generate the data needed to determine whether the management measures and strategies are effective in achieving their intended goals and objectives. This management approach will preserve and enhance the natural resources while providing the optimum environmental conditions required to sustain the military mission and realistic training conditions at Fort Hood. Management measures in this INRMP were developed based on current conditions of the resources, the military mission, and activities as they are anticipated.

1.3 Mission and Natural Resources Management History

The Army recognizes that a healthy and viable natural resources base is required to support the military mission. Areas that are deemed unusable for training affect the military mission. This INRMP ensures that environmental considerations are an integral part of planning activities at Fort Hood and that natural resources are protected in accordance with Army regulations and policies.

Military operations performed at Fort Hood have the potential to alter the environmental setting and condition of the natural resources. The absence of long-term, collaborative management measures to properly conserve and restore natural resources could potentially impede Fort Hood's ability in continuing to adequately train Soldiers. Environmental damage can place other artificial constraints on training, such as the following:

- Loss of training acreage,
- Decreased tactical maneuverability,
- Increased land and natural resources maintenance costs,
- Increased safety hazards, and
- Civil or criminal liability.

The Soldiers who utilize Fort Hood are trained to be aware of the environmental effects of their operations and to recognize that their actions in the field directly affect the long-term sustainability of the training lands and their ability to continue training. Training the Soldiers to understand their environmental stewardship responsibilities assists in preventing environmental degradation during training activities.

The primary mission of Fort Hood is to conduct readiness training, promote survivability of Soldiers, and provide combat-ready forces for worldwide deployment. Environmental initiatives and plans are typically considered secondary and should not inhibit military mission requirements. In most instances, environmental initiatives and plans are in agreement with military requirements and are generally transparent to commanders in the field. For instances with apparent disagreement, discussion amongst trainers, commanders, and subject-matter-experts often resolves differences. It is important to consider limitations due to the presence of naturally occurring resources that cannot be altered, as well as limitations resulting from natural resources that have already been affected.

Existing natural resources on Fort Hood can influence the manner in which the military mission is executed. Not only is proper management of natural resources and their use by the military a sound environmental practice, but it also directly supports the Fort Hood mission to provide sustainable training opportunities. This INRMP considers the effects of such natural resources on the mission. Examples of training activities and their effects on the environment, as well as examples of how degradation to natural resources adversely affects the military mission, are provided in **Table 1-1**.

Fort Hood Regulation 200-1, *Environment and Natural Resources*, dated April 2014, prescribes policies, assigns responsibilities, and establishes procedures for protecting the environment while preserving natural and cultural resources. Commanders are responsible for integrating

environmental management principles and environmental protection activities and programs, to the fullest extent possible, into the planning and execution of the mission.

Table 1-1. Mission Activities and Potential Effects

	Potential Effects on:	
Activity/Use	**Natural Resources**	**Training/Combat Readiness**
Vehicles operated off-road	Degradation of soil, water, and vegetation	Loss of training realism
	Erosion gullies	Safety hazards in eroded areas
	Soil compaction	Contamination of soils could limit availability of training areas
	Soil and water contamination from field maintenance	Increased maintenance costs
Foxholes Defilades	Soil displacement	Loss of training realism
	Erosion; eroded soils unable to support vegetation	Safety hazards in eroded areas
Bivouac areas	Soil compaction and/or erosion	Loss of training realism
	Loss of vegetation understory and overstory	Loss of camouflaging for vehicles and troop locations
		Limit usable training areas
Range firing	Soil compaction, erosion, and inversion	Immobilized vehicles mired in mud
	Loss of vegetation understory and overstory	Loss of training realism
		Potential administrative restrictions as a result of disturbance to Federally protected species or habitat
	Wildfires from pyrotechnics, tracer ammunition, or shell detonation	Accidental fires result in loss of usable training areas
	Artillery training produces a heavy metals residue	May result in administrative restrictions

1.4 Goals and Objectives

The strategic goals of this INRMP conform to the goal of the Conservation Program of the DoD, which is to support the military mission by:

- Providing for sustained use of its land and air resources,
- Protecting valuable natural and cultural resources for future generations,
- Meeting all legal requirements, and

- Promoting compatible multiple uses of those resources.

Fort Hood's Natural and Cultural Resources Management Branch (NCRMB) has identified a number of objectives necessary to achieve these goals. **Table 1-2** aligns Sikes Act requirements with Fort Hood's objectives and program elements.

The ability to achieve these goals depends directly on the health and condition of the natural resources. Protecting the ecological and biological integrity of the training lands ensures that those lands will continue to provide the vegetation, soil, and water resources necessary for sustainable military training. Such protection will also preserve popular outdoor recreational activities at Fort Hood, such as hunting, fishing, birding, boating, and hiking. Implementation of ecosystem management principles will provide the quantity and diversity of fish and game for enjoyable hunting and fishing experiences. Proper management of the ecosystem will maintain water quality at a level that can support quality fisheries and presents no potential risks to human health.

Table 1-2. Goals and Objectives Aligned with Sikes Act Requirements

Goal	Objectives	INRMP
1. No net loss in the capability of military installation lands to support the military mission of the installation.	Manage all resources to support long-term sustainment of the installation's training mission.	**Chapters 1-6**
2. Establishment of specific natural resources management goals and objectives and time frames for proposed action.	Implement a natural resources management program that reflects the principles of ecosystem management.	**Chapters 1, 4, and 6**
3. Integration of, and consistency among, the various activities conducted under the plan.	Use adaptive techniques to provide flexibility of management strategies based on increased knowledge and data gained from monitoring programs and scientific literature.	**Chapter 3**
4. Provide for fish and wildlife management, land management, forest management, and fish and wildlife-oriented recreation.	a. Seek to maintain or increase the level of biodiversity of native species. b. Protect sensitive and ecologically significant habitats located on Fort Hood. c. Protect woodland resources from unacceptable damage and degradation resulting from insects and disease, animal damage, non-native invasive species, and wildfire; and manage the resources in a manner that supports the military mission. d. Protect soil resources from erosion and destabilization through prevention and restoration efforts. e. Protect and preserve cultural resources.	**Chapter 4**
5. Provide for fish and wildlife habitat enhancement or modification.	Manage wildlife and fisheries resources within the principles and guidelines of ecosystem management to maintain productive habitats and viable populations of native species.	**Section 4.9**
6. Wetland protection, enhancement, and restoration where necessary for support of fish and	Prevent the degradation of water quality, protect aquatic and riparian habitats, and identify and restore degraded habitats.	**Sections 4.6 & 4.9**
7. Public access to the military installation that is necessary or appropriate subject to requirements necessary to ensure safety and military security.	a. Provide quality consumptive and non-consumptive recreational opportunities while avoiding impacts on training and maintaining a balanced and diverse ecosystem. b. Provide a positive contribution to the community by offering informative and educational instruction and opportunities.	**Section 4.9**

Goal	Objectives	INRMP
8. Sustainable use by the public of natural resources to the extent such use is not inconsistent with the needs of fish and wildlife resources management.	Monitor outdoor recreational opportunities to ensure they do not conflict with natural resources or the military mission on the installation.	**Section 4.9**
9. Enforcement of applicable natural resources laws and regulations.	Maintain an adequate number of Conservation Law Enforcement Officers to protect the natural resources of Fort Hood by enforcing laws and regulations.	**Section 4.2**
10. Review of INRMP as to operation and effect by the parties on a regular basis, but not less often than every 5 years.	a. Allocate funds for INRMP review and update. b. Continue coordination with U.S. Fish and Wildlife Service and Texas Parks and Wildlife Department.	**Section 1.5**
11. Protect and provide a benefit to threatened and endangered species.	a. Provide special protection and management that leads to the recovery of threatened and endangered species and conserves species of concern and their habitats so that new species are not listed. b. Protect rare and unique plant species identified as state or locally rare, but without legal protection status, to the extent practical without restrictions on operations.	**Section 4.7 & Appendix B**

1.5 Review, Revision and Reporting

The Sikes Act specifies that a formal review by the stakeholders must be completed no less often than every five years; however, DoD policy (specifically DODI4715.05) requires installations to review INRMPs with regard to operation and effect annually. These reviews are intended to determine whether the existing INRMP is being implemented to meet the requirements of the Sikes Act and contributing to the conservation and rehabilitation of natural resources on Fort Hood. In accordance with these regulations and AR200-1, this INRMP will be reviewed and updated as appropriate in concert with installation needs to obtain mutual agreement in coordination with the U.S. Fish and Wildlife Service (USFWS), Texas Parks and Wildlife Department (TPWD), and other internal and external stakeholders. A 5-year update will not be required if circumstances have not changed.

Interagency Coordination. In June 2015, the USFWS published *Guidelines for Coordination on Integrated Natural Resources Management Plans*. In July 2015, the DoD released *Guidelines for Streamlined INRMP Review*. Additionally, *The INRMP Implementation Manual* (DOD Manual 4715.03) was published in December 2017. These documents clarify and describe a streamlined process for reviewing and updating existing INRMPs. The goal of using a streamlined approach for updating INRMPs is to reduce the workload for all parties, ensure INRMPs are current, and sustain mission flexibility. This guidance calls for all proposed changes be outlined in a text, table, or matrix format so that reviewing agencies may expedite review times. A table outlining the updates in this INRMP is included as **Appendix A3.**

Annual reviews will be conducted between Fort Hood, the USFWS field offices (Austin and Arlington, TX), and the TPWD. Annually, formal agency consultation letters are e-mailed to the USFWS and the TPWD. These letters officially notify USFWS and TPWD of Fort Hood's intent to prepare an INRMP and associated National Environmental Policy Act (NEPA) documentation (if needed). Fort Hood distributes the draft update to the USFWS and TPWD for review and comment. Once comments are incorporated, Fort Hood distributes the final update to the TPWD and to both the USFWS field offices (Austin and Arlington, TX) and the USFWS Regional Sikes Act Coordinator (Austin, TX). Any additional comments are incorporated into the final version of the INRMP. Once signed by all parties, the updated INRMP is considered reviewed for operation and effect and will restart the 5-year window for compliance. Previous NEPA documentation is assessed to ensure that the effects of the natural resources management practices in future INRMP updates have been adequately addressed. A Draft Finding of No Significant Impact (FNSI) is prepared, if appropriate. Applicable notes and written records documenting consultations is maintained in the official Administrative Record.

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Chapter 2 Installation Overview

2.1 Maps

Figure 2-1 depicts the installation boundary with major landmarks and features, including the impact area, training areas, cantonment and recreation areas, and leased areas.

Figure 2-2 depicts the impact and surface danger zone areas, restricted areas, parks and open spaces, and major wetlands/waters that are considered (or are likely considered) "waters of the U.S" by the U.S Army Corps of Engineers (USACE).

Figure 2-3 depicts the installation in relation to other land uses, Army Compatible Use Buffer (ACUB) priority areas, parcels in easements, and other regional opportunities or constraints.

Note: All maps in this INRMP were prepared by NCRMB GIS staff utilizing 2018 data.

2.2 General Installation Information

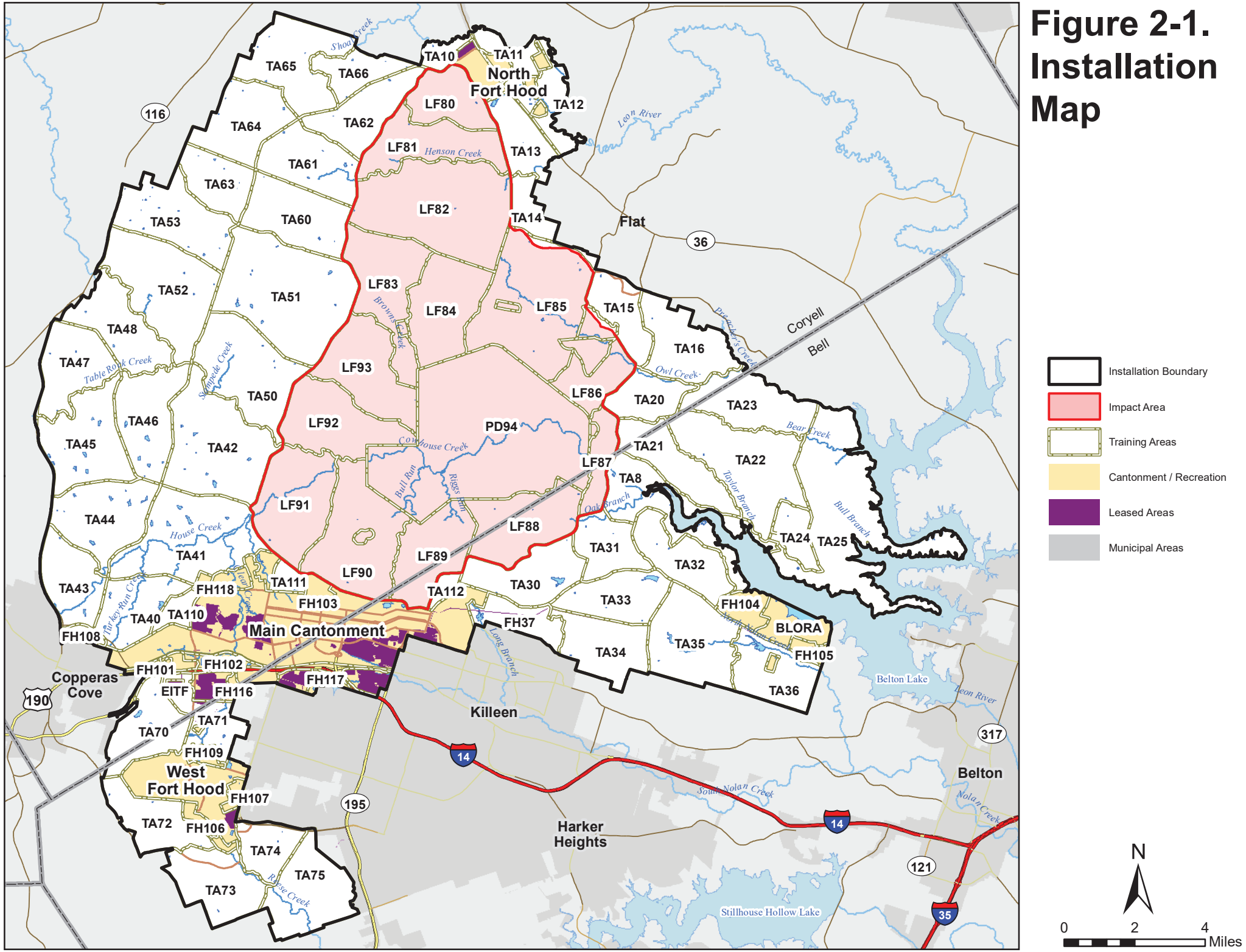
2.2.1 Location

Fort Hood Military Reservation is located in central Texas within Bell and Coryell Counties adjacent to the City of Killeen. Fort Hood lies between the major cities of Waco, 39 miles to the northeast, and Austin, 60 miles to the south. Food Hood is bounded on the east by Belton Lake and on the south by the cities of Copperas Cove, Killeen, and Harker Heights. The City of Gatesville is located north of the installation.

The installation has three cantonment areas (designated the Main Cantonment Area, West Fort Hood, and North Fort Hood), two instrumented airfields, and maneuver and live-fire training areas (see **Figure 2-1**). The Main Cantonment Area is at the southern edge of the large, central portion of the installation and is adjacent to the City of Killeen. West Fort Hood cantonment area is between the Cities of Copperas Cove and Killeen, in the center of the southern extension of the installation (south of Highway 190 / Interstate 14). North Fort Hood (NFH) cantonment area is near the City of Gatesville, in the northernmost part of the installation.

Fort Hood is one of the Army's premier installations, providing training facilities for the full range of mission requirements, including maneuver exercises for units up to brigade level, firing of live weapons, and aviation training. Fort Hood's mission is to provide an efficient and effective power projection platform—training, mobilization, deployment, and sustainment support—to produce the world's best trained and most effective Soldiers. Fort Hood provides state-of-the-art facilities to support the full spectrum of training requirements of today's modern armed forces. Installation lands and ranges provide excellent training opportunities for mechanized maneuver and small unit exercises, combined arms training, and live-fire training. Many different types of military units conduct a variety of training on Fort Hood. Representative units and their subsequent missions are outlined in **Section 2.6**.

Figure 2-1. Installation Map

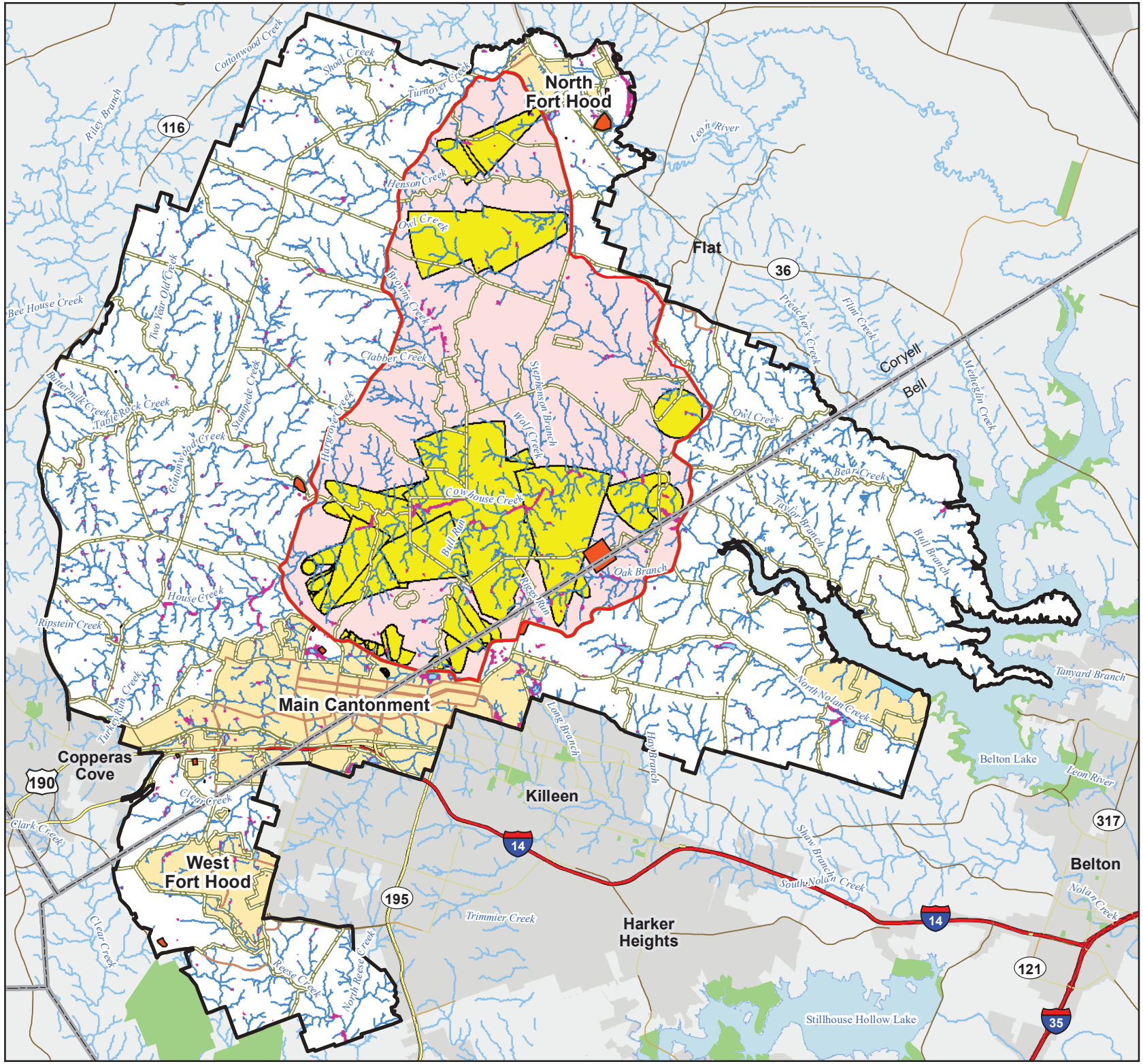


Installation Boundary
Impact Area
Training Areas
Cantonment / Recreation
Leased Areas
Municipal Areas

N

0 2 4 Miles

Figure 2-2. Constraints Map

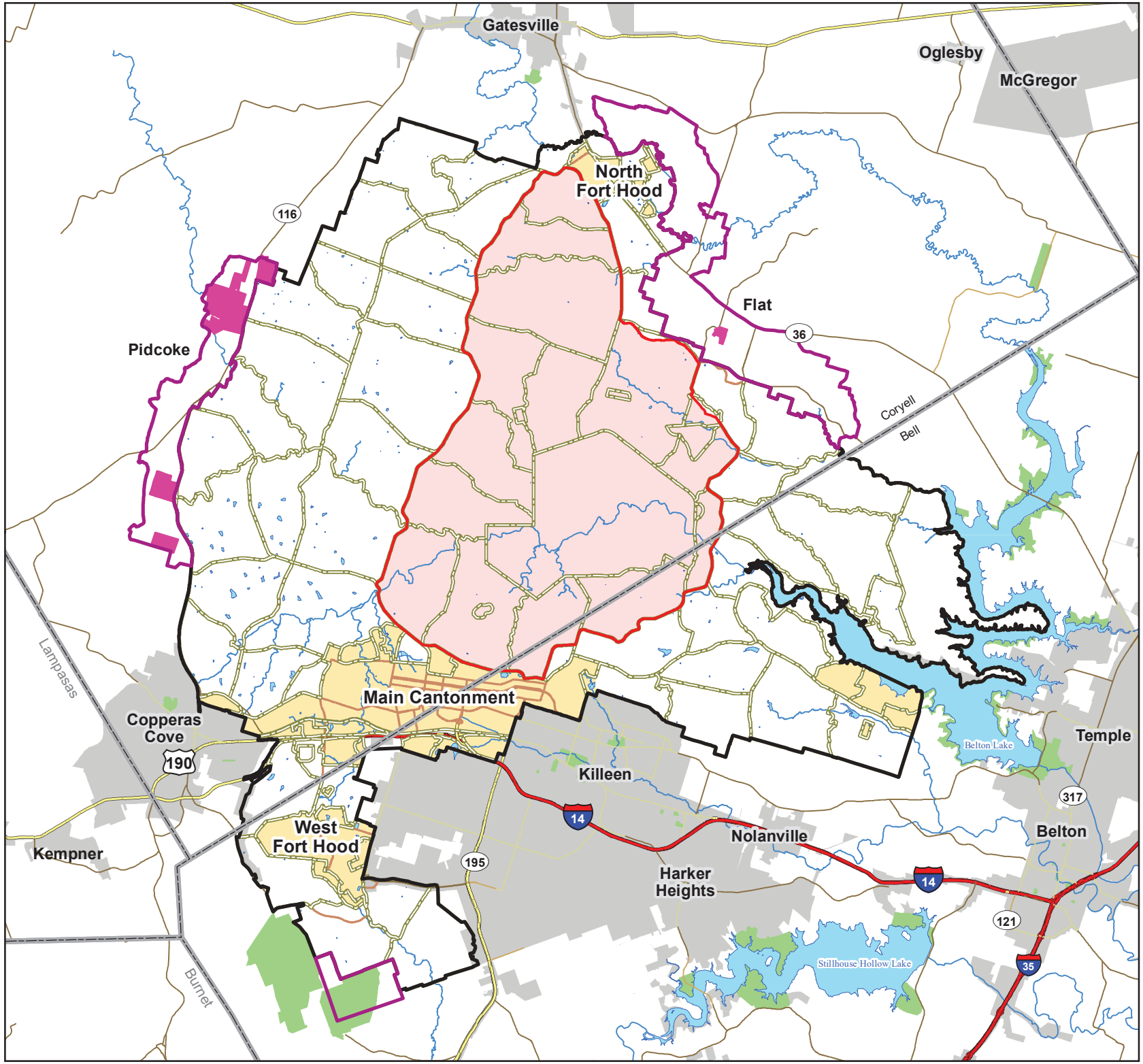


- Installation Boundary
- Impact Area
- Training Area
- Stream
- Lake / Pond
- Wetland
- Restricted Area
- Surface Danger Zone
- Park / Open Space
- Cantonment / Recreation
- County Boundary
- Municipal Area

N

0 2 4 Miles

Figure 2-3. Region Map



2.2.2 Training Facilities and Ranges

Fort Hood encompasses just over 218,823 acres (342 square miles) of land, consisting of 132,525 acres of maneuver training area and 64,272 acres of range Live-Fire Area (LFA). Maneuver training land comprises roughly 61 percent of the installations total land acreage. **Table 2-1** lists the breakdown of current land use on Fort Hood.

Table 2-1. Fort Hood Land Use

Primary Land Uses	Acreage	Percent
Training and Live-Fire Areas	**196,797**	**89.9**
Maneuver Land	132,525	60.6
Live-Fire Areas	64,272	29.4
Cantonment Areas and Belton Lake Outdoor Recreation Area	**22,026**	**10.1**
Total Acreage	**218,823**	**100.0**

Source: USAG Fort Hood Fact Sheet (5 January 2018)

2.2.3 Management Units

For ease of allocating resources (staff and funding) for this INRMP, Fort Hood's NCRMB has divided the installation into functional management units (MUs). The MUs are listed in **Table 2-2**, and a map of the MUs is included as **Figure 2-4.**

Table 2-2. Physical Characteristics of Management Units

		Land Cover				Streams	Water Bodies		Habitat	
Management Units		Bare Ground*		Vegetation		Stream Miles	Acres	Percent Area	Acres	Percent Area
	Acres	Acres	Percent	Acres	Percent					
Live-Fire Area	62,882	3,210	5.1	58,841	93.6	307.9	9.1	0.01	15,578.0	24.8
North Fort Hood	5,885	156	2.7	4,645	78.9	38.8	22.9	0.39	530.0	9.0
Northeast	27,062	366	1.4	26,673	98.6	142.0	4.5	0.02	19,269.0	71.2
Northwest	36,298	1,621	4.5	34,593	95.3	184.9	52.6	0.14	14,702.6	40.5
South	17,528	467	2.7	15,117	86.2	76.2	61.4	0.35	5,919.4	33.8
Southeast	23,514	787	3.3	22,139	94.2	92.2	134.1	0.57	11,847.9	50.4
Southwest	31,697	1,754	5.5	29,511	93.1	198.9	220.6	0.70	5,928.9	18.7
ALL MANAGEMENT UNITS	**204,866**	**8,361**	**4.1**	**191,519**	**93.5**	**1040.9**	**505.2**	**0.25**	**73,775.8**	**36.0**

*Bare Ground is defined as areas devoid of vegetation. Source: NCRMB GIS Data 2018

Live-Fire Area

The LFA and impact areas do not host much maneuver training and traffic is limited primarily to vehicles moving to and from the ranges. Access to the impact area is restricted due to danger from direct and indirect fire from active ranges and unexploded ordnances.

The LFA has the second-largest acreage of endangered species habitat of any MU. In addition, the LFA MU has 252 miles of streams, including Cowhouse Creek, which empties into Belton Lake, the drinking water supply for Fort Hood and surrounding municipalities.

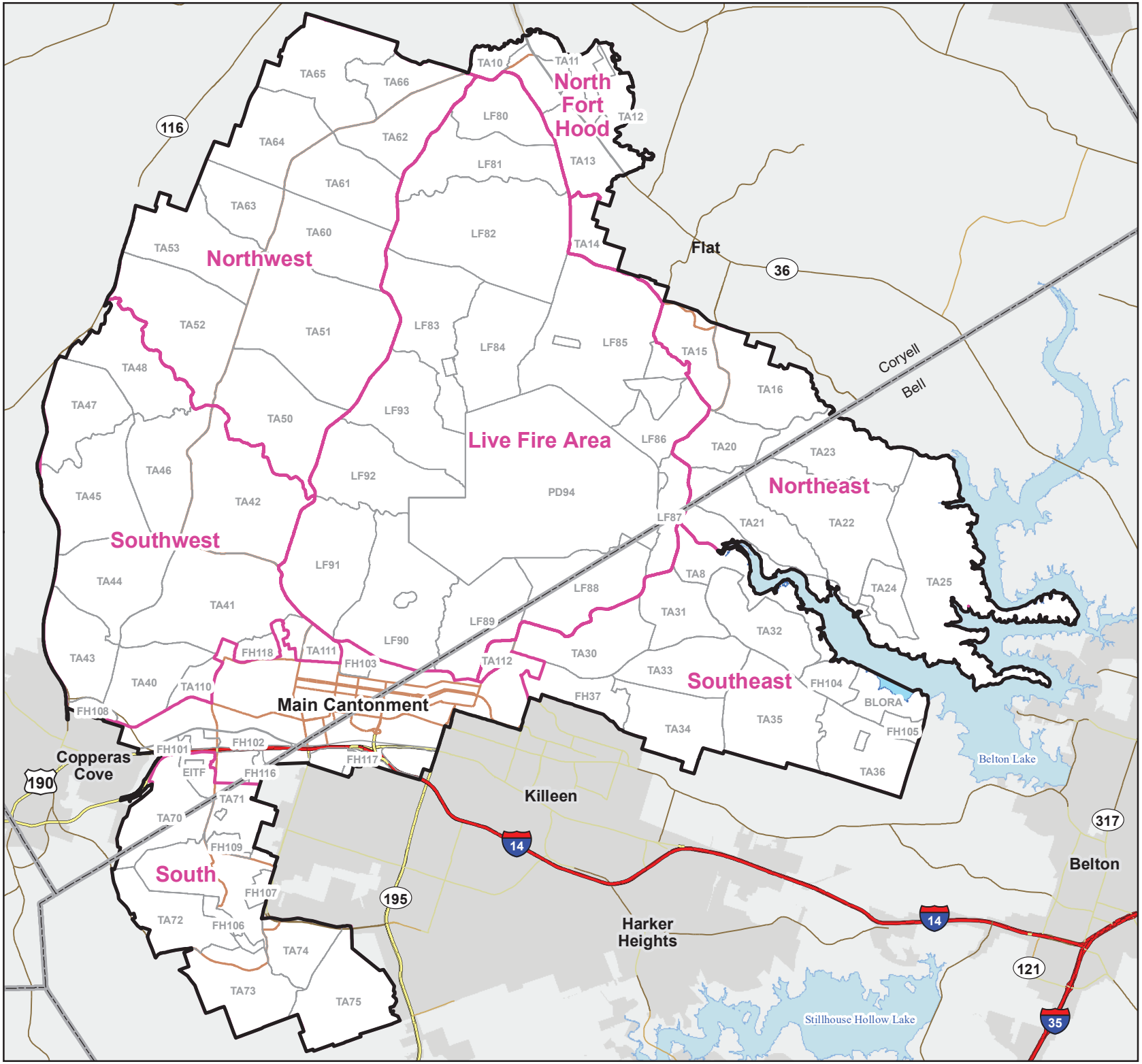


Figure 2-4. Management Units

Because very little maneuvering occurs in the LFA, this MU is not subjected to the same potential degradation as other areas, such as the Northwest and Southwest MUs in the Western Maneuver Area (discussed below). Although the restricted nature of the area precludes access to a significant portion of the LFA MU, most of the high-priority management activities are implemented to the highest practical extent.

South

The South MU includes the West Fort Hood cantonment. West Fort Hood consists of Robert Gray Army Airfield (AAF), the Ammunition Supply Point, research and administrative facilities for the Operation Testing Command, support facilities, and housing for military personnel, which accommodates both families and unaccompanied troops. The South MU is used primarily by small mechanized units, dismounted infantry training, and for logistical training.

The low-impact training that occurs in the South MU results in minimal potential degradation of the resources in the area. Habitat management is a key activity in this location due to the amount of endangered species habitat.

Southwest

The Southwest MU constitutes the southern portion of the Western Maneuver Area. Training in this MU consists of battalion- and brigade-level training, which is conducted year-round. Of all the MUs on the installation, the Southwest MU has the greatest percentage of area receiving training disturbance. The level of training and associated disturbance causes the Southwest MU to have the largest number of acres and percentage of bare ground of any of the MUs.

Because of the large amount of bare ground, management activities focus on stabilizing the soils, increasing the vegetative cover, minimizing erosion, and improving the sustainability of the training area. The Southwest MU contains many streams; therefore, aquatic habitat, fisheries, and water quality are at risk from sedimentation. The endangered species habitat in the Southwest MU is minimal in comparison to other MUs.

Northwest

The Northwest MU constitutes the northern portion of Fort Hood's Western Maneuver Area, and training in this area is similar to the training that occurs in the Southwest MU. The Northwest MU has the most extensive gully network of all the MUs on the installation. Sediment from sheet and rill erosion in the Northwest MU is transported into the various streams associated with Cowhouse Creek and eventually settle into Belton Lake.

The degradation of the vegetative cover in the Northwest MU has resulted in an extensive gully network that requires significant resources for repair, as well as to prevent further erosion and sediment loading in streams. Gully plugs have significantly reduced gully erosion in these areas. A primary focus for the Northwest MU is revegetation of bare areas and increasing the density of the vegetative cover.

Furthermore, the Northwest MU contains the largest area of black-capped vireo habitat on the installation. Management activities have and will continue to focus on maintaining the

ecological integrity of the habitat to ensure that Fort Hood continues to monitor the species in accordance with the post-delisting monitoring plan.

North Fort Hood

Activities at NFH are similar to those of the main cantonment area. Nearly a third of the MU is cantonment area; the remaining area consists of deciduous forest and woodlands. The Leon River forms the northern border, and there are potential jurisdictional wetlands within the floodplain.

The NFH MU receives relatively little disturbance from training and therefore degradation is minimal. Endangered species habitat is found in this area and represents less than 1 percent of the total endangered species habitat on the installation. The primary focus for management on the NFH MU is to maintain ecological integrity.

Northeast

The Northeast MU is heavily vegetated and cross-compartmentalized by terrain features, providing limited value as a mechanized maneuver area. The area is used year-round primarily for vehicle maneuvering, dismount operations, and military police training. The Northeast MU contains a significant amount of endangered species habitat. It has restrictive terrain and vegetation, and therefore training is normally conducted on roads and trails.

The Northeast MU has the most contiguous and the greatest quantity of, golden-cheeked warbler (*Setophaga chrysoparia*) habitat. In addition, the Northeast MU has the highest known concentration of karst habitat and features compared to any other MU on Fort Hood. Significant effort is expended to protect these sensitive habitats and the species inhabiting them. In addition, surveys will continue for additional caves and the endemic karst/cavernicole species inhabiting them. Invasive species identification/control will continue in the Northeast MU in order to minimize their impact on the sensitive habitats and species within the area.

A significant portion of this MU is bordered by water, including Belton Lake. As a result, it is important to maintain vegetated watersheds and riparian buffers to protect water quality, aquatic habitat, and biological communities, including fisheries.

Southeast

The southeast MU is used year-round for tracked-vehicle maneuver and dismounted training. This MU is heavily vegetated and contains a significant amount of endangered species habitat, the majority of which is golden-cheeked warbler habitat. The northern border consists of Cowhouse Creek and Belton Lake. The Belton Lake Outdoor Recreation Area (BLORA), Fort Hood's premier outdoor recreation area, is within the Southeast MU.

The majority of the habitat within the Southeast MU is golden-cheeked warbler habitat. The Southeast MU contains some karst habitat, which will continue to be monitored and protected. Surveys for additional caves and species will continue in this area.

Cowhouse Creek and Belton Lake compose the northern border of this MU. As with the Northeast MU, it is important to maintain vegetated watersheds and riparian buffers to protect water quality, aquatic habitat, and biological communities, including fisheries.

2.3 Regional Land Use and Setting

Both urban and rural areas surround Fort Hood. Urban land uses are primarily residential, commercial, and industrial. The rural areas surrounding Fort Hood support agricultural land uses such as farming, ranching, and hunting. Nearby Belton and Stillhouse Hollow reservoirs provide excellent recreational opportunities for surrounding communities and Fort Hood residents. Fort Hood supports a population of 382,722 people (Fort Hood 2018), and seven surrounding cities are partnered with, and provide substantial quality of life support, to Fort Hood.

2.4 Natural Environment

Climate

Fort Hood's climate is characterized by long, hot summers and short, mild winters. The average annual temperature is 67 degrees Fahrenheit (°F). The temperature ranges from the mid-30s in the winter to the high 90s in July and August. Most of the summer days have temperatures over 84°F and are a combination of stiflingly high temperatures and humidity, which commonly occurs for extended periods of time. Winters are generally mild with occasional winds that bring ice and short periods of snow. Snow is infrequent and remains on the ground for very limited periods. Annual precipitation averages 33 inches and is heaviest in May and September and lighter during the winter months. (Fort Hood 2016)

Topography

The topography of Fort Hood is defined by remnant mesas separated by wide valleys and rolling lowlands with steep canyon breaks, and it includes karst topographic features such as caves, sinkholes, rockshelters, and springs. Fort Hood is located northwest of the Balcones Fault Zone, a region of numerous geologically small faults. Over geologic time the area surrounding this fault zone, including Fort Hood, has elevated as much as 500 feet in certain areas. The subsequent erosion of these areas has created an irregular and steeply sloping terrain (USACE 2003).

Elevations range from 561 feet above sea level near the shores of Belton Lake in the northeastern portion of the installation, to 1,231feet above sea level in the Seven Mile Mountain area in the southern portion of the installation. Slopes generally range from level in the floodplains of Cowhouse Creek to as much as 33 percent on tributary valley walls. The average slope of the installation is between 5 and 8 percent. The area north of Highway 190 generally slopes east, while the area south of Highway 190 generally slopes south and east.

Hydrology

As defined by the U.S. Geological Survey (USGS), Fort Hood lies within three major watersheds trending from northwest to southeast: Leon (#12070201), Cowhouse (#12070202), and Lampasas (#12070203) (USGS 2018). Cowhouse Creek and the Lampasas River are both tributaries of the Leon River. The Leon River begins approximately 60 miles northwest of Fort Hood and

roughly parallels the installation's northern boundary. Tributaries of the Leon River, including Shoal and Henson Creeks, drain northern portions of NFH, the Western Maneuver Area, the LFA, and the Eastern Training Area. Owl Creek drains northern portions of the LFA and the Eastern Training Area and merges with the Leon River to form the northern arm of Belton Lake. Nolan Creek, which drains the southern portion of the Eastern Training Area and the main cantonment area, is also part of the Leon River Watershed and merges with this river downstream of Belton Lake. The western arm of Belton Lake is formed by Cowhouse Creek. The Cowhouse Creek watershed includes several tributaries within Fort Hood and drains most of the Western Maneuver Area and LFA along with the northern portion of West Fort Hood. A very small portion of the Lampasas River Watershed lies within the southern portion of West Fort Hood.

Ecoregions

Fort Hood is situated in the northeastern reaches of the Edwards Plateau, the southernmost extension of the Cross Timbers and Prairies, and just west of the Blackland Prairie ecological regions. Woody and shrub-dominant communities, which typify much of the land area on Fort Hood, are most closely representative of Edwards Plateau vegetative associations. The grasslands are representative primarily of the mid-grass associations of the Cross Timbers and Prairies areas, with inclusions of species more commonly associated with tall-grass associations of the Blackland Prairie. Historically, frequent natural and man-made fires confined woody vegetation to riparian areas and rocky slopes and hills. As a result of human activities including grazing, reduction and suppression of fires, and training activities, the current vegetation structure and mix of species differ from those historically associated with the region.

2.5 Installation History

2.5.1 Pre-Military Land Use

Before pioneer settlement, Fort Hood was likely a mixture of grasslands, shrublands, oak-juniper forests, and riparian corridors. These vegetation communities reflect Fort Hood's location at the intersection of the Edwards Plateau and Cross Timbers and Prairies ecoregions. Oak-juniper forests occurred on mesa slopes and tops, canyons, rolling uplands, and lowland canyons. Deciduous shrublands nested in a grassland matrix were interspersed on mesas and rolling uplands; these shrublands were the result of wildland fire and storm disturbances. Grassland valleys and riparian corridors separated forested mesas and rolling lowlands. The historic extent of these vegetation communities is unknown. The landscape remained largely agricultural with extensive grasslands until Fort Hood was established in the 1950s (Fort Hood 1999).

2.5.2 Installation Military History

Fort Hood was named for the famous Confederate General John Bell Hood. The original site was selected in 1941 in preparation for World War II, and construction of South Camp Hood began in 1942. North Camp Hood was established shortly after the first land acquisition and the founding of the cantonment area. Camp Hood formally opened for troop training in September 1942 and, at peak population, provided training grounds for over 130,000 troops. Over the years, Camp Hood expanded in size through a series of land acquisitions to accommodate new

equipment and training needs. In 1951, South Camp Hood was designated as a permanent installation and officially renamed Fort Hood.

North Camp Hood became NFH and what is now West Fort Hood was formerly Gray Air Force Base. The U.S. Air Force ran both the airfield and the base from 1947 to 1952. From 1952 to 1969, the U.S. Army under the Defense Atomic Support Agency managed the facilities which became part of Fort Hood in 1969.

2.6 Current Military Missions

Many different types of military units conduct a variety of training on Fort Hood. Representative units and their subsequent missions are outlined in the following table.

Table 2-3. Installation Users and Primary Missions

Installation Users	Primary Mission	Garrison Resources Utilized
Headquarters III Corps	A major subordinate command of U.S. Armed Forces Command, provides command and staff oversight of all assigned units at five installations, including Fort Hood.	All resources including cantonment building space, maneuver lands, range
III Corps "The Phantom Corps"	Prepared to rapidly deploy and conduct the full range of military operations to seize, retain and exploit the initiative, in order to deter or defeat any adversary.	All resources
1st Cavalry Division "America's First Team"	Prepares lethal, flexible, agile Division HQ and Brigades competent in Combined Arms Maneuver and Wide Area Security to execute missions to prevent, shape, win as directed.	All resources
1st Army Division West	Conducts training readiness, oversight, and mobilization of designated active and reserve component forces in the western area of responsibility in order to provide trained and ready forces to regional combatant commanders.	All resources
13th Expeditionary Sustainment Command "Phantom Support"	The logistical backbone of III Corps, providing supply, maintenance, transportation, field services, medical, engineering construction, smoke generation, and decontamination services.	All resources
1st Medical Brigade "Silver	Provides command and control, administrative assistance, and technical supervision of assigned and attached medical units, while providing combat health support.	All resources
36th Engineer Brigade	Rapidly deploys trained and ready engineer forces to seize, retain, and exploit the initiative across the range of military operations.	All resources
89th Military Police Brigade	Supports the III Corps as a subordinate command in peace and war.	All resources
504th Expeditionary Military Intelligence Brigade	Supports the III Corps and combatant commanders with multidisciplinary intelligence collection, analysis and dissemination.	All resources
11th Signal Brigade	Integrates tactical, strategic and sustain base communications, information processing and management systems into a seamless global information network that supports knowledge dominance for the Army, joint and coalition operations.	All resources
418th Contracting Support Brigade	Enhances installation and operational contracting support to Army commands.	All resources
Carl R. Darnall Army Medical Center	Provides service members, families and veterans quality, patient–centered care to promote a medically ready force and a healthy, resilient community.	Cantonment building space

Installation Users	Primary Mission	Garrison Resources Utilized
15th Military Intelligence Battalion	Aerial intelligence, surveillance and reconnaissance fleet that provides aerial imagery and signals intelligence support to warfighters.	All resources
1st Army Division West Headquarters	Conducts training readiness oversight and mobilization of designated active and reserve component forces in the western area of responsibility to provide trained and ready forces to regional combatant commanders.	All resources
Operational Test Command	Provides training, doctrine, and combat development of the products that Soldiers use daily and will use on the future battlefield.	Cantonment building space, maneuver lands
Fort Hood U. S. Army Garrison	Provides service with a proactive workforce to ensure combat ready Soldiers and provide comprehensive family support.	All resources
48th Chemical Brigade	Deploys and conducts operations in support of combatant commanders or other governmental agencies to counter chemical, biological, radiological and nuclear threats.	All resources
79th Ordnance Battalion	Provides 24-hour explosive ordinance disposal support to all military, local, State, and Federal agencies.	All resources
69th Air Defense Artillery Brigade	Conducts air and missile defense operations in support of global strategic contingencies to deter, and then defeat Tactical Ballistic Missile and Air Breathing Threat attacks.	All resources
7th Mobile Public Affairs Detachment	Gathers and distributes media to both internal and external audiences.	All resources
85th Civil Affairs Brigade	Organizes, trains, equips and deploys forces worldwide, in any environment, to conduct Civil Affairs operations to mitigate civil vulnerabilities to advance U.S. goals and policies within relevant foreign populations, in support of combatant commanders and US ambassadors.	All resources
13th Expeditionary Sustainment Command	Provides command and control of assigned, attached and operational control units, and plans and provides sustainment, distribution, and health service support for full spectrum operations.	All resources
11th Military Police Battalion (CID)	Provides criminal investigative services to the U.S. Army within Texas, New Mexico, and Arizona.	All resources
36th Infantry Division (Texas ARNG)	The ARNG has a partnership with Fort Hood that prioritizes their training during the summer months of June and July, plus the unit has training priority on weekends throughout the year, if scheduled.	All resources
Reserve Components	Numerous U.S. Army Reserve and Army National Guard Soldiers are mobilized, trained, equipped, and deployed from Fort Hood.	All resources

Source: Fort Hood 2017.

2.7 Public and Affiliates Access

Fort Hood allows public recreation, provided those activities do not conflict with the military mission. The Directorate of Plans, Training, Mobilization, and Security (DPTMS) Range Operations Branch and Directorate of Morale, Welfare, and Recreation (MWR) control recreational access to all training areas and may close training areas to public recreation at any time for safety or training purposes. The live-fire training area may be accessed only after authorization is received from both Range Operations Branch and the Area Access Control Center (AACC). Activities that are not allowed in the training areas are described in Fort Hood Regulation 210-3 and 210-25.

Except for special situations, road entrance points at installation perimeters are unmanned. The public is responsible for adhering to all Fort Hood regulations and restrictions placed on range access by DPTMS Range Operations Branch and the Army. Joint use of training areas is authorized daily as long as it does not interfere with military training requirements.

In accordance with Fort Hood Regulation 210-3 and 210-25, all persons desiring to conduct any recreational activity within the Fort Hood training areas must register with the Area Access Program; minors 16 years of age or younger are registered under a parent or guardian. Hunting permits are valid from the date of purchase through 31 August. Fishing and Area Access Permits are valid for one year from the date of purchase. Persons must contact the AACC for recreational access to any training area. Registration requires a person to provide picture identification, vehicle registration, and other personal information, and all persons must sign FHT Form 210-9-1, which affirms that the applicant has received the AACC briefing, understands the policies, and assumes all responsibility while in the training areas.

Entry for recreational activities into contaminated impact areas, temporary or permanent, is strictly prohibited, without exception. Central Texas Cattlemen's Association (CTCA) provides a list of its members who use the Fort Hood training areas for their livestock to DPTMS Range Operations Branch. The list is validated annually and revised as necessary.

Chapter 3 Integration Overview

This chapter describes how this INRMP is coordinated and integrated into the installation's real property master plan, range complex master plan, and any other strategic installations planning and outlines who is responsible as it relates to natural resources.

3.1 Authorities and Responsibilities

The roles of the organizations at Fort Hood that are directly responsible for, or are aiding in, the implementation of this INRMP are described in the following paragraphs. **Table 3-1** outlines the conservation laws and regulations that are applicable to natural resources management at Fort Hood and identifies the responsible Directorate and personnel for those laws/regulations.

Commanding General. The Commanding General has the overall responsibility for sustaining readiness training and complying with all laws and regulations associated with the protection of the installation's natural resources.

Garrison Commander. The Garrison Commander has the overall responsibility for implementation of the INRMP and conducts base operations in support of Fort Hood and tenant activities.

Directorate of Public Works (DPW). DPW develops coordinated master plans for future development and allied construction programs, coordinates utility and environmental programs, conducts high-visibility and command-interest studies to evaluate the effectiveness of current operations, and ensures that construction projects comply with the terms of the INRMP.

Environmental Division (ENV). ENV is responsible for the conservation, restoration, protection, and enhancement of the environment at Fort Hood. This includes the management and oversight of the natural resources (land, fish and wildlife), water pollution abatement, pest management, cultural resources, recycling, hazardous waste management, NEPA, and energy programs, as outlined in the INRMP.

Environmental Management Branch (EMB). The EMB manages, coordinates, and monitors a variety of environmental plans and programs, requests and maintains certain State and Federal operating permits or exemptions for solid waste, hazardous waste, air emissions, water use, and storm water and wastewater discharges. The EMB reviews the INRMP for correctness in the areas related to their functional areas of expertise and provides data on an annual basis.

Natural and Cultural Resources Management Branch (NCRMB). ENV's NCRMB is charged with managing all aspects of the INRMP, including the review of information, the addition of data as required, and the collection of comments from other agencies and directorates, both on and off post. NCRMB manages, coordinates, and monitors natural resources, fish and wildlife, land, and pest management. It also protects and improves fish and wildlife habitats; establishes and recommends protective measures and practices in construction and maintenance activities to avoid pollution, burning,

and unnecessary destruction of habitat; monitors, investigates, and recommends management and procedures related to game and non-game animals, birds, and fish; surveys and recommends improvements for food, cover, and water sources for wildlife; develops and monitors fish and wildlife inventories and population indices; maintains liaison with State land grant colleges and other local, State, and Federal wildlife management agencies; recommends, implements, and inspects fish and wildlife development and rehabilitation contracts; prepares reports, interagency agreements, and long-range plans related to program development and future planning; coordinates with the Directorate of Family, Morale, Welfare, and Recreation (DFMWR), and other elements to ensure healthy management of animal populations while allowing recreational hunting and fishing activities; collects and analyzes biological data during annual deer and turkey harvests; manages the funds and budget for fish and wildlife activities; performs the function of staff agronomist and entomologist; develops, prepares, and monitors long-range plans for the use and improvement of natural resources programs; develops, manages, and coordinates pest management plans; prepares and reviews plans for service projects and in-house landscape, natural resources, and pest control projects; operates a geographic information system for the collection and analysis of automated natural resources databases; monitors projects and coordinates with proponent and regulatory agencies to ensure compliance with Section 404 of the Clean Water Act (CWA); coordinates and consults with the USFWS to ensure compliance with the Endangered Species Act; conducts endangered species monitoring and research and provides oversight and approval for all endangered species research conducted by university personnel, students or other researchers; and coordinates the clearance of excavation activities in unimproved grounds.

Directorate of Plans, Training, Mobilization, and Security (DPTMS). DPTMS is the approval authority for entry onto range and maneuver areas and the central point for control and coordination for all activities conducted within the installation live-fire and maneuver training land to ensure safety and unified operations. DPTMS is responsible for establishing procedures for the recreational use of Range and Training Land to support NCRMB and DFMWR activities. The DPTMS is responsible for the Range Complex Master Plan and the Integrated Training Area Management (ITAM) Workplan for training area repair and maintenance in close coordination with the NCRMB. The DPTMS also provides awareness training to the troops on the importance of protecting natural resources when in the field. The ITAM program provides the means to understand how the Army's training impacts land management practices and what the impact of training is on the land, how to minimize and/or mitigate and repair the impacts and communicate the ITAM message to Soldiers and the public.

Directorate of Family, Morale, Welfare, and Recreation (DFMWR). DFMWR is responsible for administration of the outdoor recreation program, including the sale of hunting and fishing permits and licenses through the Sportsmen's Center, and the guided hunt program.

Directorate of Emergency Services (DES). The DES provides natural resources law enforcement on the installation, including enforcement of hunting, fishing, archaeological, and environmental statutes and regulations. The DES has the responsibility to investigate animal neglect and animal cruelty reports. The DES documents endangered species habitat violations and

works with NCRMB to ensure compliance with wildlife harvest quotas, disposes of dead wildlife resulting from motor vehicle operations, and provides a portion of the training required for hunter safety briefings as requested. The DES also serves as fire marshal, providing fire prevention and protection for the installation.

Table 3-1. Authorities and Responsibilities

Law/Regulation/MOU #	Law/Regulation/MOU Title	Responsible/ Administering Agency(s)	Responsible Directorate & Personnel Position Title(s)
DoD Financial Management Regulation 7000.14-R, Vol. 11A, Ch.16	Accounting for Production and Sale of Forest Products, August 2002.	Department of Defense	Directorate of Public Works, Wildlife Management Supervisor
16 U.S.C § 742j-l	Airborne Hunting Act	U.S. Fish & Wildlife Service	Directorate of Public Works, Wildlife Management Supervisor
7 U.S.C.§ 426-426b	Animal Damage Control Act	U.S. Department of Agriculture	Directorate of Public Works, Wildlife Management Supervisor
16 U.S.C. §§668-668d	Bald & Golden Eagle Protection Act	U.S. Fish & Wildlife Service	Directorate of Public Works, Endangered Species Supervisor
42 U.S.C. § 7401-7642	Clean Air Act	Environmental Protection Agency	Directorate of Public Works, Air Program Supervisor
16 U.S.C. 4301 *et. seq.*	Cave Resource Protection Act	Department of Defense	Directorate of Public Works, Endangered Species Supervisor
33 U.S.C. §1251 *et. seq.*	Clean Water Act	Environmental Protection Agency	Directorate of Public Works, multiple
40 C.F.R. Parts 1500-1508	CEQ Regulations - Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the NEPA	All Federal Agencies (As Applicable)	Directorate of Public Works, NEPA Program
42 U.S.C. §9601-9675	Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)	Environmental Protection Agency	Directorate of Public Works, Waste Program Manager
DoDI 4715.03	Conservation Program for Natural Resources, March 18, 2011	Department of Defense	Directorate of Public Works, Natural and Cultural Resources Branch Chief
DoDI 5525.17	Conservation Law Enforcement Program (CLEP), October 17, 2013	Department of Defense	Directorate of Emergency Services, Chief Game Warden
DoD & USFWS MOU	Conservation of Migratory Birds MOU (Partners in Flight)	Department of Defense & U.S. Fish & Wildlife Service	Directorate of Public Works, Wildlife Management Supervisor
DoD & the Pollinator	Conservation of Pollinators MOU	Department of Defense & The Pollinator Partnership	Directorate of Public Works, Wildlife Management Supervisor
DoDI 6055.06	DoD Fire and Emergency Services Program, December 21, 2006	Department of Defense	Directorate of Emergency Services, multiple
DoD 5400.7-R	DoD Freedom of Information Act Program, September 4, 1998	Department of Defense	Directorate of Public Works, multiple
16 U.S.C. §1531-1543	Endangered Species Act of 1973, as amended	U.S. Fish & Wildlife Service	Directorate of Public Works, Endangered Species Supervisor
32 C.F.R. § 651	Environmental Impact Analysis	Department of Defense	Directorate of Public Works, NEPA Program
16 U.S.C § 3901-3932	Emergency Wetlands Resources Act of 1986	Secretary of the Interior	Directorate of Public Works, Wildlife Management Supervisor
40 C.F.R. 149	EPA Sole Source Aquifers	Environmental Protection Agency	Directorate of Public Works, Water Program Supervisor

Law/Regulation/MOU #	Law/Regulation/MOU Title	Responsible/ Administering Agency(s)	Responsible Directorate & Personnel Position Title(s)
7 U.S.C. §4201 *et. seq.*	Farmland Protection Act	Natural Resource Conservation Service	Directorate of Public Works, Wildlife Management Supervisor
7 U.S.C. §136 *et. seq.*	Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended	Environmental Protection Agency	Directorate of Public Works, Wildlife Management Supervisor
43 U.S.C. §1701	Federal Land Policy and Management Act of 1976	Department of Defense	Directorate of Public Works, Natural and Cultural Resources Branch Chief
Executive Order 13514	Federal Leadership in Environmental, Energy, and Economic Performance, October 5, 2009	Department of Defense	Directorate of Public Works, Environmental Chief
7 U.S.C. § 2801	Federal Noxious Weed Act of 1974	Secretary of Agriculture	Directorate of Public Works, Wildlife Management Supervisor
33 U.S.C. § 1251-1376	Federal Water Pollution Control Act of 1977 (Clean Water Act), as amended	Environmental Protection Agency	Directorate of Public Works, multiple
16 U.S.C. §2901 – 2911	Fish and Wildlife Conservation Act of 1980	U.S. Fish & Wildlife Service	Directorate of Public Works, Natural and Cultural Resources Branch Chief
Executive Order 11988	Floodplain Management, May 24, 1977	Department of Defense	Directorate of Public Works, multiple
16 U.S.C. §1601 *et. seq.*	Forest and Rangeland Renewable Resources Planning Act of 1974	Secretary of Agriculture	Directorate of Public Works, Natural and Cultural Resources Branch Chief
Executive Order 13148	Greening the Government through Leadership in Environmental Management, April 21, 2000	Department of Defense	Directorate of Public Works, Environmental Chief
10 U.S.C. §2671	Hunting, Fishing and Trapping on Military Lands	Department of Defense	DFMWR Sportsmen's Center General
Executive Order 13112	Invasive Species, February 3, 1999	Department of Defense, State DNR, & other Federal Agencies (As Applicable)	Directorate of Public Works, multiple
16 U.S.C. §701, 702	Lacey Act of 1900	Secretary of the Interior	Directorate of Public Works, Wildlife Management Supervisor
U.F.C. 3-210-10	Low Impact Development	Department of Defense	Directorate of Public Works, Water Program Supervisor
P.L. 94-265, as amended at P.L. 109-479	Magnuson-Stevens Fishery Conservation and Management Act	Regional Fishery Management Councils (both Federal and State Agencies)	Directorate of Public Works, Wildlife Management Supervisor
16 U.S.C. §718-718k	Migratory Bird Hunting Stamp Act	U.S. Fish & Wildlife Service	Directorate of Public Works, Wildlife Management Supervisor
16 U.S.C. §703 *et. seq.*	Migratory Bird Treaty Act, as amended	U.S. Fish & Wildlife Service	Directorate of Public Works, Wildlife Management Supervisor
Public Law 91-190, 42 U.S.C. §4321-4347	National Environmental Policy Act (NEPA) of 1969, as amended	Department of Defense	Directorate of Public Works, NEPA Program
32 C.F.R. 190	Natural Resource Management Program for the Department of Defense	Department of Defense	Directorate of Public Works, Natural and Cultural Resources Branch Chief
Executive Order 11989	Off-Road Vehicles on Public Lands, May 24, 1977	Department of Defense	Directorate of Emergency Services, multiple
16 U.S.C. §4601	Outdoor Recreation on Federal Lands	Department of Defense	DFMWR Outdoor Recreation Director & General Manager Sportsmen's
10 U.S.C. §2667(d)(4)	Outleasing for Grazing and Agriculture on Military Lands	Department of Defense	Directorate of Public Works, Real Property Branch Chief

Law/Regulation/MOU #	Law/Regulation/MOU Title	Responsible/ Administering Agency(s)	Responsible Directorate & Personnel Position Title(s)
50 C.F.R. 13 para 12-4	Permit Procedures of the USFWS	U.S. Fish & Wildlife Service	Directorate of Public Works, multiple
Public Law 106-224, 7 U.S.C. §7702	Plant Protection Act	U.S. Department of Agriculture	Directorate of Public Works, Wildlife Management Supervisor
43 U.S.C. § 1701 et. Seq., 18 U.S.C. §641, and 18 U.S.C. §1361	Protection of Fossils on Federal Lands	Department of Defense	Directorate of Public Works, Cultural Resources Team Lead
DoD & USFWS MOU	Promote the Conservation of Migratory Birds	Department of Defense	Directorate of Public Works, Wildlife Management Supervisor
Executive Order 11990	Protection of Wetlands, May 24, 1977	Department of Defense, U.S. Fish & Wildlife Service, & U.S. Army Corps of	Directorate of Public Works, Wildlife Management Supervisor
Executive Order 12962	Recreational Fisheries, June 7, 1995	Department of Defense & State DNR	Directorate of Public Works, Wildlife Management Supervisor
42 U.S.C. 6901-6992 k	Resource Conservation and Recovery Act	Environmental Protection Agency	Directorate of Public Works, Waste Program Manager
Executive Order 13186	Responsibilities of Federal Agencies to Protect Migratory Birds, January 10, 2001	U.S. Fish & Wildlife Service	Directorate of Public Works, Wildlife Management Supervisor
33 U.S.C. §401 *et. seq.*	Rivers and Harbors Act of 1899	U.S. Army Corps of Engineers	Directorate of Public Works, Wildlife Management Supervisor
16 U.S.C. §670a-f	Sikes Act	U.S. Fish & Wildlife Service, State DNR	Directorate of Public Works, Natural and Cultural Resources Branch Chief
Sikes Act Tripartite MOU	Cooperative Integrated Natural Resource Management Program on Military Lands	Department of Defense, U.S. Fish & Wildlife Service, & Association of Fish & Wildlife Agencies	Directorate of Public Works, Natural and Cultural Resources Branch Chief
16 U.S.C. §2001	Soil and Water Conservation Act	Secretary of Agriculture	Directorate of Public Works, Natural and Cultural Resources Branch Chief
Executive Order 13423	Strengthening Federal Environmental, Energy, and Transportation Management, January 24, 2007	Department of Defense	Directorate of Public Works, Energy Branch Chief
50 C.F.R. 10-16	Taking, Possession, Transportation, Sale, Purchase, & Barter, Exportation & Importation of Wildlife & Plants	U.S. Fish & Wildlife Service	Directorate of Public Works, Natural and Cultural Resources Branch Chief
Title I of P.L. 102-440, signed October 23, 1992	Wild Bird Conservation Act	U.S. Fish & Wildlife Service	Directorate of Public Works, Natural and Cultural Resources Branch Chief
AR 200-1	Environmental Protection and Enhancement	Department of Army	Directorate of Public Works, Environmental Chief

3.2 External Stakeholders

Several Federal and State agencies, in addition to DoD and Fort Hood, have an interest or a role in the management of natural resources at Fort Hood. The involvement of these agencies is based on signatory responsibilities, cooperative agreements, regulatory authority, and technical assistance as required by Federal laws and regulations. In addition, several universities are active participants in projects at Fort Hood. The following table identifies the external relationships and a brief description of their responsibilities on the installation.

Table 3-2. External Stakeholders

External Stakeholder	Type	Document/Agreement	Brief Description
USFWS (Austin and Arlington, TX)	**Required Partnership**	Species Recovery Plans, Endangered Species Management Component, Biological Opinion (2015)	Assists in INRMP development and updates to address recovery goals where mutually agreed.
TPWD	**Required Partnership**	Texas Conservation Action Plan (2012)	Assists in INRMP development and updates to address Texas Conservation Action Plan goals where mutually agreed. TPWD also plays an important role in installation fish and wildlife management.
Natural Resources Conservation Service (NRCS)	**Cooperative Agreement**	RTLA Program (2015)	ITAM funds NRCS to assess the impact of maneuver training on soil/vegetation and the ability of the western training areas to sustain continuous training.
USACE	**Regional Partner**	Fort Hood Forestry Market Study (2016)	Prepared a market analysis that addressed existing forest products currently found on the training areas.
Texas Commission on Environmental Quality (TCEQ)	**Regulator**	Stormwater Pollution Prevention Plan (2016); Stormwater Management Program (2017)	Partners with Fort Hood in several areas, such as water quality and waste, and issues permits.
Texas A&M AgriLife Research - Blackland Research Center (BREC)	**Cooperative Agreement**	RTLA Program (2015)	ITAM funds BREC to document off post, ongoing sediment monitoring, gully plug erosion monitoring, and the installation flood warning system.
Texas A&M University	**Cooperative Agreement**	Research and Studies	Conducts an annual forage inventory to provide information necessary for determining grazing allotments.

External Stakeholder	Type	Document/Agreement	Brief Description
University of Illinois (U of I)	**Cooperative Agreement**	Research and Studies	Provides support to the endangered species management program and Adaptive and Integrated Management (AIM) program. Provides support in the following areas: black-capped vireo annual and seasonal staff; golden-cheeked warbler annual and seasonal staff; brown-headed cowbird seasonal staff; migratory bird management, annual, and seasonal staff; pollinator seasonal staff; karst management and survey; and invasive species management. Also collaborates with USA-CERL on a number of projects. Past investigations include a radio telemetric study of the rat snake and research on a new species of Plethodontid salamander.
University of Texas	**Cooperative Agreement**	Research and Studies	Provides expertise for karst invertebrate taxonomy.
University of North Texas	**Cooperative Agreement**	Research and Studies	Assists with projects related to white-tail deer, including implementation of a deer population and migration study, which includes netting, collaring, and tagging.
Stephen F. Austin State University	**Cooperative Agreement**	Research and Studies	Assists NCRMB staff to study and better understand karst geology and hydrogeology.
Central Texas Cattlemen's Association	**Lessee**	Grazing Lease	Leases approximately 197,000 acres of the installation for cattle grazing purposes.
Inks Lake National Fish Hatchery (USFWS)	**Cooperative Agreement**	Fish Stocking	Provides fish for stocking several ponds throughout the year.
USFWS – Balcones Canyonlands NWR	**Cooperative Agreement**	Prescribed Burning	Provides resources for burning year-round.
Engineer Research and Development Center (ERDC)	**Cooperative Agreement**	Research and Studies	Assists with projects related to wild pigs and rodent density.
Compatible Lands Foundation (CLF)	**Regional Partner**	Conservation, restoration, and preservation activities	Monarch habitat restoration and partner in the ACUB Program.

3.3 Internal Integration

This INRMP is the planning document for the management of natural resources on the installation. Other documents, primarily included in **Appendix B** of this document, are required to be integrated and mutually supportive of one another, and each document reflects the objectives and planning outlined in the INRMP. Should conflict in management practices, management tools, objectives, planning tools, or in other areas arise, the notions outlined in this document supersedes other documents that identify natural resource practices.

3.3.1 Installation Plans

Table 3-3 provides a comprehensive list of Fort Hood's plans that are utilized and integrated into this INRMP.

Table 3-3. Installation Plan Integration

Responsible Directorate	Installation Plan (Date of Approval)	Personnel Position Title(s)
DES	Conservation Law Enforcement Plan	Lead Game Warden
DPW	Endangered Species Management Component	Endangered Species Supervisor
DPTMS	US Army Garrison Strategic Plan (2017, ongoing)	Plans Specialist, PAI
DPW	Installation Compatible Use Zone Study (2017)	Air PM
DPW	Installation Karst Management Plan (2012)	Natural Resource Specialist
DPW	Installation Master Plan (ongoing)	Master Planner
	Sustainability Component Plan (ongoing)	Master Planner
DPW	Integrated Cultural Resources Management Plan (2015-2020)	Cultural Resources Team Lead
DPW	Integrated Pest Management Plan (2016)	Entomologist
DPTMS	Integrated Training Area Management Work Plan (FY18-FY23)	ITAM Manager
DES	Integrated Wildland Fire Management Plan (2012)	Chief, Fire Department
DPTMS	Range Complex Master Plan (2017)	Range Planner
DPW	Real Property Master Plan (ongoing)	Master Planner

3.3.2 Internal Coordinating Offices

Table 3-4 describes the integration of regular or daily operations, not fully addressed in the above- listed plan integration. This table outlines the Division or Department that the natural resources team coordinates with on a regular basis to effectively implement the INRMP and ensure compliance with natural resources laws and regulations.

Table 3-4. Additional Internal Coordination

Responsible Directorate	Personnel Position Title(s)	Contact
DPTMS	Range Officer	Eric Harmon
DPTMS	Scheduler	Mitchell Sheppard
DPTMS	Range Planner	Rey Navarro
DPTMS	Range Safety Officer	Alvis Perry
DPTMS	ITAM Training Area Planner	Charles Stanfill
DPW	Master Planning	Kris Manning, Jill Martin
DPW	Environmental.	Dale Frederick
DES	Fire Chief	Sergio Campos
DES	CLEO	Al Langford
DFMWR	General Manager, Sportsman's Center	Judy Johnson

Chapter 4 Program Elements

4.1 Geospatial Information Systems

A Geographic Information System (GIS) is a particularly useful tool for evaluating the relationship between various natural resources management activities and the military mission. Global Positioning System (GPS) technology allows the field staff to accurately map features and to delineate various habitats in the field or to mark the exact location of a resource, such as a cave opening.

GIS databases and map feature classes serve as a powerful management tool for facilitating the integration and implementation of the resource-specific management measures presented in this INRMP. An overlay of the feature classes for the natural and cultural resources areas graphically illustrates the complexity of the environment and provides the means to readily identify and resolve potential conflicts between natural resources issues and mission requirements. Due to the sensitive nature of natural and cultural resources, these GIS datasets are shared by the NCRMB on a need-to-know basis. All requests of such datasets are directed to the NCRMB personnel using the "Terms of Use and Disclaimer of Fort Hood DPW GIS Data" form and further distribution of these datasets is prohibited without express written permission from NCRMB. This form may be obtained at the NCRMB office, or via email.

Fort Hood natural and cultural GIS feature classes are maintained in the Fort Hood Installation Geospatial Information & Services (IGI&S) Spatial Database Engine (SDE) by the NCRMB geographer. The SDE is the Database of Records for Installation GIS data. It is managed and maintained by the DPW IGI&S team. The IGI&S Manager for Fort Hood grants access permission and editing privileges to the database. The NCRMB geographer and a cultural resources specialist update the natural and cultural GIS feature classes as needed based on field conditions and SME input, and review these datasets at a minimum quarterly for upload to the Office of Assistant Chief of Staff for Installation Management (OACSIM) IGI&S Headquarters geospatial data repository. All natural and cultural feature classes meet current Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE) 3.1 Army Adaptation standards and Army IGI&S Standard Geospatial Data Layer Quality Assurance Plans (QAP), including metadata requirements.

Program Data Management

The following table outlines NCRMB IGI&S data gathered under the GIS program to date.

Table 4-1. GIS Data

Data Description/Program	Information	Frequency of Collection	Last Update
Polygon feature class of ACUB priority areas. ACUB Program	ACUB Priority Area	One-time; modify as needed	07/17
Polygon feature class of ponds and lakes with fishing access. Hunting and Fishing Program	Fishing Location A	One-time; modify as needed	07/17

Data Description/Program	Information	Frequency of Collection	Last Update
Polygon feature class of Training Areas and their corresponding hunting area designation. Hunting and Fishing Program	Recreation Area Hunting A	Yearly update based on MWR/DPW directive	07/17
Polygon Feature class of ESA listed species habitat as delineated by SME in the field and using ancillary desktop data. Endangered Species Program	Fauna ERT A	As needed based on habitat take, and field surveys	02/18
Point feature class of ESA listed species observations for species other than the Golden-cheeked Warbler. Endangered Species Program	Fauna ERT P	As needed when sightings occur	07/17
Polygon feature class of fauna study site. Endangered Species Program	Fauna Study Site A	Yearly	02/18
Polygon feature class of land that is planted with vegetation and is maintained by NCRMB personnel. Outreach Program	Flora Planting A	As needed when new plantings occur	02/18
Polygon feature class of ponds and lakes. Waters Program	Water Feature A	As needed	07/17
Polygon feature class of vegetation communities, alliances, and associations. Flora Program	Vegetation Classification	As needed when surveys indicate vegetation changes	07/17
Line feature class of streams and rivers. Waters Program	Water Feature L	As needed	03/18
Polygon feature class of wetland areas. Wetlands Program.	Wetland	As needed based on delineations and other field surveys	02/18
Polygon feature class of both wild fires and prescribed burns. Endangered Species Program	Wildland Fire	As needed when new fires occur	03/18
Point feature class of recreational feature. NCRMB is only responsible for maintaining hunting stands in this dataset. Hunting and Fishing Program	Recreation Feature P	Yearly	10/17
Polygon feature class of lands held by non- DoD entities in which the DoD has interests. ACUB program	External Property Interest	As needed when new easements are acquired	02/18
Polygon feature class of each watershed located within the installation boundary. Waters Program	Watershed Area	One-time; modify as needed	07/17
Polygon feature class of specific areas where fire is managed or excluded.	Fire Management Area	As needed when new prescribed fire plans are created	02/18

Program History

NCRMB began utilizing GIS technology in the mid-1990s primarily as a means of tracking prescribed burning acreages and locations as well as mapping endangered species habitat. Over the years the volume of managed natural resources related GIS data has increased considerably. GIS data is obtained, created, edited, and maintained for the endangered species management

program, the wildlife management program, the prescribed fire program, other natural resources programs, as well as for the karst resources management program. The geographer conducts routine as well as complex GIS analyses in support of NCRMB programs and produces quality mapping products for use by staff and partners.

Current Condition

Fort Hood meets the Common Installation Picture (CIP) requirements for natural resources GIS datasets. Current condition of the GIS datasets listed in **Table 4-1** are up-to-date and meet current SDSFIE Army Adaptation Standards. Shells exist for a few other natural resources GIS datasets that have not yet been populated, not for lack of data, but for lack of time. These shells are Flora Species Site, Nuisance Species, and Tree Point. The geographer will work on these datasets as time allows.

Program Goals and Objectives

Efficient data collection, storage, management, and analysis are essential for conducting a comprehensive natural resources management program, especially at Fort Hood given the size of the installation and the scope of activities. The following table outlines the goals and objectives of the NCRMB's GIS program.

Table 4-2. Goals and Objectives for the GIS Program

Goals	Objectives
Maintain installation natural resources GIS data, ensuring all information is current and up-to-date	Adhere to current Army OACSIM QAPs and SDSFIE Army Adaptation standards for official natural resources feature classes. Continue data collection using aerial photography, GPS location, contracting of services, and field reconnaissance. Continue to update layers as new data become available. Manage and merge data from surveys and studies to support GIS users. Ensure that all GIS information is available to biologists, planners, contractors, and others in a quick and timely manner. Ensure accurate and usable GIS deliverables from NCRMB contracts.
Provide analytical and technical GIS products	Conduct complex and routine spatial data analyses in support of natural resources management objectives. Leverage emerging GIS technologies to enhance field data collection and desktop analysis practices. Interpret results and products as they relate to the NCRMB mission. Produce high quality cartographic products for internal use and external distribution.
GIS coordination	Provide GIS expertise to NCRMB staff and its internal and external partners. Provide GIS technical support and customer service to NCRMB staff. Share and distribute GIS data as needed.

Goals	Objectives
Maintain one or more operational GPS units to quickly and accurately map natural resources.	Ensure equipment (GPS, printers, and plotters) are ready to use.

Program Management Units

All MUs (refer to **Figure 2-4**).

Monitoring

GIS data layers are reviewed regularly, and pertinent or applicable changes are incorporated into the datasets. The NCRMB geographer continues to update the natural GIS feature classes as new information is received.

4.2 Conservation Law Enforcement

DODI 5525.17 establishes policy, assigns responsibilities, and provides direction for the Conservation Law Enforcement Program (CLEP) in accordance with the authority in DoD Directive (DoDD) 5124.02 (Reference (a)). On Fort Hood, the DES is responsible for the enforcement of the laws and regulations pertaining to natural resources, including enforcement of hunting, fishing, area access, archeological, and environmental statutes and regulations. The DES documents endangered species habitat violations and works with DPW and NCRMB to ensure compliance with wildlife harvest quotas, and to dispose of dead wildlife resulting from motor vehicle/wildlife accidents. Conservation Law Enforcement Officers (CLEOs – also known as Game Wardens) enforce the laws and regulations pertaining to natural resources on the installation, including those pertaining to threatened and endangered species, historical and archeological sites, fish and wildlife laws, and established harvest quotas. CLEOs also enforce requirements related to access to the training lands and are available to provide briefings to new arrivals.

CLEOs proactively enforce provisions of Federal/State laws to ensure compliance and help reduce violations by authorized military personnel and recreational users of the land. CLEOs actively patrol habitat areas, waterways, nesting sites, and culturally sensitive areas, as well as actively patrol ranges and enforce hunting, fishing, and area access rules to prevent conflict and ensure safety. CLEOs conduct Federal and State license/permit compliance checks to ensure recreators on the installation are in compliance with all related laws and regulations.

CLEOs assist DPW and NCRMB staff with the management of nuisance wildlife in the cantonment areas and provide educational classes (as requested) to the public concerning natural resources, recreation on Fort Hood, wildlife encounters and environmental concerns.

Program Data Management

Not applicable.

Program History

All CLEO's have completed basic Law Enforcement training and annually attend in-service training with Federal and local agencies. CLEOs receive at least 40 hours of training annually. Newly hired CLEOs are trained using a Conservation Law Enforcement Field Training Program

under the supervision of a senior Conservation Law Enforcement Field Training Officer. The U.S. Army Military Police School is developing a CLEO training academy (80-hours) at the Installation

Management Command level for newly hired CLEO's. In addition, CLEOs conduct periodic training on a host of law enforcement skills and techniques. CLEOs must qualify with a personal sidearm twice annually and familiarize themselves with shotguns and predator weapons annually.

Current Condition

Currently, the DES table of distribution and allowances provides for an authorization of seven CLEOs assigned to Fort Hood. Maintaining the authorized seven CLEOs is critical to continued enforcement of natural and cultural resource laws, statutes and regulations. Given the large patrol area, consideration should be given to increase CLEO authorizations on the table of distributions and allowances.

Program Goals and Objectives

The goal of the Conservation Law Enforcement Program is to help ensure the safety and security of the installation by enforcing natural resources laws, statutes and regulations. The objectives that have been implemented to ensure this goal is achieved are presented in **Table 4-3**. CLEOs support Fort Hood's mission by conducting proactive law enforcement patrolling, providing for the safety of recreational and military users; maintaining a wildlife education program to deter violations; and assist the installation's requirement to meet natural resources goals and objectives as outlined in the INRMP.

Effective enforcement of laws and regulations applicable to natural resources enhances the overall natural resources program, protects the natural and cultural resources, and provides public safety by enforcing off-limit areas and providing protection from criminal destruction of natural resources (e.g., activities such as trespassing and poaching).

Table 4-3. Goals and Objectives for Conservation Law Enforcement

Goals	Objectives
Protect the natural and cultural resources of Fort Hood by enforcing laws and regulations.	Ensure that laws and regulations pertaining to natural and cultural resources at Fort Hood are in accord with the laws and regulations of the United States and the State of Texas. Adopt additional laws and regulations that adequately protect the natural and cultural resources of Fort Hood. Maintain staffing levels of trained and capable law enforcement personnel sufficient to effectively monitor and enforce natural and cultural resources laws and regulations. Ensure that law enforcement personnel meet the requirements for training and weapons qualification according to their experience and rank and receive appropriate continuing education to enhance understanding of natural and cultural resources and ecosystem management.

Goals	Objectives
	Enforce the natural and cultural resources laws and regulations of Fort Hood; conduct patrols adequate to cover the installation and prioritize them to ensure protection of sensitive resources; educate military personnel and the public about natural and cultural resources protection and how to report violations; file reports for all known violations and law enforcement actions. Provide education and training to the installation populace, workforce, and general public to prevent inadvertent violation of natural resource and cultural resource laws. Report non-compliance with laws and regulations in accordance with Military Service criminal data reporting procedures. Report and track natural and cultural resources crimes and their disposition (both military and civil). Coordinate with other federal and state agencies to address specific relevant conservation law enforcement issues

Program Management Units

All MUs (refer to **Figure 2-4**).

Monitoring

Federal and State natural resources laws should be reviewed regularly, and pertinent or applicable changes should be considered for incorporation into Fort Hood's regulations. In addition, incident reports should be reviewed to ensure that adequate actions have been taken in each instance and enforcement activities should be evaluated to determine their adequacy in protecting Fort Hood's natural resources. All law enforcement personnel should have their training and qualifications reviewed annually or semiannually to ensure that training and performance consistently meet current requirements.

4.3 Climate Change

Department of Defense Manual 4715.03 (March 2011) requires installations to address potential impacts of climate change on natural resources and the training mission. Global climate models increasingly predict warming temperatures and changes in the timing and amount of precipitation in the southwestern U.S. These changes can permanently alter ecosystems. At the ecosystem level, effects will likely be gradual and challenging to assess.

Program Data Management

According to the U.S. Forest Service Climate Change Resource Center (2018), changes in the climate and in the ecosystems observed across the United States include increasing temperatures; changes in precipitation; increasing drier episodes in the West, Southwest, and Southeast; increasing invasive species, pests, and diseases; and changes in wildfire activity. The average annual temperature in the United States has increased over the last century. Increasing temperatures have wide-ranging effects, including streamflow, precipitation patterns, snowpack, insects, and invasive plant species, and influencing drought, heat waves, and wildfire.

Based on the National Climate Change Data Viewer, forecasted trends of climate change for 2025- 2049 versus 1981-2010 for Bell and Coryell counties include (USDA 2016):

- A 3.2° F increase in annual mean maximum temperature
- A 2.8° F increase in annual mean minimum temperature
- No change in annual mean precipitation
- No change in annual mean runoff
- No change in annual mean snow accumulation
- A decrease of 0.45 inches in annual mean soil storage
- An increase of 0.5 inches per month in annual mean evaporation deficit

Overall, the model predicts warming temperatures and changes in the timing and amount of precipitation in central Texas. Fort Hood's efforts to assess potential impacts should be predictive in planning for probable changes.

Program History

Many of the potential factors of climate change driving habitat conversion cannot be manipulated on an installation scale (e.g., decreased precipitation, increased annual mean temperatures). However, human-imposed stressors on habitats can be managed. Some of the actions Fort Hood is already taking to manage natural resources is likely helping ecological systems adapt to changing conditions, even though climate change was not a specific consideration in developing those actions. These actions include prescribed burning, planting native species, thinning of unwanted vegetation, promoting habitat connectivity, and controlling invasive species.

Threatened, endangered, and sensitive plant and animal species populations are continuously monitored by Fort Hood. The survey data from monitoring reports is used to inform and support the installation leaders in planning locations and timing of training events to help protect and sustain these species.

Road degradation and erosion from repeated vehicular use is mitigated by improving roads with crowning, paving or gravel. Control structures are minimizing erosion. The Fort Hood ITAM program along with the DPW, monitor and maintain roads throughout the installation, which is instrumental in decreasing impacts from erosion and dust.

The prescribed burning program at Fort Hood ensures that training lands are sustained. Firebreaks are a protective measure for cultural and natural resources. Prescribed burning is a useful management tool for controlling shrub encroachments and reducing fuel loads, and thereby reducing the potential for large, destructive wildfires.

Current Condition

Changes in the temperature and moisture regimes of central Texas could alter ecosystem composition. More drought-tolerant species and growth forms may be favored in the long-term, with shrublands likely replacing grasslands and mature woodlands, which are important resources on Fort Hood. Both add to training land diversity; mature woodlands provide nesting

habitat for the golden-cheeked warbler, and grasslands provide grazing opportunities for livestock and wildlife.

The golden-cheeked warbler is a climax community species and is overwhelmingly reliant upon that special Hill Country habitat association of mature juniper-hardwood forests, typically with high levels of canopy cover, a diverse deciduous component, and occurring along moderate to steep slopes. Hotter, drier weather could increase wildfires and the susceptibility of oaks to oak wilt and other pests, which would reduce mature woodlands and expand arid shrublands. These disturbances can impact birds directly by destroying nest sites and altering habitats. For example, in the Texas Hill Country, the effects of drought on fire regimes is compounded by the invasion of broomweed (*Xanthocephalum texanum*), Ashe juniper (*Juniperus ashei*), and mesquite (*Prosopis glandulosa* and *Prosopis juniflora*). These species are highly flammable, and as drought conditions increase, fire frequency and severity increase. Native plant species are ultimately replaced by these highly flammable species, which further increases extreme fire behavior.

In general, plant and animal species with small distributions such as karst species are more susceptible to changes in climate. Although long-term models predict increasing drought conditions, they also predict an increase in intense, single-day, precipitation events. These events could increase soil erosion rates into Fort Hood's caves, which could alter the food chain, change habitat conditions, or eliminate habitat by completely or near completely filling caves. If these species lose habitat and decrease in numbers due to factors predicted with climate change, their status designations may change. If they become listed as threatened or endangered, it could result in a decrease of the amount of land available for military training due to critical habitat designation within Fort Hood boundaries.

Drought can negatively affect the installation mission. A reduction in precipitation may increase bare ground, which can lead to greater dust production and soil erosion. Down-wind vegetation becomes covered by dust. Dust can cause mechanical damage to military vehicles, clogging filters, and can also become a safety hazard as convoys become unable to see the vehicle in front of them or helicopters are unable to land. A significant loss of top soil would alter the type of vegetation that an area can support.

Increased drought frequency and severity can also negatively affect riparian habitats, which are scarce on Fort Hood, relative to other habitat types. Prolonged drought that results in reduced water availability for both plant and animal communities would likely be detrimental to some species.

With a loss of vegetative ground cover comes an increased amount of overland water flow. Water flowing along bare tire tracks and roads picks up sediment and carries it away, eroding the soil and affecting the nutrient properties of the remaining soil. Road pathways can become rutted or pockmarked with holes to the extent that they become impassable, thus affecting the training mission. Soil particles carried by runoff can contribute to sedimentation of ponds, lakes, and other water catchments, filling them gradually and reducing their storage capacity as well as their value to wildlife and recreation.

The CTCA manages livestock grazing and stocking rates on Fort Hood through a lease agreement. If drought effects persist, stocking rates may need to be reduced and pastures may need to be rested to help sustain the grasslands.

Program Goals and Objectives

Incorporating information about the vulnerabilities and risks associated with a changing climate is an important first step. From there, emphasizing actions that maintain flexibility and address the greatest risks may preserve the most choices for future managers, even as they help meet current management goals. Specific goals and objectives to protect against climate change are listed in **Table 4-4**.

Table 4-4. Goals and Objectives for Climate Change

Goals	Objectives
Determine the installation's sensitivity and ability to adapt to climate change.	Develop Climate Change Vulnerabilities Assessments for priority natural resources (e.g., golden-cheeked warbler, karst species). Determine thresholds where climate change actions will be required. Program funds at the installation level to manage for future storm damages and wildfire events.

Fort Hood will continue to consult and collaborate with many entities to mitigate anticipated effects of climate change. These partners could include, but are not limited to, the USFWS, U.S. Forest Service, U.S. Environmental Protection Agency (USEPA) Region 6, TPWD, Texas Commission on Environmental Quality (TCEQ), local Native American Tribes, Texas A&M University, and the University of Texas.

Program Management Units

All Fort Hood lands.

Monitoring

Monitoring for climate change should be included in the Climate Change Vulnerability Assessments (see **Table 4-4**).

4.4 Soil, Erosion, and Sedimentation

There are over 30 unique soil series on Fort Hood (**Figure 4-1**). In general, these soil series are well drained and moderately permeable, but they can vary widely in other characteristics such as depth, parent material, and slope. Five soils that occur on Fort Hood are partially hydric soils, covering approximately 2.5% of the installation and are generally located along the stream banks of Cowhouse Creek, Nolan Creek, and Leon Creek and their tributaries (Natural Resources Conservation Service [NRCS] 2017). However, other soils can become hydric, exhibiting anaerobic conditions, as a result of periodic or permanent saturation or inundation. Seventeen soils that occur on Fort Hood are prime farmland soils, covering approximately 19% of the installation and are generally located near the main cantonment area, West Fort Hood, NFH, and on floodplains (NRCS 2017).

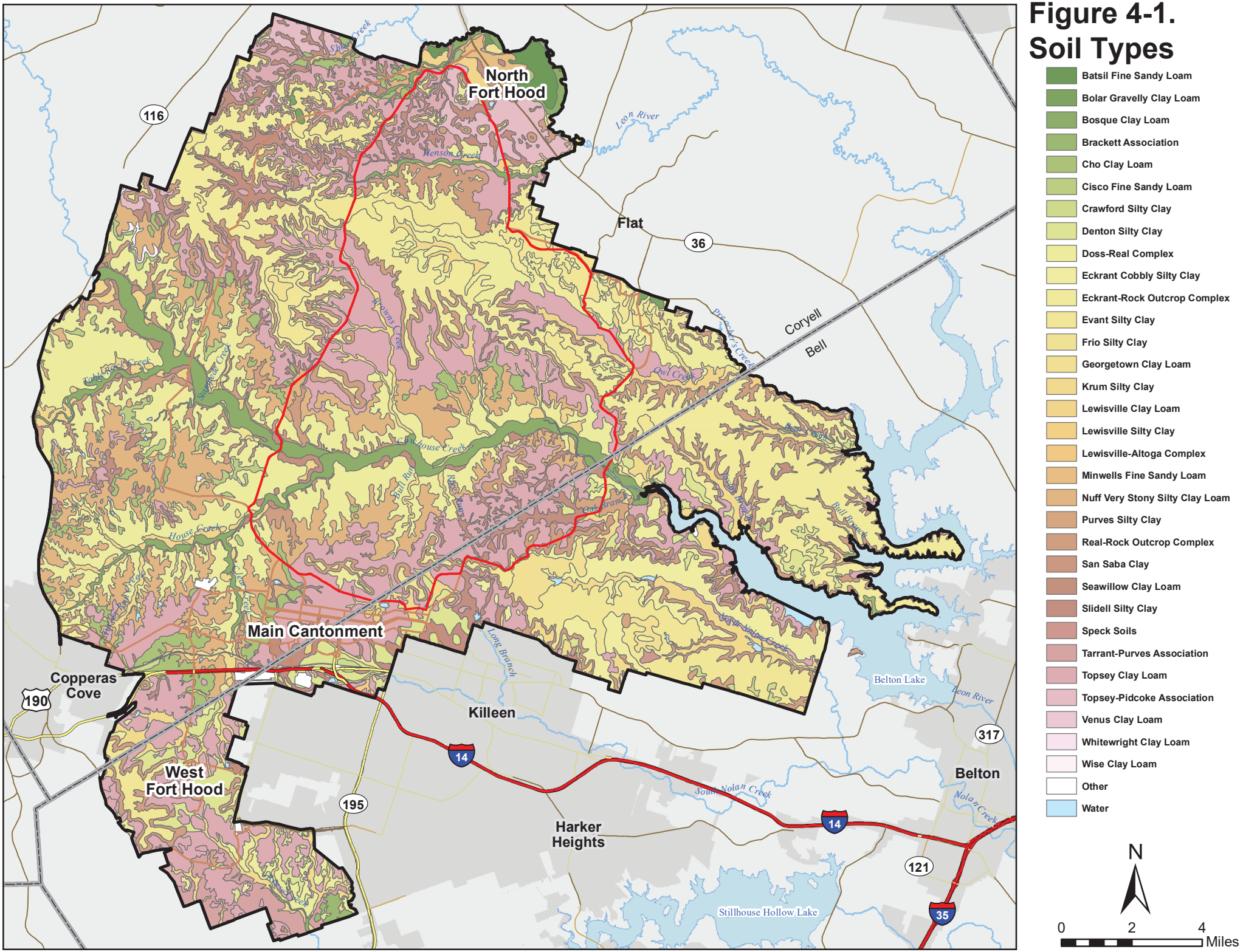


Figure 4-1. Soil Types

Many of the soils on Fort Hood are naturally susceptible to water erosion (**Figure 4-2**). Five soils are categorized as having very high-water erosion potential, covering approximately 68,128 acres, or 31% of the installation. Nine soils are categorized as having a high to moderate water erosion potential, covering approximately 82,504 acres, or 38% of the installation. The remainder of the installation has a low to very low water erosion potential (NRCS 2017).

Severe erosion areas are defined as areas with erosion rates exceeding tolerance limits established by the NRCS for each soil type according to its capability to maintain vegetative cover. Soil tolerance levels on Fort Hood range from 1 to 5 tons per acre (USACE 2003). Soils with higher tolerance values can hold soil or withstand erosion better than those with lower values. Soil loss exceeding the tolerance levels results in sheet, rill, and gully erosion, potentially limiting land availability for military training maneuvers. Erosion in areas already bare from previous activities, lack of ground cover, lack of woody vegetation, or overgrazing is exacerbated by continued effects from military vehicle tracks or wheels. Several areas of the installation, particularly training areas, have extremely high soil erosion rates due to high use by tracked vehicles and cattle grazing, resulting in high sheet, rill, and gully erosion. Loss of perennial vegetative cover (herbaceous and woody vegetation) has resulted in these high erosion rates and increased bare soil and annual plants in some areas.

Sedimentation is the most prevalent water quality threat at Fort Hood. Training exercises and land practices (e.g., cattle grazing) have resulted in erosion and sediment deposition in water bodies across the installation. To combat this erosion, Fort Hood has created 33 sediment retention structures to limit soil loss into Belton Lake, the installation's supply for drinking water. Construction and maintenance activities can also contribute to erosion and sedimentation. Storm water runoff transports eroded soils into nearby water bodies. Erosion and sedimentation adversely affect the water quality of streams and lakes and reduce the capacity of lakes and ponds.

Program Data Management

Inventories have been conducted for forage levels, soil erosion rates, and sedimentation rates to identify priority areas for restoration, including the following:

- Annual ITAM Range and Training Land Assessment (RTLA) report, ongoing
- Fort Hood Erosion and Sedimentation Reduction Project (in cooperation with the NRCS), September 1993
- Fort Hood Vegetative Resource Inventory (in cooperation with the NRCS), May 1998
- Fort Hood Vegetation Survey Project (in cooperation with the NRCS), May 2002
- Fort Hood Rangeland Health Study (in cooperation with the NRCS) as part of the 2004 Land Condition Report to Fort Hood ITAM
- Soil migration/herbicide study (2015-ongoing)

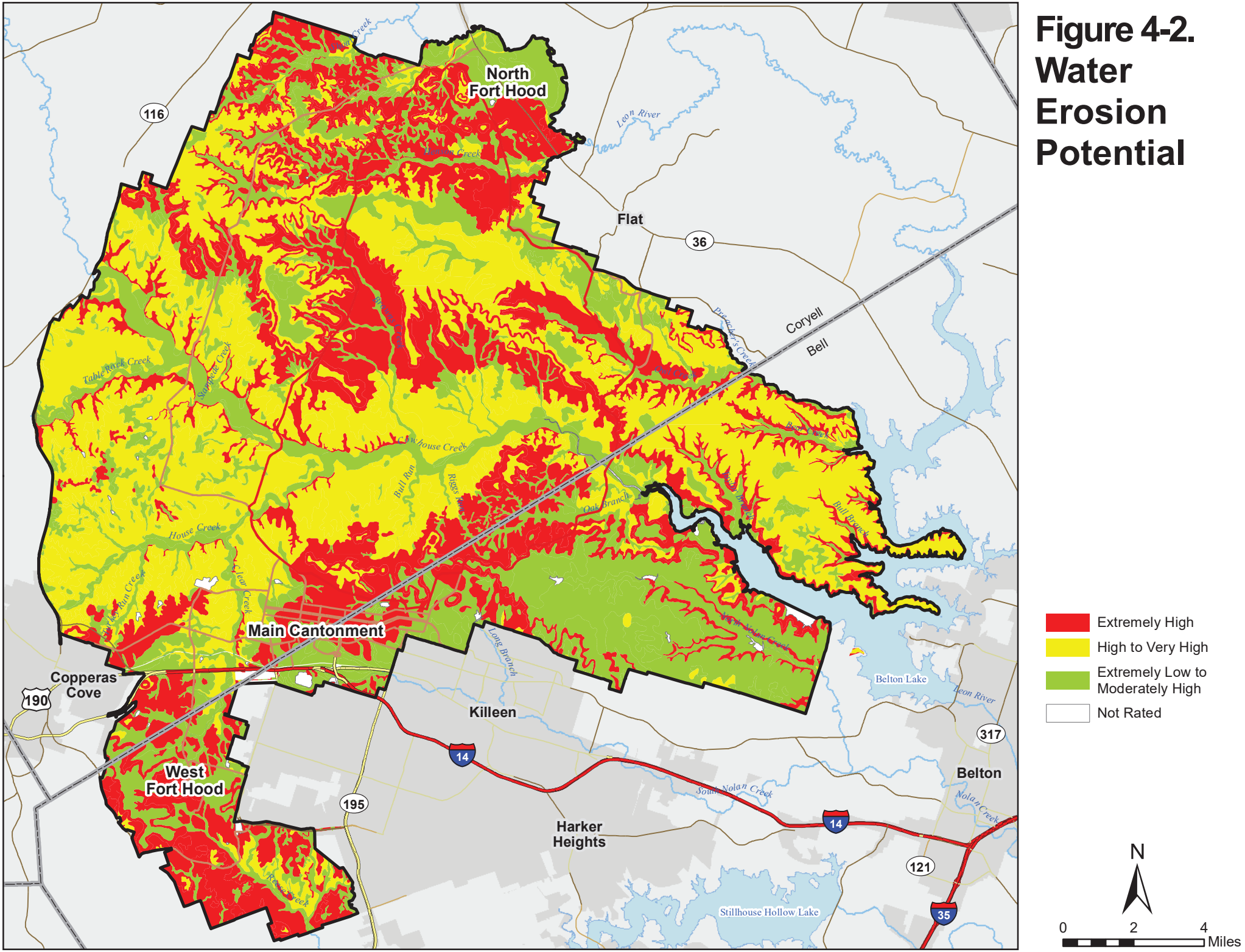


Figure 4-2. Water Erosion Potential

Program History

Fort Hood employs various erosion and sedimentation mitigation practices including, but not limited to, the following:

- Maneuver Access Structures (MAS): Also known as "gully plugs", this is the construction of a series of rock check dams in gullies to reduce erosion, contain sediment, and provide maneuver access across gullies. It has been shown that MAS not only slows erosion but has a positive impact by allowing soil deposition and vegetation re-growth within the gully. To date, over 5,000 MAS have been installed across the Western training areas.
- Riparian Buffers: Maintain riparian vegetative zones to reduce erosion along drainages as well as filter and/or catch sediment before it enters the drainage system.
- Tank Trail Improvement: Over the last five years, about 150 miles of tank trails have been repaired or improved. This reduces concentrated erosion by hardening surfaces and channeling water to established runoff areas.
- Critical Area Treatment (CAT): CAT is a combination of best management practices (BMPs) and any or all may be required to ensure serviceability of the landscape. This combination of conservation practices is required on severely degraded areas and includes MAS, mulch on bare ground, vegetation establishment, maneuver trail maintenance, hillside access trails, pipeline crossing repair, and stream crossing repair.
- Seeding: Seeding of areas where adequate vegetative cover is lacking. This is not currently ongoing in training areas but may be used in future projects. It is used on cantonment projects and smaller construction projects. Seed mixes must be a native seed mix and approved by the NCRMB.
- Maneuver Damage Program: Program under which training units file a maneuver damage report following training activities and repair damage incurred within their responsibility and capability.
- Sediment retention: Construction and maintenance of more than 30 sediment catchment basins to reduce sediment loads into Belton Lake.
- Training Restricted Area Program (TRAP): Supports maintenance of training land and specifies work areas for training avoidance and safety. As a component of ITAM, Training Requirements Integration (TRI) utilizes the TRAP as an operational program that provides locations for DPW and ITAM work areas and timeframes of work for unit planning and avoidance. (see **Section 4.15.1** for further information).

Fort Hood has an active Construction Site Storm Water Compliance Inspection Program that inspects construction sites for compliance with TCEQ Construction General Permit TXR150000. The areas of inspection include the main cantonment, NFH, West Fort Hood, and all training/live-fire areas.

Training area storm water management BMPs include the aforementioned MAS structures, silt fencing, ripping and seeding, check dams, and right-of-way clearing to ensure tracked vehicles remain in established lanes.

Current Condition

Since 1989, ITAM personnel have refined their annual RTLA survey to the current 100 reference

plots located in the Western Training Area (which is approximately 67,000 acres) in order to provide a means of ongoing land condition assessment. In 2012, the focus began to shift from erosion monitoring to vegetation cover and type monitoring in response to Woody Species Management (WSM) projects. Previously, soil erosion had been the single biggest detriment to military training. However, due to a lack of regularly occurring fires and the spread of woody vegetation due to cattle grazing, the major detriment to training is now vegetation encroachment. Therefore, the monitoring emphasis has shifted to vegetation type and cover to assess current WSM practices that are occurring as well as identifying problem areas that impede heavy and light maneuver and non-live fire training. It is anticipated that erosion monitoring will occur periodically (approximately every 5 years) to ensure BMPs remain effective.

The results of the 2017 RTLA report indicate that training activity has increased slightly from 2016 to 2017, visual signs of training activity (amber and red) have increased from 22% to 33% indicating that training is increasing overall. In 2017, training disturbance increased from 19% to 24% of plots with at least 25% of the plot showing ground disturbance (amber or red status) from military training. Training activity and training disturbance are expected to continue to increase in the future. The metric categories (training and vegetation) are presented by year as the percent of training area affected (**Table 4-5**).

Table 4-5. Summary of Measured Variables in Western Training Areas

Metric	Percent of training area affected			
Training	**Action level (criteria)**	**2015**	**2016**	**2017**
Activity	Red (> 50% of plot affected)	0	7	6
	Amber (25-50% of plot affected)	4	15	27
	Green (< 25% of plot affected)	20	39	37
	No Activity	76	39	30
Disturbance	Red (> 50% of plot affected)	0	9	3
	Amber (25-50% of plot affected)	4	10	21
	Green (< 25% of plot affected)	20	23	34
	No Activity	76	58	42
Vegetation				
Bare ground (cover)	Red (> 50% of plot bare)	2	2	2
	Amber (25-50% of plot bare)	38	12	13
	Green (< 25% of plot bare)	60	86	85

Historically, an expansive network of gullies has developed across the Western Maneuver Area. Heavy mechanized maneuver across the land produces bare soil, void of vegetative cover, which increases water and wind erosion. Much of the gully network is cumulative damage that has occurred over the past 60 years. The damage has accelerated during the past 20 years because the vehicles used for military training have become greater in number, heavier, and faster, causing increased damage to soils. Decades of continuous training with minimal land repair efforts resulted in compacted soils in some areas that did not permit rainfall infiltration needed to sustain perennial vegetative growth. In addition, cattle grazing and inadequate land repair funding have contributed to the problem. However, over the past 20 years, gully damage has been minimized by MAS structures to support readiness training and reduce sediment movement.

Efforts are ongoing to reduce sedimentation by installing MAS structures across the training landscape. This effort has significantly decreased erosion rates on the installation. As part of the 2015 RTLA report, the Texas A&M AgriLife Research – Blackland Research Center (BREC) measured 38 storm runoff events in 2013-2014. Sediment yield ranged from 0.002 to 0.046 ton/acre/year. Mean sediment yield for all stations combined was 0.018 ton/acre/year. Although very low, sediment yields were higher at the Cowhouse Creek outflow (0.016 ton/acre/year) than the Cowhouse Creek inflow (0.002 ton/acre/year). Further monitoring efforts will need to occur to determine the cause (e.g., maneuver training erosion vs. natural stream bank erosion).

Soil erosion and sedimentation is a problem at Fort Hood and has resulted in impaired training and degradation of the water resources. It also represents a threat to the long-term sustainability of the training lands. Impacts from training, cattle grazing, and vegetation removal have reduced, and in some cases, eliminated vegetative cover. However, BMPs such as the use of MAS and the improvement of stream crossings are beginning to slow the sedimentation rate across the installation. DPTMS implements both gully plugs and stream crossing repairs to the ITAM Workplan annually, significantly decreasing the soil loss on the installation.

In addition, soil erosion appears to have historically affected several caves and sinks on Fort Hood. Many caves containing species of concern are blocked by black topsoil. Many additional sinkholes currently filled with sediment are likely habitat for troglobitic species. It is likely that thick black sediment deposits in many caves are a result of soil erosion related to livestock grazing, construction projects (tank trails, borrow pits), and military activities. Thick soil deposits in some caves appear to reflect continued soil erosion in their drainage areas (Fort Hood 2012).

Program Goals and Objectives

The primary goals of soil conservation and erosion control management on Fort Hood are to identify eroded soils, protect soil resources, and prevent soil erosion and its potential impacts on water quality, habitat, and mission objectives. Approximately 87 percent of the soil series that occur on the installation are considered highly or potentially highly erodible. Most of the problems associated with soil erosion on the installation occur in areas where vegetation has been removed or disturbed on steep slopes or on long, moderately steep slopes.

The objective of soil conservation and management on Fort Hood is to avoid disturbance of soils that are considered moderately or severely susceptible to erosion. Where these areas are disturbed by anthropogenic activities or natural causes, they will be stabilized and repaired in a timely manner to avoid the development of excessively eroded sites. Installation sources of erosion and sedimentation, runoff, and dust will also be controlled to prevent damage to land, water resources, equipment, and facilities on the installation and adjacent properties.

Specific goals and objectives to protect soil resources are listed and discussed in **Table 4-6**.

Table 4-6. Goals and Objectives for Soil, Erosion, and Sedimentation

Goals	Objectives
Protect soil resources and prevent soil erosion and its potential impacts on water quality, habitat, and the military mission.	Minimize erosion, reduce the sediment load to streams and other water bodies, protect fertile soils, and revegetate bare ground, including plowing and seeding.
Continue reduction of sheet, rill, and gully erosion to acceptable limits.	Continue to use of the Revised Universal Soil Loss Equation (RUSLE) model or other Army-approved erosion model to estimate soil erosion and use of soil tolerance levels and other factors to determine acceptable limits. Continue to develop a standardized, coordinated system for recording and mapping significant erosion damage and gully sites. Investigate the use of pavers to reduce runoff in improved areas, such as parking lots, staging areas, firing points and range travel lanes, and other areas subject to heavy traffic.
Continue to minimize, where possible, impacts from vehicle training maneuvers that increase soil erosion.	Maximize vehicle flow traffic on established trails. Limit cross-country non-tactical traffic. Conduct maintenance activities following training exercises to the maximum extent possible. Harden high-use staging areas. Design criteria and specifications for wet- and low-maintenance conditions. Repair trails with significant erosion problems.
Conduct erosion and sedimentation inventory and monitoring.	Continue ITAM RTLA monitoring. Evaluate and prioritize a list of active erosion sites. Conduct new soil loss inventory via IMCOM-funded project.
Minimize erosion and degradation of training lands resulting from cattle grazing	Manage cattle grazing on training lands. Reduce stocking rates as necessary or recommended by vegetation inventories.
Maintain, and where possible, increase native vegetative cover on training lands to reduce soil erosion and facilitate maintenance, restoration, and revegetation in training areas.	Use NCRMB-approved seed mixes for stabilization of bare areas. Supply installation-generated organic matter and nutrients through the addition of mulch or other organic biodegradable material to enhance soil quality and promote vegetative growth to reduce soil erosion where practical and in keeping with overall NCRMB land management goals. Use installation-generated organic matter (e.g., grass clippings, landscape trimmings, leaves, mulch, wood chips) for application to training lands to enhance soil quality and promote native vegetative growth. Caution should be taken to ensure organic matter depth does not exceed 2 inches. Continue to maintain riparian vegetation buffers along streams. Continue forage inventory monitoring at transects to estimate changes in biomass, ground cover, and erosion rates.

Goals	Objectives
	Continue RTLA site monitoring for changes in BMP effectiveness, erosion, and maneuver damage Continue prescribed burning to help restore and maintain the ecological health of the soils.
Continue to implement designation free excavation sites and restrictions for military training.	Continue to restrict excavation sites within 50 meters of trails, streams, and karst features, and within 10 meters of trees.
Develop and implement a comprehensive plan on the management of borrow sites.	Prohibit the use of non-permitted and unregulated borrow sites and develop a program for rehabilitating / reclaiming borrow areas. Encourage the reuse of construction "spoil" material. Eliminate illegal dumping sites to include construction/deconstruction materials.
Continue to implement existing BMPs, assess their effectiveness, and continue to search for new BMPs applicable to Fort Hood.	Continue to implement the following BMPs to minimize erosion, conserve soil resources and protect vegetation. • Critical Area Planting (NRCS Code 342) • Early Successional Habitat Development/Management (NRCS Code 647) • Fences (NRCS Code 382) • Grazing Land Mechanical Treatment (NRCS Code 548) • Heavy Use Area Protection (NRCS Code 561) • Land Reconstruction, Currently Mined Land (NRCS Code 544) • Mulching (NRCS Code 484) • Prescribed Burning (NRCS Code 338) • Prescribed Grazing (NRCS Code 528 and 528A) • Prescribed Grazing: Acceptable Grazing Use on Rangeland, Native Pasture, Grazed Forestland, Grazed Wildlifeland and Pastureland (NRCS Code 528) • Prescribed Grazing: Resting or Deferring Grazing Land for a Prescribed Period (NRCS Code 528) • Restoration and Management of Declining Habitats (NRCS Wetland Code 643) • Rock Barriers (NRCS Code 555) • Sediment Basins (NRCS Code 350) • Stream Crossings (NRCS Code 578) • Use Exclusion (NRCS Code 472) • Water and Sediment Control Basins (NRCS Code 638) • Wildlife Habitat Management (NRCS Code 644) • Wetland Wildlife Habitat Management, Texas Supplement (NRCS Code 644) • Gully Plugs Monitor effectiveness of hardened stream crossings and continue to construct new ones as appropriate. Monitor effectiveness of diversion terraces and grassed waterways and continue to construct new ones as necessary.

Goals	Objectives
	Monitor effectiveness of hardened hillside access points and continue to construct new ones as appropriate. Use existing roads and openings to the maximum extent possible.

Program Management Units
All MUs (refer to **Figure 2-4**).

Monitoring
Most of the current or planned projects are designed to address problems resulting from erosion on training areas and concerns with realistic maneuver training. Because of the erosion potential of disturbed areas on Fort Hood, it is necessary that a comprehensive soil resource management approach be followed. The current policy of addressing problem erosion areas as they occur through the Integrated Training Land Management (ITLM) program will be continued (see **Section 4.15.2**). In addition, a management approach designed to avoid the disturbance of potential problem erosion areas will be implemented, when possible, in a manner consistent with mission objectives.

A comprehensive monitoring program involving both the NCRMB and the ITAM program has been incorporated into the objectives to ensure the effectiveness of the soil conservation and erosion control measures that will be implemented as part of this INRMP.

4.5 Geology

The topography of Fort Hood is defined by remnant mesas which are separated by wide valleys, rolling lowlands, and steep canyon breaks, and it includes karst topographic features such as caves, sinkholes, rockshelters, and springs. Fort Hood is located northwest of the Balcones Fault Zone, a region of many faults. Over geologic time, the area surrounding this fault zone, including Fort Hood, became elevated as much as 500 feet. The subsequent erosion and weathering of those elevated areas created an irregular, steeply sloping terrain (USACE 2003).

Elevations range from 561 feet above sea level near the shores of Belton Lake in the northeastern portion of the installation, to 1,231feet above sea level in the Seven Mile Mountain area in the southern portion of the installation. Slopes generally range from level in the floodplains of Cowhouse Creek to as much as 33 percent on valley and canyon walls. The average slope of the installation is between 5 and 8 percent. The area north of Highway 190 generally slopes east, while the area south of Highway 190 generally slopes south and east. **Figure 4-3** shows the topographic relief on Fort Hood.

Several geologic formations from the Cretaceous and Quaternary Periods are exposed on Fort Hood. These formations are, from oldest to youngest: Glen Rose, Paluxy Sand, Walnut Clay, Comanche Peak Limestone, Edwards Group Limestone, Kiamichi Clay, Duck Creek Limestone, Fort Worth Limestone, and Denton Clay formations.

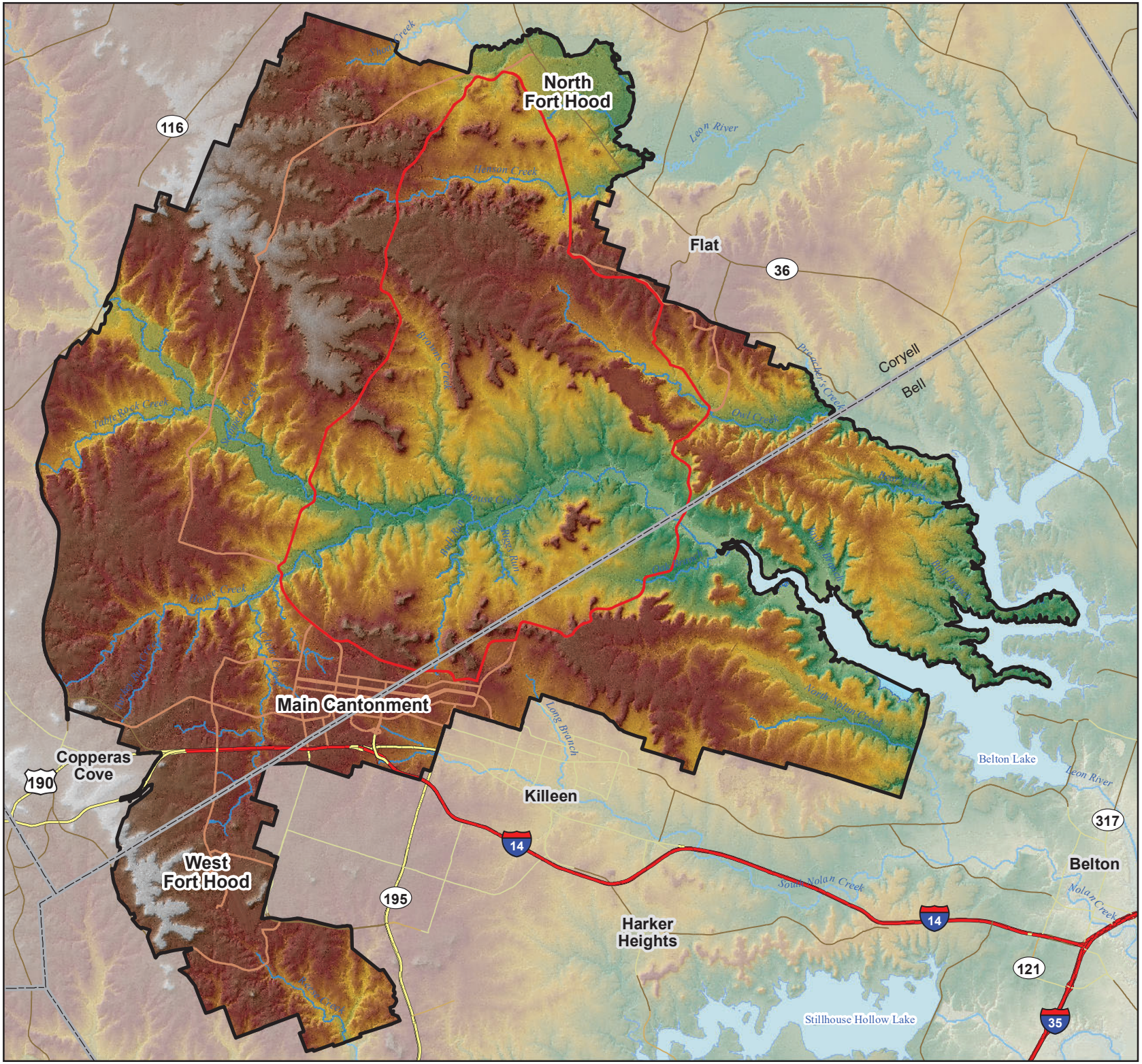


Figure 4-3. Topography

Elevation in Meters

394
265
133

N

0 2 4 Miles

In general, these formations and groups are composed of limestone, sandstone, calcareous clay, shale, sand, and/or sandy marl (USACE 2003). Cretaceous strata exposed on Fort Hood strike generally in a north-northeasterly direction, and dip in an east, southeasterly direction. Due to the composition and differential erosion of the formations, terraced or 'stair step' configuration is expressed on the surface when traveling from mesa top down to creek benthic. Formations from the Quaternary Period can be found near Leon River, Cowhouse Creek, and their tributaries. These formations are Pleistocene terrace remnants and Holocene flood plain sediments, composed of gravel, sand, silt and clay size sediment eroded from upstream uplands (USACE 2003).

Fort Hood lies within the Lampasas Cut-Plains region, which includes the Edwards Plateau and Cross Timbers and Prairies regions. The southern and eastern boundary of the Edwards Plateau is defined by the Balcones Escarpment, which is an area of normal faults that rises abruptly from the Gulf Coast Plains. Erosion of the escarpment by east, south, and southeast-flowing streams has created areas of high relief along the southeast margin of the plateau commonly referred to as the Texas Hill Country. The bedrock of the Edwards Plateau consists primarily of Cretaceous Period limestone. The dissolution of fractured limestone and fossiliferous reefs has formed the karst topographic features (caves, sinkholes, rockshelters, and springs) that are found throughout Fort Hood (Reddell and Veni 2012).

The NCRMB's primary goal for geologic resources on Fort Hood is to provide adequate and sufficient protective measures to karst features, karst fauna habitat, and cave cricket foraging areas, thus protecting karst-adapted species of concern. Because of this overlap, details regarding karst management, past surveys, program history, current conditions, and a list of goals and objectives can be found in **Section 4.7.2**, Species of Concern.

4.6 Water Resources

The water resources of Fort Hood can be classified into two main categories—groundwater and surface water. Each of these water resources has its own physical and chemical characteristics, uses, and potential issues. Fort Hood's major uses of water resources primarily involve surface water and include municipal water supply, training, recreation, vehicle maintenance, and aquatic habitat.

Groundwater – The major aquifer that underlies Fort Hood is the Trinity Aquifer. Parts of both the outcrop and the downdip are deeply buried below Fort Hood. The Trinity Aquifer extends through parts of 55 counties of central Texas. The stratigraphic column units from oldest to youngest includes the Glen Rose, Paluxy, Walnut Clay, Comanche Peak, Edwards, and Georgetown limestones. The Paluxy and Walnut Clay units are exposed in wide valleys separating mesa ridges and on the rolling lowlands and associated canyons above major creeks, and the Glen Rose unit is exposed in the benthic along major creeks (USACHPPM 2001; Charles Pekins, personal communication 2014). The Comanche Peak, Edwards, and Georgetown units are exposed on mesa tops, slopes, and canyons.

The Travis Peak formation, which does not outcrop at the surface in Fort Hood, is the deepest and hydrologically the most important stratigraphic unit in the Fort Hood Region. No major

groundwater resources outside the installation are affected by recharge from within Fort Hood, and recharge that occurs within the installation affects only the small, shallow groundwater supplies that mostly remain on the installation (USACHPPM 2001, Charles Pekins, personal communication 2014).

Potentially sensitive groundwater areas of the Fort Hood region are the outcrop areas of the Paluxy formation and recent alluvial materials within and adjacent to Cowhouse Creek, Henson Creek, and the Leon River, as well as the karst systems developed over thousands of years in the Edwards Group on mesas throughout the installation. The aquifers recharged by these areas are relatively shallow, and therefore they could be affected by hazardous material spills and seepage. However, these waters are not used for municipal purposes (USACHPPM 2001). Surface water, not groundwater, is the primary water supply for Fort Hood. Groundwater resurges from many springs and seeps and generally flows along short runs into surface creeks or ponds. These springs and runs are critically important sources of water for Fort Hood's flora and fauna, including stygobitic and troglobitic invertebrates. Pollutants which enter groundwater are passed through karst conduits unfiltered, which could negatively affect wildlife, as well as municipal supply because some groundwater eventually discharges into Belton Lake via creeks.

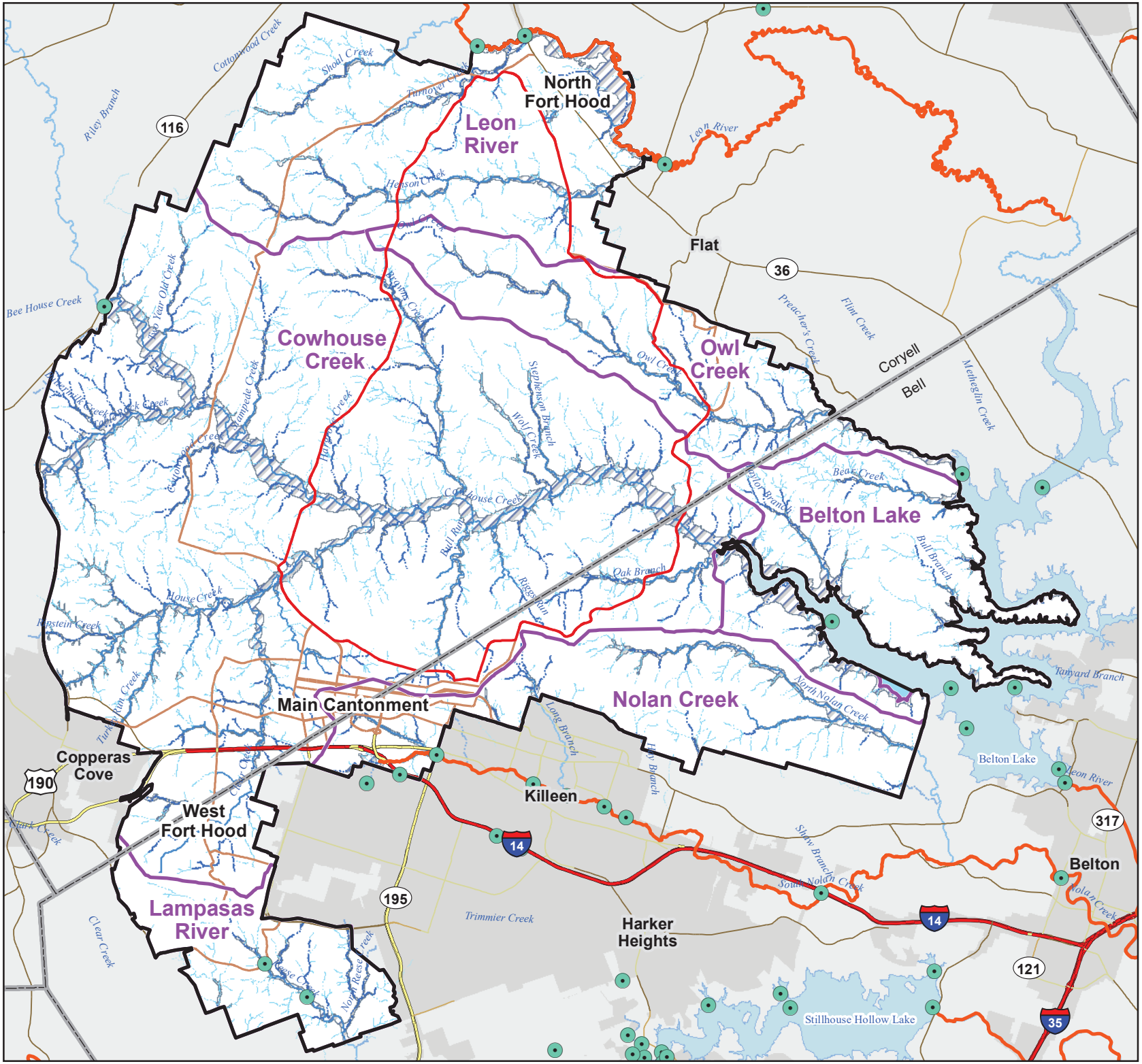
Surface Water – Fort Hood is in the Brazos River Basin. Surface water resources consist of numerous small to moderate sized streams, which generally flow in a southeasterly direction. Fort Hood has approximately 200 miles of named intermittent and perennial streams with numerous additional tributaries associated with these features. Fort Hood contains more than 200 water impoundments constituting approximately 692 surface-acres. Most of these are used for flood control, sediment retention, wildlife and livestock water, and fish habitat.

The installation is located directly upstream of two man-made reservoirs—Belton Lake (a sole source water supply for approximately 200,000 people in Fort Hood and the surrounding communities) and Stillhouse Hollow Lake (a water supply for several surrounding communities). Both reservoirs function as fish and wildlife habitat and provide flood control and recreation opportunities for the public.

Fort Hood can be divided into portions of six watersheds and several smaller sub-watersheds. The six main watersheds are Belton Lake, Cowhouse Creek, Lampasas River, Leon River, Nolan Creek, and Owl Creek (**Figure 4-4**). These watersheds can be further divided into minor sub-watersheds, which include portions of the main stems and tributaries of the major water bodies listed above. The Leon River and Cowhouse Creek form the two arms of Belton Lake, while Owl Creek flows directly into the Leon River arm. Reese Creek and its tributaries flow south toward the Lampasas River which feeds Stillhouse Hollow Lake. Overviews of the main watersheds on Fort Hood are described in the following paragraphs.

Belton Lake is a man-made reservoir that is owned and operated by the USACE for flood control, conservation, storage, and recreation. Most of Fort Hood drains to this water body, and it is the primary water supply for Fort Hood and surrounding areas. The area classified as the Belton Lake watershed comprises the eastern portion of the installation, just below the point where the Leon River drains into Belton Lake. It includes those areas with shoreline along Belton Lake where all waters drain directly into the lake. This watershed includes tributaries such as Taylor

Figure 4-4. Watersheds



TCEQ Water Quality Monitoring Station

Impaired Stream Segment

Stream

Perennial

Intermittent

Ephemeral

Watershed

FloodZone

Additional Data Source: Texas Commission on Environmental Quality
Water Quality Monitoring Stations, 2017
Surface Water Quality (Segments), 2014
https://www.tceq.texas.gov/gis/download-tceq-gis-data/

N

0 2 4 Miles

Branch, Bear Creek, Bull Branch, and several unnamed tributaries. The BLORA is located in this watershed.

Belton Lake was impounded in 1954 and has a surface area of 12,300 acres. In addition to serving as a municipal water supply, the lake is a major site for recreation. It is estimated that nearly three million people visit the lake annually for recreational purposes. Designated uses for the lake include contact recreation, high aquatic life support, and use as a public water supply. In 2013, zebra mussel (*Dreissena polymorpha*) populations were discovered in Belton Lake.

The Cowhouse Creek watershed is the largest at Fort Hood, draining more than 50 percent of the surface runoff of the installation. The watershed is close to the center of Fort Hood and extends from the western to the eastern installation boundaries. Cowhouse Creek and its tributaries flow in an easterly direction and drain into Belton Lake. Tributaries to Cowhouse Creek include Beehouse Creek, Browns Creek, Bull Run, Buttermilk Creek, Clear Creek, Cottonwood Creek, House Creek, Oak Branch, Riggs Run, Ripstein Creek, Stampede Creek, Stephenson Creek, Table Rock Creek, Two Year Old Creek, Wolf Creek, and several other unnamed tributaries. Upstream portions of the Cowhouse Creek watershed extend far to the northwest outside Fort Hood's boundaries.

The Cowhouse Creek watershed contains combat training areas where maneuver and live-fire operations occur. This area is heavily affected by these operations in terms of soil disturbance and destruction of vegetation, which results in surfaces prone to erosion and surface water runoff. In turn, sedimentation affects surrounding water resources. There is also a possibility of influence on water resources due to the receipt of surface water runoff that might contain residue from explosives and artillery use in high-explosive-impact areas in the Cowhouse Creek drainage basin.

A very small portion of the Lampasas River watershed lies within the southern portion of the Fort Hood installation. This watershed contains tributaries to the Lampasas River, including Reese Creek, North Reese Creek, and Clear Creek. These waters drain to Stillhouse Hollow Lake just outside Fort Hood.

Portions of the Leon River watershed are in NFH. The tributaries in this watershed include Henson Creek, Shoal Creek, Turnover Creek, and Cottonwood Creek. At various points, the Leon River coincides with the boundaries of the installation. Several tributaries feed directly into the Leon River, which drains to Belton Lake. The Leon River watershed includes urban areas, as well as training areas where maneuver and live-fire occur. The Leon River's designated uses include contact recreation, high aquatic life use support, and use as a public water supply. Segment ID 1221, Leon River (below Proctor Lake), was first listed as impaired for bacteria in 1996, and portions remain on the approved 2014 Texas 303(d) list. The portions affected are described as "from confluence with Stillhouse Creek, upstream to confluence with Plum Creek" and "from confluence with South Leon Creek upstream to confluence with Walnut Creek". The affected segment portions are upstream of Gatesville and do not receive runoff from Fort Hood.

Upstream portions of the Nolan Creek watershed lie in the southeastern portion of Fort Hood. Most of the headwaters of Nolan Creek originate within the installation and flow in a southeasterly direction into the creek. Eventually, Nolan Creek flows into the Leon River below Belton Lake. The portion of the Nolan Creek watershed that is within Fort Hood contains several tributaries, including North Nolan Creek, South Nolan Creek, Shaw Branch, Hay Branch, and several unnamed tributaries. In addition to training areas, this watershed contains most of the urban areas on Fort Hood. Segment ID 1218, Nolan Creek/South Nolan Creek was first listed as impaired for bacteria in 1996 and remains on the approved 2014 Texas 303(d) list. The portion affected is described as the "portion of South Nolan Creek from the confluence with North Nolan/Nolan Creek fork upstream to confluence with Liberty Ditch in the city of Killeen in Bell County". Water quality monitoring, data inventory, public participation activities, and watershed analyses are currently ongoing. This segment receives runoff from a small portion of Fort Hood's southeastern training areas, Airfield Lake and its tributaries, and a portion of Robert Gray AAF.

The Owl Creek watershed is almost entirely within Fort Hood. The watershed is just south of NFH, and the creek drains directly into Belton Lake. The Owl Creek main stem, as well as numerous unnamed tributaries, flows through Fort Hood before its confluence with Preachers Creek and Belton Lake.

Floodplains – Although precipitation varies from year to year at Fort Hood, most precipitation occurs during May through June and October. January is the driest month of the year. Installation-wide flooding is usually of short duration, occurring only after heavy downpours. However, flooding can be a safety concern to Soldiers and equipment. Flood zone areas are shown on **Figure 4-4**.

Wetlands – Wetlands exist across the installation and range from small emergent wetlands associated with ephemeral streams to large, forested wetland complexes adjacent to perennial channels. Wetlands in central Texas and at Fort Hood are most common on floodplains along rivers and streams (riparian wetlands), along the margins of lakes and ponds, and in other low- lying areas where the groundwater intercepts the soil (springs). There are numerous natural springs on Fort Hood, but many of their locations have not been mapped.

Most of the surface water features located on the installation are classified as waters of the U.S. as defined by the USACE under Section 404 of the CWA. Approximately 30% of the installation has been delineated, primarily in areas associated with range and cantonment area construction projects. During the planning phase of construction projects, these delineations are utilized to assist in the avoidance and minimization of impacts to waters of the U.S, as required by Section 404. The delineations are also used to calculate the amount of unavoidable impacts, which is used to determine permitting requirements and any appropriate compensatory mitigation.

It has been the practice of Fort Hood, in accordance with Executive Order 11990, to avoid or minimize impacts to wetland areas from construction; however, these areas might be indirectly affected by ongoing installation activities such as military training activities, livestock grazing, hydrologic alterations, and urban and training area storm water runoff.

Program Data Management

Various water quality studies have been conducted to monitor the condition of the water resources across the installation. Through these studies, water quality sampling has taken place at several locations throughout the Fort Hood area. These locations are shown on **Figure 4-4**.

Water quality studies at Fort Hood include sedimentation and erosion studies; storm water data collection (conducted quarterly by Fort Hood); Texas Pollutant Discharge Elimination System (TPDES) permit monitoring (conducted weekly and quarterly by Fort Hood); studies of metals, explosives, and perchlorates in the groundwater, surface water, and sediment in the Cowhouse Creek drainage basin (conducted by USCHPPM in 2001 and 2004); and a limited focus investigation of the potential overall impact of munitions constituents resulting from live-fire training operations that occurred at select ranges on the installation (conducted by USCHPPM in 2007).

In addition, Fort Hood monitors industrial sites identified in the Fort Hood Industrial Stormwater Pollution Prevention Plan (SWPPP) in accordance with the Multi-Sector General Permit TXR050000. Sites are monitored annually and/or semi-annually. Typical pollutants sampled are heavy metals, total suspended solids, and chemical oxygen demand. Site specific pollutants are determined by the type of operation. Most sites meet regulatory requirements; however, the following sites have a history of exceeding permit benchmark parameters: DPW Classification Unit, Defense Logistics Agency Disposition Services, Landfill, and the Recycle Center.

Program History

Currently, Fort Hood operates industrial, construction, and municipal storm water programs. Specific industrial activities are managed under an industrial storm water permit (TPDES Permit No. TXR05P855) that comes from the general permit, TXR050000. These industrial activities include aircraft maintenance, bulk fuel storage, watercraft maintenance, landfill operation, and recycling activities. These activities are inspected on at least a quarterly basis. Depending on the specific industrial activity, annual or semi-annual storm water sampling is also conducted.

Fort Hood also operates various sites under the TCEQ Construction General Permit TXR150000 for construction activities that occur on the installation. Such sites with land disturbance greater than one acre or within a Common Plan of Development that exceeds the one-acre limit are required to obtain coverage under this permit. At some time in the future, the USEPA may require sites with greater than 10 or 20 acres of disturbance to monitor storm water discharges for turbidity.

Fort Hood's Storm Water Management Program ensures the installation complies with all Federal, State, and local storm water regulations. Fort Hood is required to comply with the rules and regulations established in Section 402 of the CWA and Chapter 26 of the Texas Water Code. Fort Hood has been granted permission by the TCEQ to discharge storm water to surface waters in the State under TPDES General Permit No. TXR040000 for small Municipal Separate Storm Sewer Systems (MS4). Fort Hood developed a Storm Water Management Plan (SWMP) that outlines all requirements of the permit and summarizes the work plan that will be conducted. Fort Hood has been approved by TCEQ for their SWMP, which includes the following five minimum control measures:

- Public Outreach Education and Involvement
- Illicit Discharge Detection and Elimination
- Construction Site Storm Water Runoff
- Post Construction Storm Water Management in New Development and Redevelopment
- Pollution prevention/good housekeeping for municipal operations.

Fort Hood has a TPDES wastewater permit (Permit No. TX0002313). This permit covers industrial wastewater discharges from various vehicle washing and maintenance activities located in the main cantonment. Various BMPs and innovations are employed to limit the potential for pollutants to enter water resources. These include the use of wastewater and storm water detention ponds and four tactical vehicle wash facilities which treat and re-circulate wash water so that no discharges occur. Water quality samples are collected weekly at TPDES permit outfall locations, when discharging, to ensure compliance with permit requirements.

Current Condition

Groundwater studies conducted at Fort Hood do not show any critical issues attributable to the installation; however, there are there are a host of hazards to nearby waterbodies that require monitoring. These include:

- Storm water runoff from training areas
- Storm water runoff from agricultural operations in the agriculture outlease areas
- Sanitary sewer overflows
- Fats, oils, and grease in the waste water collection system
- Portable latrines, mobile kitchens and showers, and hand-washers
- Zebra mussel populations in Belton Lake
- Elevated MCOC concentrations from munitions impacts

Program Goals and Objectives

The primary goal of water resources management at Fort Hood is to identify and restore degraded aquatic habitats, protect aquatic and riparian habitats, and prevent degradation of water quality. Fort Hood's goals and objectives for water resources are presented in **Table 4-7** and described below.

Table 4-7. Goals and Objectives for Water Resource

Goals	Objectives
Groundwater	
Protect groundwater resources and prevent degradation of water quality.	Continue to develop an inventory and characterization of karst features and groundwater hydrologic flow characteristics on Fort Hood. Locate refueling activities and other training activities with the potential for generating pollutants away from karst features. Disseminate information on proper spill prevention and control techniques to be implemented in karst areas. Develop adequate understanding of hydrologic environment sufficient to determine wells or springs to be quarantined if spills occur in karst areas. Continue to maintain protective zones around spring resurgences and spring runs.
Surface Water	
Identify and restore degraded aquatic habitats, protect aquatic and riparian habitats, and prevent degradation of water quality.	Design and implement a comprehensive sampling and assessment plan. Identify areas of high erosion and sediment input through stream and watershed assessments. Develop a database to assess status and trends in water quality and habitat suitability. Repair and maintain aquatic resource infrastructure such as dams and spillways to maintain safety and established aquatic habitat.
Reduce erosion and sedimentation in water resources.	Continue evaluation of effectiveness of existing BMPs to reduce sedimentation and erosion of streams and assess possibilities of new ones. Establish and maintain sufficient vegetative buffers (stream bank and shoreline vegetation) around water bodies to minimize the flow of nonpoint source pollution, particularly sediment, into the streams. Limit activities within the buffer zone to those causing little or no impact on water quality and aquatic habitats. Continue revegetation of disturbed lands.
Protect, maintain, and enhance waters of the U.S., and ensure no net loss of wetland habitats.	Identify, delineate, and characterize the waters of the U.S. on Fort Hood. Develop an installation-wide wetlands delineation, increase wetlands management activities and use GIS to track wetlands and other environmentally sensitive areas. Continue evaluating potential impacts of current mission activities on waters of the U.S. and determining need for permits. Establish a database to monitor habitat quality and ecological integrity. Maintain a GIS data layer with available attributes.

Goals	Objectives
Continue environmental awareness and outreach programs.	Develop Sustainable Range Awareness (SRA) materials to disseminate information to Soldiers and commanders.

Program Management Units

All MUs (refer to **Figure 2-4**).

Monitoring

To gain a thorough understanding of the current state of water resources at Fort Hood and identify water quality issues, it is necessary to maintain a comprehensive water monitoring program. Ideally, the program should include routine water and sediment sampling across the installation, in addition to assessments of the stream habitat and biological communities.

It is also necessary to monitor the integrity of waters of the U.S., including wetlands, following their identification, delineation, and characterization. The development of a database to monitor their status and trends not only will enable NCRMB staff to determine future management efforts but also will facilitate the decision-making process on future training and range activities. Activities occurring in or adjacent to wetlands, karst features, and spring runs that would result in impacts will be avoided, when possible, in a manner consistent with mission objectives. Where impacts on waters of the U.S, including wetlands are not avoidable, mitigation of the impacts will be implemented.

4.7 Sensitive Species

4.7.1 Threatened and Endangered Species

The Endangered Species Act of 1973 (ESA; 16 U.S.C. § 1531 et seq.) requires all Federal agencies to conserve listed species. Conservation, as defined by the ESA, means the use of all methods and procedures necessary to bring any listed species to the point where protections pursuant to the ESA are no longer necessary. The ESA specifically requires agencies not to "take" or "jeopardize" the continued existence of any endangered or threatened species, or to destroy or adversely modify habitat critical to any endangered or threatened species. Under Section 9 of the Act, take means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect"; under Section 7, jeopardize means to engage in any action that would be expected to "reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species."

On 28 September 1994 the Acting Assistant Secretary of the Army (Civil Works) signed a multi-agency Memorandum of Understanding (MOU) on implementing the ESA. The purpose of the MOU was to establish a general framework for greater cooperation and participation among the agencies exercising their responsibilities under the ESA. The MOU states that the departments will work together to achieve the common goals of (1) conserving listed species, (2) using existing Federal authorities and programs to further the purposes of the ESA, and (3) improving the efficiency and effectiveness of interagency consultations conducted pursuant to Section 7(a) of the ESA. Each signatory agreed to (1) use its authorities to further the purposes of the ESA by carrying out programs for the conservation of Federally listed species, including

implementing appropriate recovery actions that are identified in recovery plans; (2) identify opportunities to conserve Federally listed species and the ecosystems on which they depend within existing programs and authorities; (3) determine whether its respective planning processes effectively help conserve threatened or endangered species; and (4) use existing programs, or establish a program, to evaluate and reward the performance of personnel who are responsible for planning or implementing programs to conserve or recover listed species or the ecosystems on which they depend.

Army policy on listed species includes the following elements: balancing mission requirements with endangered species protection, cooperating with regulatory agencies, and conserving biological diversity within the context of the military mission. As required by AR 200-1, the Army must ensure that it carries out mission requirements in harmony with the requirements of the ESA. All Army land uses, including military training and testing, recreation, and grazing, are subject to ESA requirements for the protection of listed species and critical habitat. In fulfilling its conservation responsibilities, the Army is required to work closely and cooperatively with the USFWS and National Marine Fisheries Service, the two Federal agencies responsible for enforcing the act. Installations are encouraged to engage in informal consultation with the USFWS and National Marine Fisheries Service during the planning of projects or activities to ensure ESA compliance. In conserving biological diversity, installation commanders and Army natural resources managers are required to develop and implement policies and strategies to maintain viable populations of native plants and animals, maintain natural genetic variability within and among populations, maintain functioning representations of the full spectrum of ecosystems and biological communities, and integrate human activities with the conservation of biological diversity.

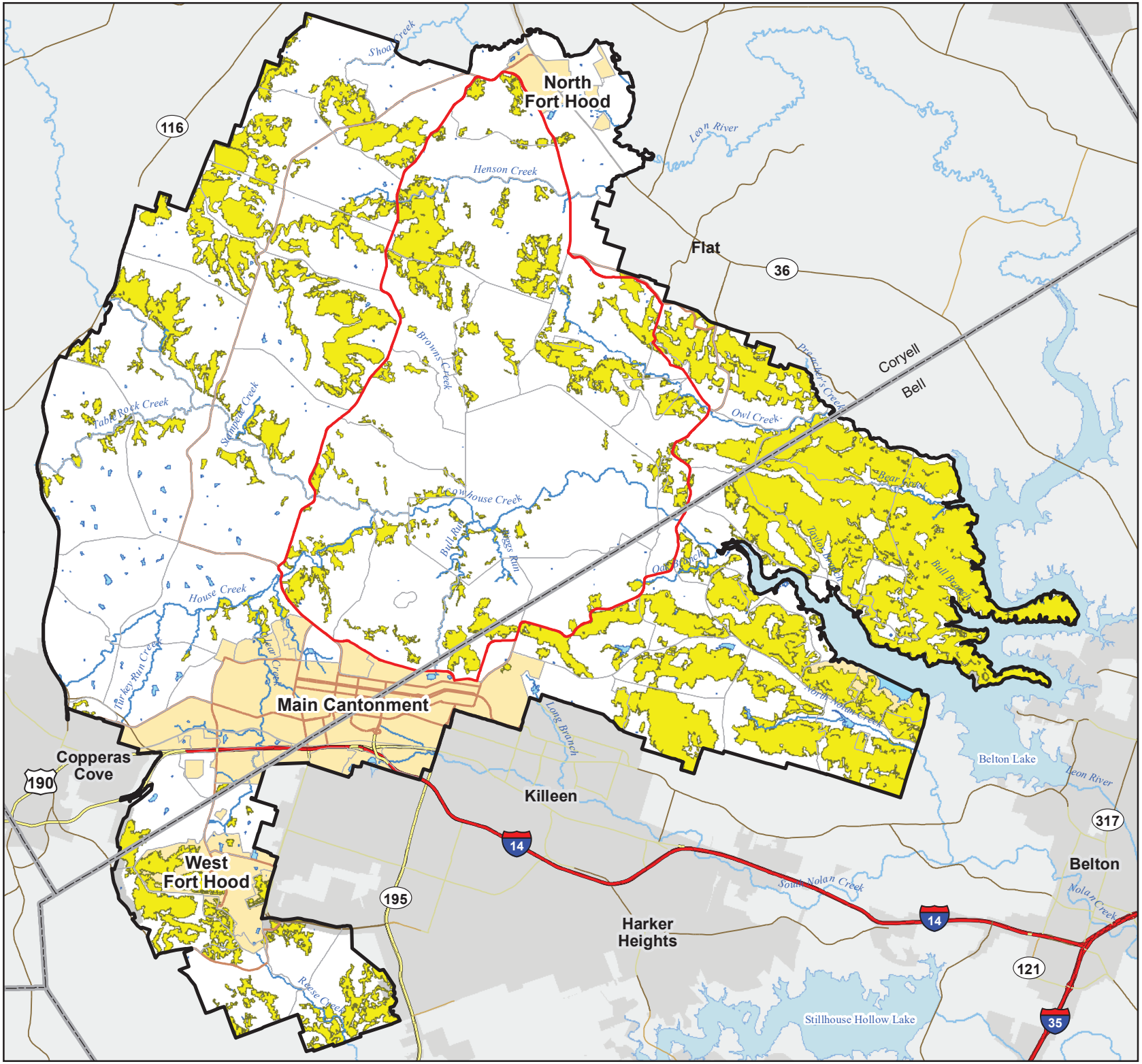
The following table lists the Federally-listed threatened and endangered species that occur or may occur on Fort Hood. **Figure 4-5** shows the extent of endangered species habitat on Fort Hood.

Table 4-8. Federally Listed Threatened and Endangered Species

Scientific Name	Common Name	Federal Status	State Status	Installation Status*	Existing USFWS Consultation
Setophaga chrysoparia	Golden-cheeked warbler	E	E	A	USFWS BO for Fort Hood (30 June 2015)
Vireo atricapilla	Black-capped vireo	DL	E	A	USFWS BO for Fort Hood (30 June 2015)
Grus americana	Whooping crane	E	E	B	Endangered Species Management Component
Cyclonaias houstonensis	Smooth pimpleback mussel	C	T	C	

Legend: E – Endangered; T – Threatened; C – Candidate for listing; DL – Delisted
*Status refers to population status on Fort Hood according to these definitions: (A) Population established on Fort Hood. Recent information documents an established breeding population or regular occurrence on the installation. (B) Recently recorded on Fort Hood, but there is no evidence of an established population. This includes species considered to be transient, accidental, or migratory (e.g., some migrating birds may use the installation as a stopover site during migration to and from their wintering grounds). For some species in this category, further inventory may reveal breeding populations. (C) Known small population immediately adjacent

Figure 4-5. Endangered Species



Endangered Species Habitat

- Golden-cheeked Warbler
- Installation Boundary
- Impact Area
- Training Area
- Cantonment / Recreation

N

0 2 4 Miles

Program Data Management

In accordance with the ESA, the Army must assist in the recovery of all Federally listed threatened and endangered species and their habitats under the installation's management authority. The Army requires installations to prepare an Endangered Species Management Component of the INRMP addressing each species, each species proposed for listing, and the critical habitat present on the installation, including areas used by tenant organizations. The ESMC is used as a tool to achieve conservation objectives for populations of listed and proposed species while minimizing impacts on the training mission. The ESMC must prescribe area-specific measures necessary to meet the installation's conservation goals for the subject species and critical habitats.

The ESMC for Fort Hood is under revision and provides management and monitoring guidelines for the next 5 years. Following completion and approval, it will be included in **Appendix B1**. The 2015 programmatic Biological Opinion (BO) for Fort Hood (see **Appendix B2**) provides requirements and guidance for endangered species management. The ESMC is written specifically for use by natural resources managers and leaders of training operations on Fort Hood to accomplish military training objectives while meeting conservation objectives for these species.

Data gathered on the primary endangered species and a recently delisted species known to occur on the installation is as follows:

- *Golden-cheeked Warbler* – Research and conservation efforts for this species on Fort Hood have been numerous. Research projects have included nest survival rates, forest cover and its impacts on density, and nest predation to name a few. Current ongoing research includes a breeding range wide geolocator study to determine migration corridors and over- wintering site fidelity; impacts of geolocators on reproductive success, site fidelity, and survival; and source-sink population dynamics. Monitoring and research activities for the warbler on Fort Hood were initiated in 1991 and continue through the present.

  Past monitoring (1991-2015) efforts include point count surveys to determine detection rate and trends, while current monitoring efforts employ distance sampling to determine population estimates and trends. Current and past research includes demographic monitoring in selected study sites, research in habitat selection, studies to determine the effects of habitat fragmentation and wildfire on warbler demographics, and population viability analyses.

- *Black-capped Vireo* – Research and conservation efforts for this species on Fort Hood have been numerous. Recent research projects have included studies of nest depredation, conspecific attraction, the relation between nest success and snake activity, nest parasitism and cowbird management, selection of nest sites, demography in relation to habitat, survival, age and sex determination, adrenocortical responses, habitat selection by juveniles, longevity, habitat suitability models, habitat restoration, source-sink population dynamics, and juvenile behavior. Monitoring activities include distance sampling to determine population estimates and demographic monitoring in selected study sites.

As a part of the endangered species population monitoring program, Fort Hood employs the use of helicopter over-flights to map wildfires in endangered species habitat and control wild pigs. Fort Hood's use of helicopter surveillance is an effective means of monitoring available habitat.

Program History

Fort Hood's past actions of prescribed burning, juniper removal, and cowbird control continues to the present. The prescribed burn policy emphasizes reduction of fuel loads in grasslands surrounding endangered species habitats which reduces the threat of wildfire damage. Prescribed burn policies emphasize use of preventative prescribed fire to maintain blacklines near habitat areas annually. Fort Hood also employs firebreaks in association with endangered species habitats to reduce fire risk. Prescribed burns are managed through the Fort Hood NCRMB (see **Section 4.10.3**).

From 2005 to 2010, juniper was removed from approximately 22,598 acres on the installation. Of this acreage, approximately 5,700 acres was black-capped vireo habitat and 372 acres was golden- cheeked warbler habitat. The USFWS has determined that juniper removal in vireo habitat typically does not adversely affect the species. In many instances juniper removal improves vireo habitat by thinning out the density of the shrubland, providing more sunlight for other species of woody shrubs, and maintaining the openness of the habitat preferred by vireos. Juniper removal within warbler habitat does adversely affect the warbler, therefore incidental take must be authorized by the USFWS for this activity.

Fort Hood conducts extensive operations to reduce numbers of brown-headed cowbirds (*Molothrus ater*) on the installation. The program consists of trapping and shooting activities that target feeding concentrations of cowbirds throughout the installation and cowbird individuals in endangered species nesting habitat. The objective of the control program is to maintain the incidence of cowbird parasitism of vireo nests below 10 percent annually in managed study sites.

Current Condition

Golden-cheeked Warbler – The golden-cheeked warbler, which was Federally listed as endangered in December 1990, occurs on Fort Hood from March through July. Warbler habitat includes mature Ashe juniper with peeling bark and a variety of oak species. Known distribution of potential warbler habitat on Fort Hood is based on vegetation mapping, visual interpretation of aerial photography, and ground surveys. Currently, it is estimated that approximately 50,343 acres of suitable warbler habitat occur on Fort Hood (see **Figure 4-5**). Warbler occurrence is widespread and has been documented in all training areas with suitable habitat on the installation.

Estimated abundance from 491 point counts conducted in 2008 was 4,482-7,236 male warblers not including extrapolation to the LFA. In 2015, a pilot survey using distance sampling methodology was conducted. In 2018, the distance survey and analysis resulted in an estimated installation-wide density of 0.29 per ha, with 95% confidence interval of 0.23-0.37, calculated with 1,833 points on a grid system. The best model has a calculated installation-wide

population estimated at 5,962 males, with 95% confidence interval of 4,727-7,520 (Macey and Grigsby 2017).

Prior to the 2015, BO, approximately 9,541 acres of golden-cheeked warbler habitat was categorized as "core habitat" on the eastern portion of the installation. This core habitat was subject to training restrictions year-round, with additional restrictions applicable to the breeding season. The implementation of restrictions in core habitat was previously included as a Conservation Measure in past consultations with the USFWS. However, due in large part to successful endangered species management at Fort Hood, the 2015 BO eliminated all golden-cheeked warbler core habitat designation on Fort Hood.

Black-capped Vireo – The black-capped vireo was listed as endangered in November 1987 and was delisted in 2018. It nests on Fort Hood from March through July each year. Vireo habitat at Fort Hood typically is shrubby with a "clumped" vegetation structure. Known distribution of potential vireo habitat on Fort Hood is based on ground surveys (see **Figure 4-5**). Most habitat patches were caused by accidental fires or mechanical clearing related to military training and operations. The current estimate of suitable vireo habitat on Fort Hood is 23,481 acres. Distance sampling based on surveys at 300–850 points has been used to estimate the abundance of vireos at Fort Hood. The estimate for 2017 was 8,432 male vireos with a 95% confidence interval of 6,651– 10,691. An increasing trend in vireo abundance was evident from 2007 to 2017. The delisted black-capped vireo is subject to a 12-year, post-delisting monitoring plan. Despite delisting, the black-capped vireo is included in this section because the post-delisting monitoring requirements are a consequence of its prior status as an endangered species.

Whooping Crane – The whooping crane is a rare migrant. Three whooping cranes were sighted in 2017, and this species was previously documented on Fort Hood. They may fly over or near Fort Hood during spring and fall migration. They may stop at Belton Lake during migration and have been observed at other wetland areas on Fort Hood.

Smooth Pimpleback – A baseline freshwater mussel survey of Fort Hood streams was conducted in 2011. The smooth pimpleback mussel was observed in a segment of the Leon River which borders the northern installation boundary. Freshwater mussel surveys are ongoing and occur on an annual basis.

Management actions and minimization measures for endangered species are outlined in the 2015 BO (see **Appendix B2**). Currently, construction and range improvement projects on Fort Hood, as well as habitat loss due to wildfire, have been authorized under the BO for a five-year period ending in 2020. Currently, there are no restrictions on training in designated threatened and endangered species habitat areas, and there is no habitat on Fort Hood designated as critical habitat by the USFWS (per ESA (4)(a)(3)(B)(i) and DoDM 4715.03, Enclosure 4(2)).

Program Goals and Objectives

The management goals for threatened and endangered species on Fort Hood are to preserve these species on the installation in accordance with the ESA, Endangered Species Recovery Plans, U.S. Army regulations and guidance, and BO. **Table 4-9** lists the goals and objectives for the

management of threatened and endangered species.

Table 4-9. Goals and Objectives for Threatened and Endangered Species

Goals	Objectives
Manage all identified rare, threatened, and endangered species in accordance with the ESA, U.S. Army regulations and guidance, State wildlife regulations/laws, and approved site-specific management plans.	Continued ongoing monitoring of intensive study areas to assess critical demographic parameters of golden-cheeked warblers. Provide approval and oversight for research conducted by universities, graduate students, and other researchers. Actively manage black-capped vireo habitat in accordance with the provisions of the ESMC. Continue freshwater mussel surveys.
Protect and enhance the habitat and populations of those plant and animal species listed as threatened, and endangered or those with the potential to be listed in the future.	Continue to provide aerial support to monitor land use impacts in endangered species habitat.
Continue cowbird control through an active trapping and shooting program based on recovery/research needs.	Maintain parasitism levels in black-capped vireo nests below 10% within intensive study sites.
Continue support and encouragement of research programs with potential to improve knowledge concerning the status and management of endangered bird populations.	Continued monitoring to determine population trends, demographic parameters, and effectiveness of management initiatives.
Continue support for range-wide population and habitat conservation and protection measures.	Assess the feasibility and desirability of participating in regional surveys of selected species and habitat types to contribute to the understanding of the ecology of the black-capped vireo and golden-cheeked warbler, or other sensitive species. Continue to collaborate and cooperate with agencies and organizations conducting monitoring and conservation of listed species on the wintering grounds, including collaborative training and data-sharing.
Ensure that scientifically sound and commonly accepted data collection methods and sampling techniques are used.	Continue to develop and assess new and innovative survey techniques for endangered species. Provide recommendations that might improve or enhance research projects conducted by universities, graduate students, or other researchers and provide oversight for the implementation of these projects.

Program Management Units

All MUs (refer to **Figure 2-4**). Golden-cheeked warbler habitat is shown on **Figure 4-5**.

Monitoring

The BO includes provisions for monitoring. The reasonable and prudent measures outlined in the BO include (1) continuing to implement monitoring and research programs for the golden-cheeked warbler; (2) managing vegetation- clearing projects to minimize fire hazard from slash and to avoid impacts on residual stands; (3) emphasizing the use of prescribed burning to support protection and maintenance of endangered species habitat and to support ecosystem management principles; (4) implement management options to reduce nest losses and habitat degradation; (5) monitoring the quality and quantity of available endangered species habitat; (6) incorporating preventive measures to avoid future uncontrolled burns similar to the

February 1996 fires; (7) develop management options through the adaptive management process for actions located within endangered species habitat.

Additional recommended conservation practices are outlined in the BO (see **Appendix B2**).

4.7.2 Species of Concern

Table 4-10 includes species, not identified in the previous section, that are declining and appear to need conservation in order to sustain Fort Hood's military mission in the near-term or foreseeable future. Species of Concern is an informal term used to refer to species that need proactive protection, but for which insufficient information is available to indicate a need to list the species as endangered. The term is not defined in the ESA.

For the purposes of this INRMP, Species of Concern include Texas state-listed species. DoD and Department of the Army policy requires Fort Hood to provide for the protection and conservation of state-listed species when practicable. Fort Hood will provide similar conservation measures for state-listed species as are provided to species listed under the ESA, as long as such measures are not in direct conflict with the military mission. When conflicts do occur, consultations will be conducted with TPWD to determine if any conservation measures can be feasibly implemented to mitigate impacts.

Table 4-10. Species of Concern

Scientific Name	Common Name	Federal Status	State Status	Status on Fort Hood*
Various species	Cave invertebrates	Not currently listed	--	A
Danaus plexippus	Monarch Butterfly	Under review	--	A
Spilogale putorius interrupta	Plains Spotted Skunk	Under review	--	A
Plethodon albagula	Slimy salamander	Not currently listed	--	A
Myotis velifer	Cave myotis	Not currently listed	--	A
Perimyotis subflavus	Tri-colored bat	Under review	--	A
Croton alabamensis var. *texensis*	Texabama croton	Not currently listed	--	A
Phrynosoma cornutum	Texas horned lizard	Not currently listed	Threatened	A
Colinus virginianus	Northern Bobwhite	Not currently listed	--	A
Haliaeetus leucocephalus	Bald eagle	DL 28 June 2007	Threatened	B
Falco peregrinus anatum	American peregrine falcon	DL 1999	Threatened	B
Falco peregrinus	Peregrine falcon	Delisted 1999	Threatened	B
Fusconaia mitchelli	False spike	Under review	--	C
Truncilla macrodon	Texas fawnsfoot	Candidate	Threatened	C
Eurycea chisolmensis	Salado springs salamander	Threatened	--	C
Sternula antillarum athalassos	Interior least tern	Endangered	Endangered	C
Canis rufus	Red wolf	Endangered	Endangered	C
Crotalus horridus	Timber rattlesnake	Not currently listed	Threatened	C

*Status refers to population status on Fort Hood according to these definitions: (A) Population established on Fort Hood. Recent information documents an established breeding population (even if small) or regular occurrence on the installation. This includes those species for which research and management is ongoing and several endemic cave invertebrates. (B) Recently recorded on Fort Hood, but there is no evidence of an established population. This includes species considered to be transient, accidental, or migratory (e.g., some migrating birds may use the installation as a stopover site during migration to and from their wintering grounds). For some species in this category, further inventory may reveal breeding populations. (C) Not known to occur on Fort Hood.

One of the objectives of the ESMC is to provide adequate and sufficient protective measures to avoid listing karst-adapted species found on Fort Hood under the ESA. Karst-adapted species are identified as Species of Concern at Fort Hood. Such listings would add restrictions to military training. Therefore, the primary focus of much of this section of the INRMP is on karst and karst-dependent species management.

Karst Program Data Management

Studies of caves on Fort Hood were conducted in the 1960's; however, no other studies were conducted on Fort Hood until 1991 when the U.S. Army Construction Engineering Research Laboratory (USACERL) contracted a biological study. All previously known caves and karst features on Fort Hood were examined. The studies entailed surveys of the caves' layout from which all other research could be overlain for meaningful analysis. Biological collections were conducted, and specimens sent to taxonomists specializing in those animals for authoritative identification.

Between 1991 and 1998 many new features were found. Although no transect surveys have been conducted on Fort Hood, areas already known to contain caves were covered fairly completely as incidental efforts in collecting, mapping, and locating those caves.

The 1998-1999 field season was largely devoted to conducting searches for new features in areas not yet visited or poorly known. A total of 58 new karst features were documented. From 2000 to the present, additional karst surveys have resulted in the discovery of many new karst features and caves, including several containing endemic species. Continued excavation has also resulted in the opening of new caves containing endemic species. At present 329 caves, 862 sinks, 192 springs, and 639 rockshelters are documented and recorded. Important parts of the study for the last few years have been searching for unknown karst features and the taxonomic description of the new species discovered on Fort Hood.

Fort Hood prepared a Karst Management Plan (June 2012) designed to eliminate, mitigate, and prevent harm to the species of concern. A copy of this plan can be found in **Appendix B3**. By proposing a plan for all species of concern, not just those proposed for endangered listing, Fort Hood can take a broader and more effective ecosystem-based approach to species management, similar to habitat conservation plans. Standard Operating Procedures have been developed between Cultural Resources and Natural Resources Branches to coordinate research at karst features that may contain cultural remains, significant resources, or have spiritual significance.

Karst Program History

Fort Hood covers several karst fauna regions. Karst landscape identifies the caves, sinks, and the network of dendritic fissures and cracks that supply nutrients to the features. The regions are defined based on geologic and hydrologic continuity and the distribution of karst adapted and dependent species. Sub-regions are zones within karst fauna regions that have different faunal assemblages.

Karst fauna regions and sub-regions can be further divided into "karst fauna areas." USFWS (1994) described the karst fauna area as "known to support one or more locations of the listed

species [species of concern at Fort Hood] and is distinct in that it acts as a system that is separated from other karst fauna areas by geologic and hydrologic features and/or processes that create barriers to the movement of water, contaminants, and troglobitic fauna." The purpose of the karst fauna areas in managing the species of concern is to establish areas such that if a catastrophic event that might kill species or destroy habitat occurs in one area, it will not affect species or habitat in other areas.

There are several threats to karst species on Fort Hood. These include:

- Vegetation removal around and within 164 feet (50 meters) of karst entrances and cave footprints is a threat to the integrity of the ecosystem because important microclimate variables are altered.
- Disturbances related to vegetation removal promote the colonization of red imported fire ants, an important predator of cavernicoles and cave crickets.
- Military vehicle maneuvers and bivouacs around entrances and over footprints promote soil disturbances around karst features and constitute a safety hazard because Soldiers may unintentionally fall into a feature and/or damage equipment.
- Loose soil, which is easily washed into karst features and plugs passages, alters critical hydrologic recharge and nutrient exchange between the karst feature and the surface.
- Anthropogenic disturbances such as vandalism, trash dumping, and unauthorized visits degrade and destroy karst ecosystems and the ecosystem processes.
- Urban growth into the karst regions and the subsequent loss of habitat, as well as direct impact on the species.

Karst Current Condition

Cave Adapted Fauna – Troglobitic faunal communities (karst-adapted and dependent organisms) are often represented by rare endemics due to the narrow ecological niche and natural isolation of the caves and cave systems they inhabit. Several endemic and currently undescribed cave invertebrate species and one probable new subspecies of slimy salamander occur on Fort Hood.

Karst investigations at Fort Hood have found at least 16 species of troglobites endemic to Fort Hood. These species include five spiders, two pseudoscorpions, one millipede, one ground beetle and seven ant-like litter beetles. A full listing of species can be found in the Karst Management Plan (see **Appendix B3**). None of these species are known to occur outside of Fort Hood. Population estimates for the invertebrate species of concern are not available due to their inaccessibility, rarity, and sometimes secretive habits.

Additional species, presently under study, may also prove endemic to Fort Hood and will need to be added to the list. Population of a silverfish species found on Fort Hood is worthy of conservation because of its rarity or because it represents a peripheral, isolated population. Without pro-active monitoring and management, these species could be proposed for listing in the future. Additional, non-endemic troglomorphic and non-troglomorphic species have been observed utilizing Fort Hood caves, resulting in a minimum of 286 invertebrate and 32 vertebrate species, including two bat species of concern (cave myotis and tri-colored bat).

Slimy Salamander – Specimens of the slimy salamander have been collected from caves and springs in the east/northeast training areas of Fort Hood. This species is not cave-restricted; however, it is troglophilic (depends upon karst features) and has a very limited geographical range (Training Areas 20-25 & possibly LFA 85). The species is unique because two color morphs exist on Fort Hood: one is all black (atypical) and the other is mottled black-and-white (typical).

Cave Myotis – Four known roosts occur on Fort Hood: 1) an active maternity roost, with an estimated 20,000 - 25,000 bats during the warm season, 2) two abandoned, but restored roosts, and 3) an unmonitored roost in an underground river. Additionally, cave myotis can be found in small groups (10 – 150 individuals) and single bats in other karst features (caves and rockshelters) and in four underground training facilities (MOUT tunnels) on Fort Hood during the spring-autumn seasons. The bats migrate during late-autumn, meaning they are mostly absent from the installation during the winter; however, small groups typically remain to hibernate in a small number of caves.

Tri-colored Bat — This species diffusely roosts in Fort Hood's forests and shrublands during the warm season (spring and summer), typically as single bats, and diffusely roosts in caves and rockshelters during the cold season (autumn and winter), typically ranging in groups from 1-30 bats. Because the species has a wide, tolerable temperature range for hibernacula, the bats frequently move between roosts during the cold season. Additionally, because of this tolerance, they will hibernate in a greater number of hibernacula, meaning they are widely scattered amongst many karst roosts across the landscape; however, they have been regularly observed in at least six hibernacula.

Other Species of Concern Current Condition

Monarch Butterfly – Monarch butterfly and milkweed surveys were conducted in 2016 and 2017 to gather baseline data and are planned to continue. One thousand (1,000) monarch butterflies were tagged in 2017 using tags from Monarch Watch. Resources and background information on the Monarch Watch program is available at https://www.monarchwatch.org/tagmig/index.htm. Detailed information on this Fort Hood project can be found under the Non-Game Management section (see **Section 4.9.4**).

Plains Spotted Skunk – During camera-trap grid surveys, these skunks were detected in Fort Hood's forests (most observations), shrublands, riparian forests, and semi-open forests on the eastern, western, and southern (West Fort Hood) regions. Most of the surveyed areas co-occur with endangered songbird habitat, resulting in "umbrella" protection. Their density, territory size, landscape usage, survival, productivity, and population trend on Fort Hood are unknown.

Texabama Croton – In 1989, a distinct population of this species was discovered on Fort Hood. Other Texas populations have subsequently been discovered in Travis and Coryell counties. After taxonomic review, the Texas population of this species was designated a new variety. Both significant populations on Fort Hood occur in protected canyons along the Owl Creek river drainage. Several scattered plants and a small population have been found near tributaries of Owl Creek. The total population on Fort Hood is estimated to be around 20,000 individuals.

Texas Horned Lizard – Four separate lizard surveys have been conducted on Fort Hood (1994-1996, 1998-1999, 2001, and 2009). A total of 16 horned lizards were observed, widely scattered across a broad geographic range. Texas horned lizards appear to be widely scattered at low overall densities. Further data collection on the species will be initiated in 2018.

False Spike – A survey of archeology sites revealed the false spike was historically present in the streams near the present-day Belton Lake. False spike was observed in the Leon River just upstream of Fort Hood in the 1920s but has not been observed since.

Program Goals and Objectives

The management goals for species of concern (primarily karst species) on Fort Hood constitutes a proactive role that could preclude listing of the species as threatened and/or endangered. Should listing occur, Fort Hood's proactive role will no doubt result in less intense restrictions (i.e., should not increase above current protection and management levels found in the Karst Management Plan). Additionally, most of Fort Hood's karst areas co-occur with endangered species habitat. As a result, many karst features receive "umbrella" protection and management via endangered species habitat management, protection, and threshold reviews. **Table 4-11** lists the goals and objectives for the management of species of concern.

Table 4-11. Goals and Objectives for Species of Concern

Goals	Objectives
Protect and enhance the habitat and populations of species of concern.	Continue to survey and monitor for the presence of Species of Concern and collaborate with researchers who are studying declining species. Delineate and manage habitat (occupied and unoccupied).
Conserve rare and endemic invertebrates and salamanders and their habitat throughout the karst landscape of Fort Hood.	Continue to search, identify, document, survey, map, study, and protect karst features and areas with significant faunal assemblages. Continue to study, monitor, and protect the Rocket River Cave System in LFA, and Bear Springs on the east side. Continue to study the hydrology/water flow of the Rocket River Cave System, the System springs, and the surrounding aquifer, and continue to delineate, protect, and manage the upstream and downstream watersheds. Determine and monitor sedimentation rates in the Rocket River Cave system. Study the hydrology/water flow, movement of spring resurgence and flow path through time at Bear Springs. If funding is available, investigate if the massive tufa mound age can be determined. Continue to assess, investigate, and excavate sinkholes for their potential to become caves and/or significant locations for cavernicoles. Continue to monitor salamander cave and spring habitats for degradation and/or human and non-invasive species damage. Continue to manage, update, and the limit the distribution of karst location and species composition databases and GIS data.

Goals	Objectives
	Continue to determine the appropriate number, size, and shape of karst fauna areas targeted for management.
Provide protection to targeted karst fauna areas. Specific protective measures include installing rock (physical) barriers, protecting the areas from vegetation clearing, implementing erosion control practices, and protecting cave watersheds.	Identify and monitor training effects on karst areas and disseminate educational information to Soldiers and trainers to raise awareness, when appropriate. Restrict the use of pesticides, fertilizers, herbicides, or other chemicals at and near karst preserve locations, and within 50 meters of karst feature entrances and footprints. Limit vegetation removal within karst fauna areas. Implement conservation measures and management of targeted karst fauna areas in accordance with the Karst Management Plan. Continue ongoing research and conduct additional research about the life history of rare and endemic invertebrates and salamanders. Determine troglobitic invertebrate detection rates in biodiverse karst features. Study, delineate, map, and characterize the karst bearing geologic formations on Fort Hood Sample springs and water caves for groundwater fauna and develop species lists. Conduct geochemical and anion/cation analyses of spring and cave water. Continue to survey, map, and sample the biota in known and newly discovered karst features in conjunction with the Karst Management Plan. Protect the karst surface and subsurface watershed. The subsurface watershed is the dendritic network of cracks and fissure around a feature that direct nutrients and water underground. Protect surface area and vegetation within 50 meters of karst feature entrances and footprints to conserve cave cricket populations, limit surface erosion, and prevent sedimentation/filling of karst features. Continue to study and monitor the cave microclimate of selected karst features. Continue to limit human visitation to researchers with appropriate karst competency skills. Maintain Level 1 & 2 cave and cliff rescue proficiency and competency, and rescue equipment cache in accordance with National Cave Rescue Commission standards, training, and qualifications. Investigate feasibility of assembling cave rescue team with DES-Fire Department personnel. Continue to conduct semi-annual checks of cave gates for operations, lubing, debris blockage, and vandalism. Repair when necessary.

Goals	Objectives
	Continue to collaborate with Cultural Resources Management Branch staff to ensure conservation and protection of cultural sites and traditional cultural properties, along with researcher access to such sites Continue to coordinate with Cultural Resources Management Branch staff for excavation activities at karst sites Continue to update karst feature list, descriptions, and species occurrence.
Continue bat cave conservation activities.	Continue to monitor, study, and protect the maternal colony of cave myotis in the western maneuver area. Continue to monitor, study, and manage bat caves in the LFA and maneuver areas. Continue to search for and document bats utilizing karst features as hibernacula and transient, migratory roosts. Investigate and document rockshelters and caves for bat occupation and signs of use. Continue to search, study, and document cave bat use at rockshelters and other non-cave habitats. Continue to monitor known and newly discovered bat cave roosts for signs of White-nose Syndrome. Report and collect samples in accordance with USFWS and TPWD protocol. Continue consultation and collaboration with governmental and non-governmental cave and cave biota management organizations.
Control or eradicate fire ants near karst systems.	If necessary, evaluate and prioritize a list of karst systems that require non-pesticidal or least-toxic control strategies (e.g., hot water or steam) fire ant control.
Monitor status and distribution of Texabama croton populations.	Visit known locations to visually assess condition of known populations. Develop and implement an annual monitoring plan.
Survey, manage, and protect Texas horned lizard populations.	Develop a monitoring plan.

Program Management Units

Karst habitat and features are managed in the LFA, Northeast, Northwest, South (West Fort Hood), and Southeast MUs. All other species of concern are managed in all MUs. (refer to **Figure 2-4**).

Karst Monitoring

The Karst Management Plan provides detailed descriptions of the actions necessary to monitor the karst features of Fort Hood (see **Appendix B3**).

All karst fauna areas targeted for conservation should be monitored to determine the success or failure of the management actions implemented and to guard against irreversible declines in the species' status. The status of the species of concern and existing or potential threats to either should be monitored on a basis recommended by the USFWS. Monitoring criteria that are as quantitative as possible should be developed to minimize sampling or interpretational bias

and to facilitate comparison between monitoring periods and other observations. The results of the monitoring should be assessed periodically to determine whether changes, additions, or deletions to the conservation program are needed.

Any monitoring program should take care not to adversely affect cave fauna. It is both impractical and probably harmful to do intensive, regular detailed monitoring of many of the small caves. Larger caves, where only selected areas are monitored, can be safely monitored two to four times a year. Any cave in a potentially affected karst fauna area should be studied immediately after the event. Additional surveys should be conducted if there is evidence of an adverse impact on the karst ecosystem or, especially in the event of a spill of hazardous materials. Caves and karst features should also be monitored if heavily affected by vegetation clearing activities, flooding, or fires.

4.8 Migratory Birds

The Migratory Bird Treaty Act (MBTA, 16 USC 703-712; 50 CFR Part 10) states that, "Unless and except as permitted by regulations…it shall be unlawful at any time, by any means or in any manner, to pursue, hunt, take, capture, kill, attempt to take, capture, or kill…any migratory bird, any part, nest, or eggs of any such bird…concluded November 19, 1976." Further, Executive Order 13186 provides guidance to Federal agencies with the purpose to, "minimize the potential adverse effects of migratory bird take, with the goal of striving to eliminate take, while implementing the mission."

In accordance with Executive Order 13186 and the associated MOU between the DoD and the USFWS to Promote the Conservation of Migratory Birds, Fort Hood will, to the extent feasible and practical, conduct non-military readiness activities in a manner that will minimize or avoid their impacts on migratory birds, with special emphasis on migratory bird species of concern.

DoD installations must ensure that INRMPs and NEPA analyses adequately address migratory bird management and the potential impacts of proposed military activities – readiness and non- readiness related alike – on migratory birds. Section 315 of the 2003 National Defense Authorization Act and the Military Readiness Rule (50 CFR Part 21) authorizes, with certain limitations, the incidental take of migratory birds during "military readiness activities". Nonetheless, the Armed Forces must give appropriate consideration to protecting migratory birds when planning and executing military readiness activities; however, implementing protections must not diminish the effectiveness of those activities. Moreover, this requirement pertains to all military readiness activities, not just those that may result in a significant adverse effect on a population of a migratory bird species. Under the provisions of that rule (NEPA and ESA considerations), Fort Hood units, civilians, and contractors conducting a Military Readiness Activity may unintentionally take migratory birds.

"Military Readiness Activities" includes all training and operations of the Armed Forces that relate to combat, and the adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use. It does not include (a) routine operation of installation operating support functions, such as administrative

offices; military exchanges; commissaries; water treatment facilities; storage facilities; schools; housing; motor pools; laundries; morale, welfare, and recreation activities; shops; and mess halls, (b) operation of industrial activities, or (c) construction or demolition of facilities listed above.

On December 22, 2017, the USFWS released M-Opinion 37050 (Opinion) regarding whether incidental take is prohibited under the MBTA. The Opinion concludes that "...the MBTA's prohibition on pursuing, hunting, taking, capturing, killing, or attempting to do the same applies only to direct and affirmative purposeful actions that reduce migratory birds, their eggs, or their nests, by killing or capturing, to human control" (M-Opinion 37050, pg. 41). The Opinion clarifies that, under this interpretation, the MBTA does not prohibit the incidental or unintentional take of migratory birds and/or their active nests. However, Office of the Assistant Secretary of Defense memo dated 6 February 2018 states that military departments should continue to follow existing DoD guidance.

The NCRMB is the review authority for migratory bird consideration in NEPA analyses and has developed BMPs for avoidance and minimization of potential incidental take of migratory birds. These BMPs ensure the installation is meeting its compliance obligations under the MBTA for both Military Readiness Activities and non-Military Readiness Activities.

Program Data Management

The NCRMB manages USFWS Birds of Conservation Concern and DoD Mission-Sensitive Species through the Adaptive and Integrative Management (AIM) Program. Priority species are identified by utilizing lists of species of concern (SOC) provided by reputable avian conservation communities. These include the USFWS Birds of Conservation Concern (2008), comprehensive bird conservation plans (North American Waterbird Conservation Plan, U.S. Shorebird Conservation Plan, Partners in Flight Bird Conservation Plans, North American Waterfowl Management Plan), and Game Birds Below Desired Condition. These lists are useful tools for installation managers to identify species that may be on their lands and most in need of conservation attention. These lists also provide a starting point for DoD natural resources managers interested in addressing concerns over potential impacts of readiness and non-readiness activities on SOC. A complete list of SOC by Bird Conservation Region (BCR), and the location of each installation by BCR, can be found on the DoD PIF website.

Inventory and Monitoring

Currently, data is being collected in grassland habitats, as grassland birds are declining faster than any other group of bird species across North America due to habitat loss and fragmentation. The data collection will provide a better understanding of the current distribution and abundance of declining avian grassland species, enabling the NCRMB staff to provide BMPs for all stakeholders and streamline the NEPA process.

Avian grassland data has been collected from 2016-2018 using the point count method. Much of the research conducted is a replication of work done by The Nature Conservancy in 2008-2010. Data may be compared to archived data to establish trends overtime, if feasible. Much of the landscape has changed due to vegetation encroachment, training activities, construction, and vegetation clearing. Statistically sound analysis will be challenging though changes in vegetation and patch size are being documented.

Once adequate data is collected for all avian species utilizing grassland habitats, research efforts will take a more targeted approach. Future research goals and timeframes are outlined in **Table 4-12**. Target research species selections are subject to change and will be aligned with the most current SOC research recommendations from DoD PIF.

Incidental data is also collected across all habitats. The data is managed using eBird, an online database of bird observations providing scientists and researchers with real-time data about bird distribution and abundance. The database is supported by The Cornell Lab of Ornithology.

Table 4-12. Migratory Bird Future Research Goals and Timeframes

Target Species Common Name	Scientific Name	Anticipated Research Timeframe
Northern Bobwhite	*Colinus virginianus*	2019-2020
Sprague's Pipit	*Anthus spragueii*	2021-2023
Bell's Vireo	*Vireo bellii*	2021-2023

Research priority for mission-sensitive species will be determined using the most current DoD Partners in Flight (PIF) ranking (See **Table 4-13**).

Table 4-13. DoD Species Ranking and Occurrence on Fort Hood

Common Name	Scientific Name	DoD PIF Ranking	Occurrence on Fort Hood
Northern Bobwhite	*Colinus virginianus*	Mission-sensitive	Year Round
Mountain Plover	*Charadrius montanus*	Mission-sensitive	Migration/Winter (Non-breeding)**
Burrowing Owl	*Athene cunicularia*	Mission-sensitive	Winter *
Golden-winged Warbler	*Vermivora chrysoptera*	Mission-sensitive	Migration**
Cerulean Warbler	*Setophaga cerulea*	Mission-sensitive	Migration**
Golden Eagle	*Aquila chrysaetos*	Watch List	**
King Rail	*Rallus elegans*	Watch List	**
Long-billed Curlew	*Numenius americanus*	Watch List	Migration*
Eastern Whip-poor-will	*Caprimulgus vociferus*	Watch List	Migration*
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Watch List	Winter (Non-breeding)**
Loggerhead Shrike	*Lanius ludovicianus*	Watch List	Year Round
Prairie Warbler	*Setophaga discolor*	Watch List	Migration**
Wood Thrush	*Hylocichla mustelina*	Watch List	Migration**
Chestnut-collared Longspur	*Calcarius ornatus*	Watch List	Winter (Non-breeding)
Canada Warbler	*Cardellina canadensis*	Watch List	Migration**
Swallow-tailed Kite	*Elanoides forficatus*	Watch List	Migration**
Olive-sided Flycatcher	*Contopus cooperi*	Watch List	Migration*
Sprague's Pipit	*Anthus spragueii*	Watch List	Winter (Non-breeding)
Blue-winged Warbler	*Vermivora cyanoptera*	Watch List	Migration**
Kentucky Warbler	*Geothlypis Formosa*	Watch List	Migration**
Grasshopper Sparrow	*Ammodramus savannarum*	Watch List	Year Round
Rusty Blackbird	*Euphagus carolinus*	Watch List	Migration**
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Watch List	Migration**
Prothonotary Warbler	*Protonotaria citrea*	Watch List	*
Bald Eagle	*Haliaeetus leucocephalus*	Reassess in 2022	Year Round
Upland Sandpiper	*Bartramia longicauda*	Reassess in 2022	Migration
Buff-breasted Sandpiper	*Tryngites subruficollis*	Reassess in 2022	Migration**
Common Nighthawk	*Chordeiles minor*	Reassess in 2022	Summer (Breeding)

Common Name	Scientific Name	DoD PIF Ranking	Occurrence on Fort Hood
Chuck-will's-widow	*Antrostomus carolinensis*	Reassess in 2022	Summer (Breeding)
Prairie Falcon	*Falco mexicanus*	Reassess in 2022	Winter (Non-breeding)**
Sage Thrasher	*Oreoscoptes montanus*	Reassess in 2022	**
Harris's Sparrow	*Zonotrichia querula*	Reassess in 2022	Winter (Non-breeding)
Painted Bunting	*Passerina ciris*	Reassess in 2022	Summer (Breeding)
Dickcissel	*Spiza Americana*	Reassess in 2022	Summer (Breeding)
Bell's Vireo	*Vireo bellii*	Reassess in 2022	Summer (Breeding)

Legend: *Uncommon, **Rare (Reassessment: DoD PIF will collaborate with avian conservation communities to reevaluate mission sensitive status every 5 years utilizing most current data available.)

The NCRMB also manages all avian nests that are discovered in motor pools and on construction sites. A monthly Environmental Compliance Officer course is offered at Fort Hood during which Soldiers and contractors who are in attendance are briefed on the MBTA law, ethical management of avian nests, and proper reporting protocols. Detailed information pertaining to this topic is provided in the following section.

Program History

The greatest risk of unintentional take occurs during the migratory bird nesting season, which at Fort Hood is 15 March to 15 August (runs concurrently with endangered species nesting season).

Given the intense and dynamic training requirements and construction, and security activities at Fort Hood, and the need to occasionally conduct these activities during the nesting season, the installation has developed comprehensive BMPs to minimize impacts to migratory birds.

- **NEPA Requirements:** NEPA analyses are performed on a programmatic level to address the potential comprehensive and cumulative impacts associated with all Military Readiness and non-Military Readiness Activities on Fort Hood. These NEPA analyses are completed, and then coordinated with all stakeholders before a decision document is signed by the appropriate Army leadership. Additional tiered NEPA analyses is completed prior to project implementation, as necessary. The level of these analyses (e.g., Record of Environmental Consideration [REC], Environmental Assessment [EA], or Environmental Impact Statement [EIS]) is dependent on the scope of the effort and the potential for environmental impacts through implementation of the proposed action and alternatives. All environmental media is evaluated in the analysis, including migratory birds as well as threatened and endangered species.

- **Disturbance:** Birds and/or bird nests protected under the MBTA are not removed from building exteriors and interiors without coordinating with the NCRMB. Any nests found in inactive vehicles or equipment are assessed to determine if a depredation permit is required prior to disturbance. If the nest is determined to be active, a depredation permit is obtained from USFWS prior to any activities that could result in a take. When nests are found on a vehicle during a field mission readiness activity and no other viable alternative is available, the nest may be taken by NCRMB personnel.

Nest stage (eggs vs. nestlings) determines whether the nest is destroyed or delivered to a licensed rehabilitator.

- **Contracts:** All contracting documents associated with the training, construction, and security activities includes comprehensive BMPs and measures for protection of migratory bird populations for each project.

- **Briefings:** Prior to commencement of work activities, appropriate stakeholders (e.g., contractors and contract inspectors) working on a project site receive a NCRMB MBTA briefing. The brief discusses the MBTA, Federal agencies responsibility under the MBTA, Fort Hood's BMPs and methods of minimizing the effects of project implementation to migratory birds. The presentation includes color handouts for field referencing of examples and pictures of the different types of nests that are likely to be encountered and discusses behavioral clues that may indicate a nearby nest (e.g., flushing, scolding). This interactive discussion also includes the procedures to be taken in the event a nest is located. The briefing occurs prior to onset of each project implementation. A list of MBTA briefing attendees is provided to the contracting officer or NCRMB office, as appropriate.

- **Funding:** Although subject to Federal funding cycles and congressional approvals, projects are scheduled to occur outside MBTA nesting season wherever feasible and practical.

- **Surveying:** Vegetation including trees, shrubs, and grassland areas in the entire project area are surveyed and assessed by qualified biologists with experience in surveying and locating bird nests. Primary surveying responsibility is with NCRMB MBTA biologists. Although NCRMB makes every effort to supply a MBTA biologist for every project, shortfalls may occur due to funding constraints. Non-availability of a NCRMB biologist does not preclude adherence to the MBTA. All organizations (military and civilian) and contractors conducting business on Fort Hood are required to abide by the terms and conditions of the MBTA.

  The surveying biologist's qualifications are reviewed and approved by NCRMB prior to approval of the biologist working on a project. The position is solely dedicated to migratory bird survey work and is not tasked to several positions on the project site or sites. If it is determined the biologist lacks appropriate experience or qualifications, the contract biologist is not allowed to make migratory bird/nest decisions on project sites.

  The systematic surveying occurs within 72 hours prior to commencement of work activities in the immediate project area. For large parcels, the biologist surveys the smaller parcels where the work will begin first and phases the surveying to immediately precede (within 72 hours) project disturbance. The biologists mark the nesting areas with flags at a safe distance to avoid the potential take of the birds. GPS coordinate data is taken at all nests locations. Prior to removing a tree or shrub, crews

(staff or contractor) are also instructed to inspect the tree/shrub as thoroughly as possible to determine if a nest is present.

- **Identifying and Marking:**
  Range and non-cantonment project sites: A progressive distance-buffer system has been developed to minimize and/or eliminate potential impacts to nesting birds on Fort Hood. If a nest is discovered within the work site at ground level (0 to 10 feet above grade), the site containing the nest is flagged or marked, a 60-foot radius buffer around the site delineated, and the area avoided. If a nest is discovered at low tree height (10 to 20 feet above grade), it is marked, a 30-foot radius buffer is established around the area of the nest, and the area avoided. If two or more nests are observed at one site location, the buffer increases to a 100-foot radius for ground and a 60-foot radius for low tree height nesting locations. If three or more nests are observed at one site location, the buffer is a 100-foot radius for both ground and low-tree nesting sites.

  Cantonment area project sites: Cantonment projects vary substantially in scope, and disturbances to bird species (traffic noises, frequent human interaction, etc.) are common. Urban birds, therefore, are much less likely to abandon a nest due to nearby disturbances than birds in open range conditions. Buffering is determined based on project scope, duration, and direct impact to avian species. NCRMB biologists perform initial site evaluations to determine appropriate buffers. This initial site visit is conducted either 1) prior to MBTA nesting season (15 March) or 2) no fewer than 14 working days before the start of construction activities. If a qualified biologist is hired by the contractor, the biologist follows the buffering and management recommendations of the NCRMB biologist. Buffering distances start at the same level as range and non-cantonment project sites above, but may be reduced based on both the initial, and follow-up, site visits.

  Motor pools: Motor pool actions are not considered a military readiness activity, as such active nests that occur within motor pools are not eligible for take authorization under the existing MOU with the USFWS. All active nests in motor pools must be reported to the NCRMB for species identification, nesting stage determination, and conservation management implementation. Buffering is determined on a case by case basis.

- **Notification:** Project survey biologists notify all appropriate stakeholders (i.e., DPW NCRMB staff, all the active field crews, and DPTMS/Range staff) that the pre-project survey has been completed, and provide details on number, location, and species of nests found. All marked nests are treated as active, unless NCRMB staff determines a nest to be inactive. NCRMB informs stakeholders of nests that they determine to be inactive within one week of notification of nest location.

- **Tracking and Data Collection:** NCRMB maintains records on nest data and locations for the duration of the nesting season. All nests located during nesting season are tracked through GIS so that nesting habits, populations, and even species can be observed and monitored during the nesting season in which it is discovered, as well as

tracked over time for better understanding of population trends. Fort Hood NCRMB staff has implemented a robust monitoring, data collection, and tracking system. Data collected from the MBTA program is managed with this established data management program.

- **Assessment and Determination:** The DPTMS/Range Project Manager assesses the vegetation conditions (e.g., type and density) and limitations (e.g., nest density and locations) and determines the best vegetation removal methods that pose the least risk to the surrounding environment. Product and methodology is reviewed through the Project Review Board and approved by NCRMB prior to implementation of the project.

- **Project Execution and Verification:** Once the assessment of conditions and determination is made, the Project Manager removes the targeted vegetation only. NCRMB staff confirms and verifies the evaluation, assessment, and project execution process. Any project delays require Garrison Commander approval.

- **Burning:** DES, DPW, and USFWS personnel are the only personnel currently allowed burning privileges on Fort Hood. No contractors can conduct prescribed burning but may burn brush piles as approved by DES. Should the Prescribed Burn program be transferred to another directorate, this organization will also be allowed burning privileges. Brush piles are monitored for avian species and other wildlife. If nests or dens are discovered in a brush pile, the brush pile is not burned until 1) the den or nest is able to be relocated or
  2) the den or nest cycle is complete.

Unintentional take of migratory birds is avoided and/or minimized by following the above BMPs.

On June 14, 2018, the USFWS issued a memorandum (FWS/DMBD/AMB/068029) to provide guidance on and to clarify the application of the MBTA to the destruction and relocation of migratory bird nests. This memorandum outlines three policies regarding take. Policy 1 states that a permit or other regulatory authorization is not required under the MBTA to destroy an inactive migratory bird nest, provided no possession occurs during or after the destruction. Policy 2 states for active nests, an individual or entity whose activity unintentionally or accidentally destroys an active nest, or is likely to do so, may collect the eggs or chicks and temporarily possess them for the purposes of transport to a federally-permitted rehabilitator. Policy 3 states that the USFWS can issue Special Purpose permits (50 C.F.R. § 21.27) for ongoing projects that regularly need to intentionally remove or destroy nests.

For recurring projects, including, but not limited to, vegetation thinning and clearing projects, Fort Hood will continue to work outside of the migratory bird nesting season when feasible. In addition, NCRMB MBTA biologists will be available to check the area for active nests or contracted biologists will be required to apply for a permit. Collection of eggs or chicks in project areas must be immediately coordinated with, and reported to, NCRMB biologists. Those involved with

recurring or large-scale projects may not collect eggs and chicks in lieu of obtaining proper permitting.

Current Condition

Several hundred species of non-game birds protected by the MBTA use Fort Hood. A comprehensive list of birds known to occur on Fort Hood and their abundance is provided in **Appendix C1**. These species use the installation for breeding, overwintering, or migratory stopover.

Program Goals and Objectives

The primary goals and objectives are to provide conservation efforts and management actions that lessen impacts and provide benefits to migratory birds. They improve existing habitat, create new habitat, enhance degraded habitat, and improve conditions for migratory birds. Fort Hood's goals and objectives for migratory birds are presented in **Table 4-14** and described below.

Table 4-14. Goals and Objectives for Migratory Birds

Goals	Objectives
Protect and enhance the habitat and populations of migratory birds.	Establish baseline population data for monitored species. Continue brown-headed cowbird control to minimize nest parasitism. Control erosion to minimize damage to the landscape. Revegetate areas affected by excessive erosion with native species to improve soil stability. Continue wetland, lake, and pond management. Monitor the presence and spread of oak wilt disease.
	Continue the prescribed burning program. Construct and maintain fire breaks to minimize wildfire risk. Increase habitat for ground-nesting grassland birds by maintaining areas of grassland habitat.

Program Management Units

All MUs (refer to **Figure 2-4**).

4.8.1 Bald and Golden Eagle Protection Act Species

Bald eagles were previously listed as Federally-threatened but were delisted on 28 June 2007; however, they are still protected by the Bald and Golden Eagle Protection Act (BGEPA) and the MBTA. The golden eagle (*Aquila chrysaetos*) is also protected under the BGEPA and the MBTA. The bald eagle is a Texas Threatened Species while the golden eagle is not listed in the State of Texas.

Among many provisions, the BGEPA prohibits take of eagles. "Take" is defined to include disturbing eagles to the extent that they are harmed; "disturb" means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, injury to an eagle, a decrease in its productivity by substantially interfering with normal breeding, feeding, or shelter behavior.

The bald eagle has been recorded year-round on the installation near Belton Lake. The bald eagle does not currently nest on the installation although it does nest nearby along the Lampasas and Leon Rivers, and an apparent pair was observed on Fort Hood in 2010 and 2011. Fort Hood may implement a Bald Eagle Restricted Aviation Zone (1 October – 31 March) which is intended to minimize disturbances from low-level helicopter flights. Flight restrictions are lifted when no bald eagles have been observed for a period of 2 weeks.

Golden eagles are rare migrants, and there are only two to three recorded sightings on the installation annually.

No goals and objectives for bald or golden eagles have been established at this time. If nesting bald or golden eagles are found on the installation in the future, the NCRMB would contact USFWS and TPWD and implement management actions based on the Bald Eagle Management Guidelines (USFWS 2007) including establishing an "off-limits" buffer around the nest site during the nesting season. This INRMP would subsequently be updated to include management goals and objectives.

4.9 Fish and Wildlife

There are approximately 196,356 acres of land available for fish and wildlife management at Fort Hood. Several projects are ongoing and planned to maintain or improve fish and wildlife habitat. Although not intended primarily for their benefit, most of the planned elements being implemented for other purposes will benefit fish and wildlife.

Fort Hood's wildlife species include fish, mammals, herpetofauna, avifauna, and invertebrates [troglobitic (sub-surface) and surface] typical to central Texas. Some Fort Hood species are widespread in Texas and the southwestern/southeastern United States. Some species are endemic to the Edward's Plateau ecoregion, while others are endemic to the Cross Timbers and Prairies ecoregion. Such wildlife diversity is attributed to Fort Hood's location on the boundary between the two ecoregions. In turn, the ecoregions influence ecosystem diversity on Fort Hood where grasslands, wetlands, mature juniper-oak forests, deciduous forests, riparian forests, shrublands, and karst features provide food, water, cover, and shelter for various populations of wildlife. For a complete list of fish and wildlife species found on Fort Hood, refer to **Appendix C** of this document.

The fish and wildlife habitat management program at Fort Hood is targeted toward maintaining the ecological health of the installation to support the long-term viability of diverse wildlife populations, while maintaining mission readiness. This is accomplished through wildlife surveys, habitat delineation and inventory (forests, grasslands, shrublands), management/monitoring of habitat extent and diversity, protection of water resources, maintenance of databases and geospatial data, and appropriate representation during construction and stakeholder project planning. Where appropriate, certain ecosystems are restored via passive methods (e.g. natural succession) or active methods (e.g. wild pig management).

4.9.1 Recreation

Fort Hood has a very active Outdoor Recreation Program, managed by DFMWR, and is one of the Army's best recreational program.

Program Data Management

All persons, 17 years of age or older, desiring to conduct any recreational activity within the Fort Hood training areas must register with the Area Access Program. The AACC issues Area Access Permits that are valid for one year. All recreational users must sign in daily using an online system before entering any area for recreational purposes and must sign out after departing the area. Instructions for use of the online system are provided in the DFMWR Annual Hunting, Fishing, and Area Access Guide. Individuals fishing in "No Check In/Out" fishing ponds and lakes are not required to check in or out. Persons using Fort Hood's facilities are responsible for familiarity with the applicable statutes, regulations, and procedures for hunting safety, water safety, range entry, and proper conservation practices. Area clearances are not issued to anyone suspected of alcohol or drug consumption.

The fee structure for each permit year is published in the DFMWR Annual Hunting, Fishing & Area Access Guide which can be obtained from the Sportsman's Center or online at https://hood.armymwr.com/programs/sportsmens-center. All fees are collected concurrently: DPW/Natural Resource Management Fee pursuant to the Sikes Act and the DFMWR/Recreational Activity Fee pursuant to AR 215-1. All fees are subject to change on an annual basis. DFMWR recreational activity fees are utilized to support requirements for supplies, labor, facility, equipment, and other related expenses. NRMB permit fees are utilized to support administration, habitat improvement, fish and wildlife management, fish stockings, and other related expenses. The following is the 2017-2018 fee schedule.

Program History

The Outdoor Recreation Program provides basic recreation opportunities (e.g., hunting, recreation lodging, swimming, camping, boating, fishing, hiking) and other opportunities that meet more specialized interests (e.g., water skiing, scuba diving, excursions, horseback riding, mountain bike riding, archery, skeet shooting, paintball, kayaking, climbing and rappelling). All recreational activities are coordinated with the NCRMB to ensure compliance with regulations.

Current Condition

The DFMWR supports one of the largest active duty armored posts in the United States, enhancing the quality of life by providing numerous recreation opportunities and services. Fort Hood offers a wide variety of outdoor recreational opportunities from horseback riding, swimming, camping, and mountain biking at BLORA to hunting, fishing, and trapping on training lands.

The BLORA, the Sportsmen's Center, the Recreation Equipment Checkout (REC), and the West Fort Hood Travel Camp (WFHTC) are the main components of the Recreation program.

Belton Lake Outdoor Recreation Area – The BLORA is a 2,032-acre major recreational and leisure area that offers a wide variety of facilities and activities to military members and their eligible

dependents, as well as the general public. Recreational activities available include RV camping, cottages, tent camping, swimming, boating, fishing, and sunbathing. BLORA is equipped with party pavilions, a paddleboat dock, a boat dock, a fishing marina, nature/hiking trails, horseback riding trails, mountain bike trails, waterslides, and a paintball course. Unit parties, family picnics, and similar functions can be held there. Most BLORA facilities are open to the public. Only facilities that require contracts, including watercraft rentals, camping sites, pavilion sites, and cottage rentals, are restricted to authorized users only. There is a daily privately-owned vehicle gate fee to enter BLORA.

The BLORA has three nature/hiking trails, totaling approximately five miles in length. These trails are well marked with signs and have rest areas located at set intervals along the paths. The trails wind through the beautiful rolling terrain at BLORA. Deer, wild turkey, and other wildlife, including the endangered golden-cheeked warbler, are frequently seen.

Horseback and pony riding opportunities are available at BLORA Ranch, and riding lessons are available upon request. Facilities are subject to inspection by the post veterinary services to ensure proper care of the animals and clean stables.

The BLORA Trailblazers Mountain Biking Program was implemented in 1998 to promote mountain bike riding at Fort Hood. A trail system offers approximately 14 miles of riding trails and accommodates riders of all skill and endurance levels. Riding trails at BLORA are located and designed in close coordination with NCRMB to ensure that environmental concerns and sensitive areas are fully considered. A five-year study was conducted by NCRMB and USFWS to evaluate the potential impacts of recreational mountain biking on golden-cheeked warbler populations in the area (Pekins 2002). The study concluded that mountain biking at current intensity levels did not have an apparent adverse impact on the species.

The BLORA Paintball Program was implemented in May 2000 to provide a safe, controlled environment where participants can enjoy recreational paintball. Several playing fields have been designed and established to accommodate players of all skill levels.

Sportsman's Center – The Sportsmen's Center supports hunting, fishing, and archery, as well as recreational skeet and trap shooting. The facility is open to the public. All controlled deer and turkey hunt programs are administered by the Sportsmen's Center. A Fort Hood Hunting and Fishing Advisory Council has been established to provide the installation and Garrison Commander with an additional source of input on hunting and fishing issues, as well as to provide a forum for recreational users to suggest improvements in the use of Fort Hood's recreational resources.

The Sportsmen's Center operates three skeet ranges, two trap ranges, and an archery range to promote shooting sports. These range facilities are open to the public. The Sportsmen's Center also oversees the Hunt and Saddle Stables to board privately owned horses. The stable facilities are for authorized users only and a monthly stall fee is charged per horse.

All-terrain Vehicle Course – An all-terrain vehicle (ATV) course is located west of TA 111, north of Turkey Run Road. The course is open to the public. ATV riders wishing to use the course must register at the Sportsmen's Center prior to gaining access.

West Fort Hood Travel Camp – The WFHTC provides 80 temporary RV camping sites, 3 large group picnic areas, and dry boat storage facilities for incoming and outgoing patrons. This facility is open year-round for authorized users.

Recreation Equipment Checkout – The REC facility provides a wide variety of outdoor recreational equipment to promote camping and outdoor activities. Recreational items available include tents, campers, utility and travel trailers, vans, recreational games, sports equipment, camping equipment, and more. This facility is for authorized users only and is open year-round.

Program Goals and Objectives

Fort Hood's NCRMB provides support to the outdoor recreational program by protecting and enhancing the natural resources on which these recreational activities rely. NCRMB's primary goal for supporting recreational opportunities is to ensure that the natural resources maintain their ecological integrity and that the recreational pursuits do not adversely affect endangered species (**Table 4-15**).

Table 4-15. Goals and Objectives for Recreation

Goals	Objectives
Provide quality consumptive and non-consumptive recreational opportunities while avoiding impacts on training and maintaining a balanced and diverse ecosystem.	Ensure through monitoring that recreational activities and designated recreational areas do not cause adverse impacts to sensitive species or habitats.

Program Management Units

All Fort Hood property designated for recreational use. A map of the designated recreation areas is available upon request at the AACC and the Sportsmen's Center.

Monitoring

Most of the monitoring done to support recreational opportunities like hunting, fishing, and trapping is discussed under **Sections 4.9.2** (*Fisheries Management*) and **4.9.3** (*Game Management*). Fort Hood will continue to monitor recreational activities in BLORA to ensure that endangered species populations continue to remain unaffected.

4.9.2 Fisheries Management

Per AR 200-1, the fisheries management program on Army installations must provide for the management of fish populations and their habitats consistent with accepted scientific principles, in compliance with the ESA and other applicable laws and regulations. The program is to emphasize maintaining and restoring habitat favorable to the production of indigenous fish, particularly Federally listed species protected under the ESA. In addition, fisheries stocks are to be managed to conserve both game and non-game species.

Program Data Management

Most ponds and lakes on the installation are considered free access to anglers age 17 through 64 if they go directly to and from the waterbody, have a valid Area Access Card, valid Fort Hood fishing permit, and valid state fishing license in their possession. A list of these ponds and lakes can be obtained at the AACC. Funds generated by selling fishing permits are used to procure catfish (*Ictalurus punctatus*) to seasonally stock ponds and small lakes. Fort Hood Areas Access Cards and fishing permits are available for purchase at the AACC. A DFMWR activity fee, assessed at the time of permit sales, is used to offset the operational costs of the Sportsmen's Center. All Fort Hood permits/cards are valid for one year from the date of purchase. If the person or guests plan to conduct any activity other than fishing, the user must check in/out through the online system.

Program History

Fishing opportunities abound in Belton Lake and the small lakes, stock ponds, streams, and rivers on the installation. Boating is allowed on Fort Hood lakes and ponds, but gasoline-powered motors are prohibited. This restriction does not apply to Belton Lake.

Current Condition

Fort Hood has approximately 193 miles of named intermittent and perennial streams, as well as numerous additional tributaries associated with these features. Fort Hood contains more than 222 water impoundments constituting approximately 584 surface-acres and shares 43 miles of shoreline with Lake Belton. A list of native fish species is provided in **Appendix C2**. Current fish habitat management includes, pond and lake renovation, dredging for silt removal, bottom contouring, shoreline improvement, aquatic weed management, and dam and spillway repair.

Fish are stocked seasonally (through the Put and Take Program) to provide quality fishing opportunities at some lakes and ponds (**Table 4-16**). "Put and Take" refers to stocking (Put) legal size fish in installation waters that permitted fishers can immediately fish for and keep (Take) as a part of their creel. Largemouth bass (*Micropterus salmoides*) are stocked to maintain or establish balanced populations within a pond, particularly in newly built or renovated ponds. Supplemental stockings can be of any size, depending on the need identified, while new stockings are primarily fingerlings. Channel catfish are stocked annually in many of the installation ponds, and particularly in some of the more popular fishing ponds and lakes, to provide greater angler opportunities and to facilitate fish management by concentrating fishing pressure into specific areas. Forage fish, such as bluegill (*Lepomis macrochirus*), redear sunfish (*L. microlophus*), and fathead minnows (*Pimephales promelas*), are stocked to supplement forage deficiencies in established ponds or to provide forage in newly constructed or renovated ponds. Stocking by anyone other than the NCRMB prohibited.

Table 4-16. Fish Stocking Record (FY 2017)

Date	Lake	Species	Length (IN)	Weight (LB)	Amount	Total (LB)
15-Mar-17	Cantonment B - Kids Pond	Channel Catfish	13.02	0.70	547	358
15-Mar-17	Cantonment A	Channel Catfish	13.02	0.70	529	352
19-Apr-17	Heiner Lake	Channel Catfish	14.31	0.87	384	342
19-Apr-17	Larned Lake	Channel Catfish	14.31	0.87	399	359
24-May-17	Cantonment B - Kids Pond	Channel Catfish	14.33	1.00	380	351
24-May-17	Nolan Lake	Channel Catfish	14.33	1.00	386	360
28-Jun-17	Clear Creek Lake	Channel Catfish	19.57	2.45	160	392
28-Jun-17	Airfield Lake	Channel Catfish	19.57	2.45	133	326
26-Jul-17	Larned Lake	Channel Catfish	23.70	3.95	93	341
26-Jul-17	Nolan Lake	Channel Catfish	23.70	3.95	94	398
06-Sep-17	Cantonment B - Kids Pond	Channel Catfish	23.00	3.70	78	292
				TOTAL	**3,183**	**3,871**

Habitat protection and the availability of suitable habitat are essential for productive fisheries and the successful management of the fisheries (USEPA 1993). The condition of the surrounding watershed plays a significant role in determining the quality of the water and the physical habitat. The implementation of watershed management practices improves and protects the quality of the water resource and therefore must be incorporated into the fisheries management program.

Fort Hood's approach to fisheries management places a high priority on habitat restoration aimed at creating ecosystems capable of producing self-sustainable populations of fish. Long-term increases in fishing quality at relatively low costs are achieved by implementing habitat improvement and protection measures. Costs for enhancing or rehabilitating fish stocks are controlled by implementing self-sustaining habitat and water quality protection measures.

Program Goals and Objectives

The goal of fisheries management at Fort Hood is to provide quality recreational fishing opportunities while maintaining a balanced and diverse aquatic ecosystem. The best long-term approach, as well as the most efficient use of resources for achieving this goal, is to establish and maintain the biological integrity of the water bodies. The inability of water bodies to provide sustainable populations is often the result of habitat degradation, poor water quality, introduction of undesirable species, and overfishing. **Table 4-17** lists the goals and objectives for fisheries management.

Table 4-17. Goals and Objectives for Fisheries Management

Goals	Objectives
Provide quality recreational fishing opportunities while maintaining a balanced and diverse aquatic ecosystem.	Evaluate current fisheries, develop a database to evaluate the future condition of fish populations, and enhance fishing opportunities on Fort Hood. Continue to develop and expand recreational fishing opportunities.
Protect, restore, and enhance aquatic ecosystems to protect water quality and support an adequate fisheries resource.	Protect the biological integrity of streams. Control/eradicate exotic and undesirable species in lakes and ponds.

Goals	Objectives
Maintain, protect, and enhance riparian areas to protect water quality, aquatic habitat, and fisheries and to enhance native biodiversity.	Maintain riparian buffer zones along streams, lakes, and ponds.
Enhance fish habitat.	Where necessary, conduct silt removal, bottom contouring, shoreline diversification, dam and spillway renovation, and riparian habitat management. Monitor aquatic weeds and implement necessary controls.
Manage fish harvests to maintain fish populations within the capacity of available habitat.	Continue to obtain adequate data to support the development of sustainable fish harvests.
Continue the reduction of sheet, rill, and gully erosion to acceptable limits.	Evaluate and prioritize a list of active erosion sites.
Assess existing best management practices.	Continue to improve the program through research and implementation of new management practices.

Program Management Units

All Management Units (refer to **Figure 2-4**).

Monitoring

Fish populations in installation ponds and lakes are monitored individually, and data indicate that there is considerable variation in game fish populations throughout the year. The monitoring methods used are consistent among water body types (e.g., lakes/ponds and streams) and from year to year. Such consistency allows the comparison of data between water bodies of a similar type, as well as the evaluation of temporal status and trends occurring for each water body. Management measures that produce the desired results will be continued for as long as they successfully meet their objectives.

4.9.3 Game Management

Several projects are ongoing and planned to maintain or improve wildlife habitat. Although not intended primarily for their benefit, most of the planned elements being installed for other purposes benefit wildlife.

Hunting and fishing are the primary outdoor recreational activities conducted at Fort Hood. Deer and turkey hunting are the most popular, however, quail, small game, duck, goose, dove, wild pig, and unprotected wildlife hunting are also available.

Program Data Management

Deer and turkey are the installation's primary game species. An annual deer census is conducted, using spotlight and incidental survey techniques. The NCRMB collaborates with TPWD to establish a sustainable harvest quota based on the survey data. Harvest quotas for Rio Grande turkeys are also established by NCRMB. Seasons and bag limits for all game animals conform to State and Federal laws and regulations and in some cases are more restrictive. All harvested big game animals must be checked at the game check station. Deer and turkey harvest data are collected at the game check station and are forwarded to the TPWD.

Quail populations vary from year to year depending on numerous environmental factors.

Overutilization of bobwhite food sources and escape cover by cattle, and fire ant predation play major roles in quail population dynamics. Depending on yearly weather conditions and predator population size, small game populations also experience large population fluctuations.

Program History

A valid Fort Hood hunting permit and a valid state hunting license are required when hunting or participating in a hunt (including the guided deer hunts) on Fort Hood. Fort Hood hunting permits are available for purchase at the Sportsmen's Center, Building 1937. October is the typical archery season for deer and turkey. Firearms hunting occurs from November to early January. The spring turkey season typically lasts from early April to mid-May. All large game (deer and turkey) hunting is controlled by the Sportsmen's Center. Hunters are issued a hunting clearance on unguided hunt programs; or they are placed in a deer stand by a volunteer deer guide for each hunting area on the guided hunt programs.

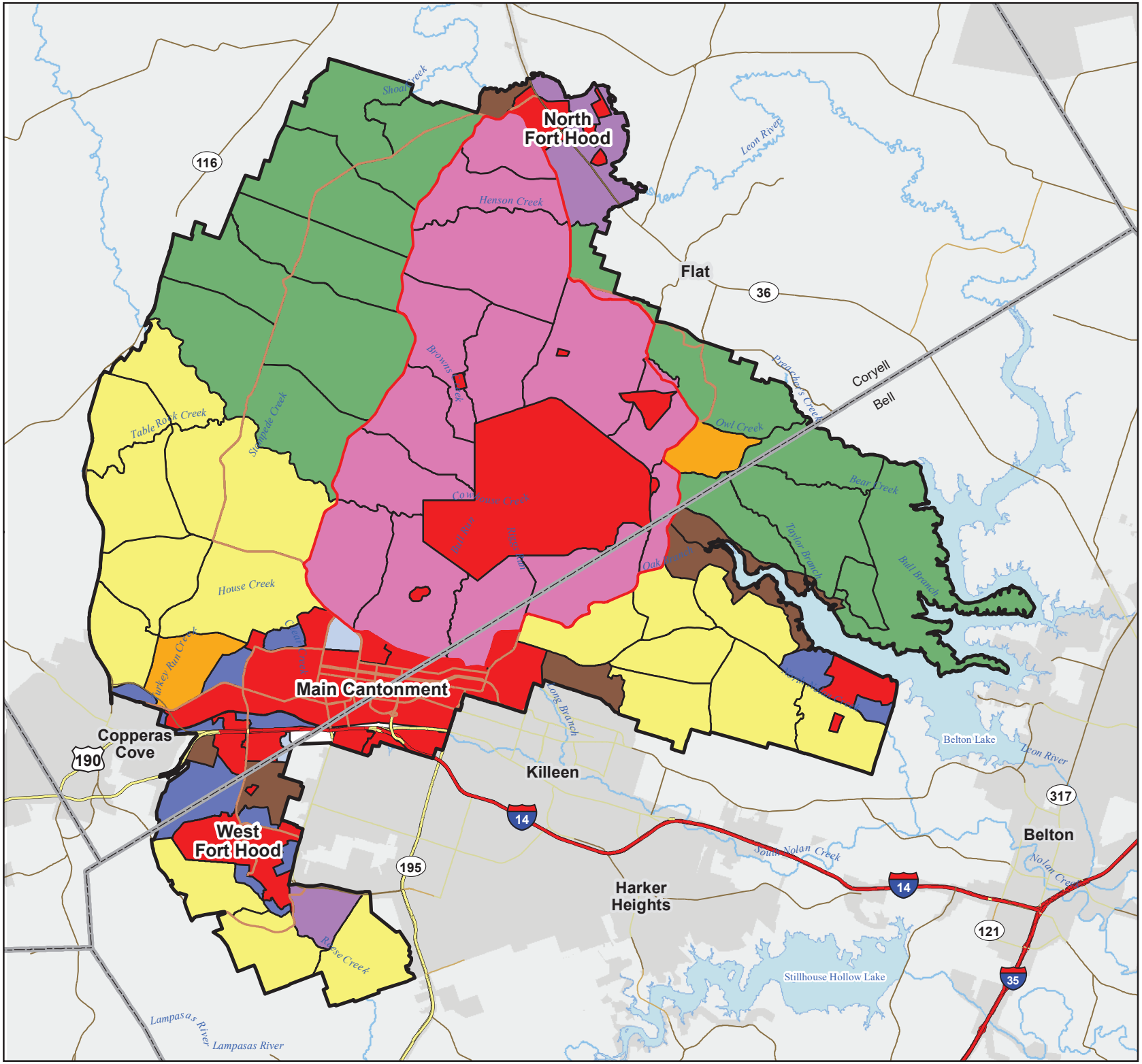
Live trapping is authorized on the installation, but participation has historically been low. Growth of this activity will depend on market pressures and user demands based on prices for common pelts. Only live traps are authorized, and the traps must be marked with the name and address of the trapper. Traps must be checked every 36 hours, and hunters/trappers of furbearing animals must possess a valid Texas Trappers License and a Fort Hood Hunting Permit. Trapping of wild pigs by the public is prohibited, and trapping of any kind in the cantonment areas is prohibited unless approved, in writing, by DES Game Wardens and NCRMB. Required information for trapping and the most recent guidance and regulations may be found in the Fort Hood Integrated Pest Management Plan (IPMP). LFA deer guides must attend an unexploded ordnance class. Participants in the fall guided rifle deer and turkey hunt programs must wear at least 400 square inches (total) of safety orange on the head and upper torso. Fort Hood's hunting areas and their restrictions (e.g., guided, unguided, archery only) are provided in **Figure 4-6**.

Per Texas law, any hunter whose birth date is on or after 2 September 1971 must attend a hunter safety course, however since September 1, 1999 per AR 210-21, any person hunting on a military installation must have attended an approved State hunting education class regardless of date of birth. The Sportsmen's Center conducts approximately 10 Texas Hunter Safety Education Classes annually, and approximately 400 hunters attend these classes each year.

The following installation regulations and instructions are related to the management of hunting and fishing programs on Fort Hood. They contain all information regarding hunting and fishing on the installation, including the types of weapons that can be used, information on guided and unguided hunting, and the type of game that can be hunted.

- III Corps and Fort Hood Regulation 210-25 establishes the policy for hunting, fishing, and natural resources conservation on the Fort Hood military reservation. Proof of completion of a state-sponsored hunter education safety course is required in accordance with AR 350-19. A Fort Hood fishing permit is required to fish on Fort Hood and a Fort Hood hunting permit is required to hunt.

Figure 4-6. Hunting Areas



- III Corps and Fort Hood Circular 210-YY-22, the Installation's Hunting and Fishing Bag Limits and Seasons regulation, is issued each September and sets hunting and fishing bag limits, possession limits, size limitations, fishing and hunting seasons, and other restrictions for sport species at Fort Hood. It establishes equipment restrictions which comply with Federal and State regulations; in some instances, they are more restrictive than the Federal and State regulations.
- III Corps and Fort Hood Regulation 210-3, Installation's Recreational Use of Maneuver and Live-Fire Training Areas regulation, covers access to and use of Fort Hood maneuver and live-fire training areas for recreational purposes. It establishes III Corps and Fort Hood policy, procedures, responsibilities, and user liability related to the recreational, non- military use of all Fort Hood maneuver training areas and live-fire training areas. Personnel using Fort Hood's maneuver training areas and live-fire training areas for recreational purposes must have a personal liability release form on file at the AACC. All entry into numbered training areas for recreational purposes is controlled by registering annually with the AACC and obtaining a valid FH Form 210-9 Area Access Card upon completion of the registration process.
- III Corps and Fort Hood Regulation 200-1, Facilities Engineering Environment and Natural Resources regulation, prescribes policies, assigns responsibilities, and establishes procedures for protection of the environment, preservation of natural resources, and hazardous material/hazardous waste management.
- DFMWR Annual Hunting, Fishing, and Area Access Guide is a guidebook for hunters and anglers that contains basic information on hunting and fishing at Fort Hood and a list of prohibited activities.

All persons, 17 years of age or older, desiring to hunt within the Fort Hood training areas must register with the Area Access Program. Hunting permits are valid from 1 September to 31 August. All hunters must sign in daily using the online system before entering any area and must sign out after departing the area. Instructions for use of the online system are provided in the DFMWR Annual Hunting, Fishing, and Area Access Guide.

Persons using Fort Hood's facilities are responsible for familiarity with the applicable statutes, regulations, and procedures for hunting safety, water safety, range entry, and proper conservation practices. Area clearances are not issued to anyone suspected of alcohol or drug consumption.

Current Condition

The deer population has remained stable in some regions on the installation. Increased military training requirements in the training areas might be a factor in the decline. Annual deer censuses and recommended annual harvest totals reflect a well-managed herd. Average deer harvest weight has continued to increase, and more mature bucks with quality racks are being harvested. The current doe-to-buck ratio is approximately 2:1. Close coordination is maintained with DPTMS Range Operations Branch in maximizing utilization of available training areas to support hunt program requirements.

NCRMB restricts the turkey harvest to only male birds and one less than the State permitted bag limit for the county to ensure that populations remain healthy. Turkey harvest numbers continue to remain about the same and reflect a stable population of birds. As new/better census

techniques are developed for estimating turkey numbers, they will be utilized to more accurately assess the Fort Hood population.

Opportunities to hunt waterfowl on Fort Hood are numerous. There are many small lakes, stock ponds, and rivers that offer ducks a temporary refuge during their migratory flight south during the winter season and provide exceptional duck hunting opportunities. Ponds that were constructed to minimize erosion and collect runoff during heavy rains provide additional habitat for ducks. With approximately 175,000 acres for small game hunting at Fort Hood, there is great potential for continued growth of small game hunting for squirrel, rabbit, and doves.

Program Goals and Objectives

The goals of the game management program (**Table 4-18**) are to sustain diverse, indigenous populations and their habitats using integrated ecosystem management principles while accommodating military training needs. Furthermore, wildlife resources and habitats for consumptive and non-consumptive uses are managed in compliance with Federal and State laws (Sikes Act, ESA, CWA, State laws), and U.S. Army regulations (e.g., AR 200-1) and guidance.

Table 4-18. Goals and Objectives for Game Management

Goals	Objectives
Sustain game populations and habitats for consumptive and non-consumptive uses that are managed in compliance with Federal and State laws (Sikes Act, ESA, CWA, State laws) and U.S. Army regulations (e.g., AR 200-1) and guidance.	Improve and sustain habitat quality for game species, maintain quality of existing habitat, maintain existing habitat diversity, and ensure healthy wildlife populations in a manner consistent with land use. Manage native vegetation to promote plant communities at different levels of succession. Ensure an appropriate mix of grasslands, forests, and shrublands occur at the landscape scale. Maintain existing water availability and quality. Enhance the value of ecosystems by eradicating exotic animal and plant species, promoting native plant communities, preventing the introduction of new exotic species, and restoring areas disturbed by training.
Develop a standardized, coordinated system for recording and mapping resource observations (e.g., plants, wildlife, erosion, damage).	Ensure that scientifically sound and commonly accepted data collection methods and sampling techniques are used to create and update wildlife inventories. Evaluate and research factors influencing deer populations. Continue RTLA monitoring as a component of ecosystem management.
Manage wildlife harvests to maintain game populations within the capacity of available habitat.	Continue to obtain adequate data to support the development of sustainable game harvests. Continue to provide aerial support for wildlife surveys.
Continue environmental awareness and outreach programs.	Continue support and development of the Fort Hood Outdoor Recreation Program.

Program Management Units

All Management Units (refer to **Figure 2-4**).

4.9.4 Non-Game Management

Fort Hood has many ecosystems which are managed and maintained to support military training in addition to the long-term survival, productivity, and biodiversity of invertebrates, fish, reptiles and amphibians, birds, mammals, and vegetation. Fort Hood's approach for non-game management is baseline surveys and ecosystem management which may include: maintain status quo, prevent excessive fragmentation, provide connecting corridors, prevent succession, restoration, and mitigate harmful land management/use. In some instances, specific management techniques may be employed to benefit a target species or guild, resulting in "umbrella" benefits and conservation for many taxa (e.g., maintaining intact riparian corridors or utilizing prescribed fire in grasslands and shrublands).

Program Data Management

Planning level surveys (installation – wide inventories to characterize essential components of the installation natural resources), inventory surveys, species-specific targeted surveys, and incidental observations/surveys are conducted for non-game and non-Federally/State listed wildlife in many ecosystems so that Fort Hood's baseline can be identified and better understood. With such data, the baseline can be monitored for changes across time, species presence or absence determined, and certain secretive species can be discovered, and more observations recorded (e.g., spotted skunks). It also allows for adaptive management and conservation techniques to be employed to detect and halt declines. Additionally, Fort Hood can demonstrate responsible monitoring, conservation, and management, thus possibly reducing regulatory-driven, training restrictions.

Monarch Management – Every spring and fall, Fort Hood serves as a backdrop for the monarch butterfly migration. Fort Hood is in the southern core monarch conservation unit as defined by the Monarch Joint Venture. The highest density of monarch detections occurs during fall migration, when monarchs return to their wintering grounds and funnel through the Texas central flyway. In the last decade overall monarch populations have experienced a dramatic decline and have been petitioned to be listed under the ESA. The listing decision is due June 2019.

To gain a deeper understanding of how monarchs use Fort Hood's natural resources during fall migration, monarchs were captured and tagged in the fall of 2017. A total of 1,000 monarchs were captured and tagged using Monarch Watch tags. Monarch Watch is a nonprofit education, conservation, and research program based at the University of Kansas that focuses on the monarch butterfly, its habitat, and fall migration. The purpose of the tagging is to associate the location of capture with the point of recovery for each butterfly. The data from these recaptures are used to determine the pathways taken by migrating monarchs, the influence of weather on the migration, the survival rate of the monarchs, etc. Data collected included: sex, wing size and condition, fat scores, and nectar source use.

Ophryocystis elektroscirrha (OE) samples were also collected. OE is an obligate, protozoan parasite that infects monarch and queen butterflies. In October of 2017, the first detection of OE on Fort Hood was documented. Of the 1,000 monarchs sampled, three percent were infected with the protozoan parasite.

The 2017 data collection revealed preferred monarch nectar sources and provided more insight on what areas are predominately used by monarchs for feeding and roosting. This information enables NCRMB to apply proactive conservation actions by better coordinating the maintenance and use of these sensitive areas during peak migration times.

Monarch Habitat Restoration – Through a partnership with Compatible Lands Foundation (CLF), NCRMB staff initiated work on 120-acre grassland restoration project in 2017 (**Figure 4-7**). The CLF is a nonprofit organization whose mission is to promote the conservation, restoration, and preservation of land and natural resources and to foster compatible land uses among both public and private landowners. In 2017, CLF was awarded a grant through the Monarch Butterfly Conservation Fund, administered by the National Fish and Wildlife Foundation (NFWF). The funds will be used to enhance monarch breeding and migratory habitat on or adjacent to four U.S. military bases. The project will plant native milkweed and nectar plants and control invasive species to improve 325 acres of habitat across multiple installations. Fort Hood will be a matching contributor, restoring heavily encroached grasslands on the installation and conducting pre- and post-restoration pollinator activity surveys. The project's total cost with matching funds is estimated to be over $600,000.

Monarch Habitat Conservation – Monarchs cannot survive without milkweed (*Asclepias* spp.). These plants play an important role throughout the monarch life cycle. Monarchs lay eggs on milkweed, monarch caterpillars almost exclusively eat milkweed, and adults use milkweed flowers as a nectar source. To provide all stakeholders with BMPs for milkweed populations on Fort Hood, data has been collected on species diversity, abundance, and flowering and seed dispersal times from 2016 and is ongoing.

In the spring and summer of 2016 and 2017, over 450 milkweed stem count surveys in grasslands were conducted (**Table 4-19**). The 2017 field season yielded a more comprehensive data set. Seven species were detected with spider milkweed (*Asclepias asperula*) being the most abundant species as expected.

Table 4-19. Results of Milkweed Stem Count Surveys

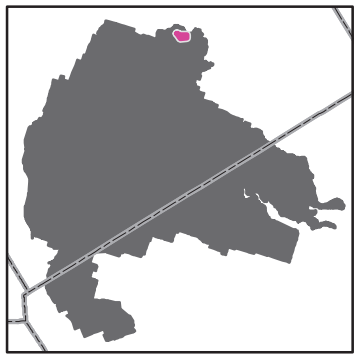
Common Name	Scientific Name	Total # of Stems
Spider milkweed	*Asclepias asperula*	51,264
Green milkweed	*Asclepias viridis*	12,960
Wand milkweed	*Asclepias viridiflora*	799
Zizotes milkweed	*Asclepias oenotheroides*	82
Whorled milkweed	*Asclepias verticiliata*	2
Purple milkweed vine	*Matelea biflora*	325
Narrowleaf milkweed	*Asclepias stenophylla*	4
N/A	Unknown milkweed	84

During these counts a milkweed species new to Coryell County was discovered: narrow leaf milkweed (*Asclepias fascicularis*). Further data analysis is being done to calculate the relative abundance of milkweed across varying grassland types.

Figure 4-7. Military Monarch Initiative NFH Proposed Area

Proposed Project Area

Installation Boundary



N

0 400 800 Feet

On the installation, large areas are cleared of vegetation for a variety of reasons, one of them being maintenance of ROWs. By working collaboratively with contractors and DPW Maintenance Division damage is minimized to nectar sources used by monarchs and other pollinators, especially during peak migration times. To mitigate the impact that vegetation clearing might have, NCRMB provides BMPs and works with contractors to ensure that disturbed areas are revegetated using eco-region specific pollinator friendly seed. Untimely mowing of sensitive areas during monarch migration will also be monitored.

Program History

Because baseline knowledge of ecosystems and species/guilds present are required for land management and/or policy decisions, several surveys and inventories have been conducted on Fort Hood. These surveys and inventories varied in their effort and focus. However, the unifying concept for all is presence/absence and species' ecosystem/region assignment.

The first documented baseline survey occurred during 1978-1979. The following were inventoried during this survey: Plants, reptiles and amphibians, avian species, mammals, fish, aquatic macroinvertebrates, zooplankton, diatoms, and algae. Additionally, coarse-scale vegetation structure, water quality parameters, and species' ecosystem assignments were determined (Severinghaus *et al.* 1980).

In addition to these early studies, more recent works include:

Invertebrates

- Karst invertebrates (James Reddell and Charles Pekins unpublished report 1999-current)
- Mussels (Cowan and Krejca 2011; Virginia Sanders unpublished data 2012-current)
- Butterflies (summaries of annual butterfly counts pre-2010; Jackelyn Ferrer-Perez, Chelsea Blauvelt, Charlie Plimpton, unpublished data 2015-current)

Fish

- Stream fish (Johnson 1992 & 1994)
- Pond and stream fish (Kevin Cagle, Virginia Sanders, and Charles Pekins, 1995-current, observations during field work and pond and stream surveys)

Reptiles and Amphibians

- General survey (Johnson 1997)
- Unpublished incidental observations and recordings (Charles Pekins 2000-current)
- Texas horned lizard (Webb and Henke 2008)
- *Plethodon albagula* (Taylor *et al.* 2005; Charles Pekins unpublished surveys 2016-2017)

Birds

Biologists have used point counts to survey birds on the installation. Although the objective of each project was to determine the abundance of a single species, field workers also recorded detections of all species. For example, from 1995 to 1997, 25 points were surveyed several times each spring and summer for brown-headed cowbirds. From 1998 to 2005, 135 points were surveyed annually to determine the abundance of black-capped vireos.

Seventy-six additional points were surveyed for this species in 1999 and 2001 to 2005. These surveys concentrated on the area of an extensive fire that occurred in 1996. The Institute for Bird Populations ran Monitoring Avian Productivity and Survivorship (MAPS) stations on Fort Hood from 1997 to 2011.

Avian grassland species were monitored using the point count method from 2008 to 2010 and again from 2016 to 2018. Over 240 points were monitored during these breeding seasons. In the wintering months the same areas are revisited using the Project Prairie Bird method.

Mammals

- Medium-sized mammals (Edwards *et al.* 1998; Carroll *et al.* 1999)
- Small mammals (Sperry and Weatherhead 2009; CERL, Champaign, IL 2017-current)
- Chiropteran mist-net and acoustic survey, 5-year study 2006-2010 (Pekins unpublished data)
- Medium-large sized mammals, 6-year camera trap grid 2011-2016 (Pekins unpublished data)

See **Appendix C** for non-game wildlife lists generated via surveys and inventories.

Current Condition

There are many invertebrate taxa, especially aquatic and terrestrial insects and arthropods, with unknown presence/absence and ecosystem assignment status. Moreover, with the exception of karst invertebrates and pest species, no species list for these taxa exist. Similarly, except for White-Nose Syndrome studies in bat caves and oak wilt surveys, no surveys have been conducted for Fungi nor have any species lists been generated.

Baseline data regarding non-game wildlife and the ecosystems they occupy have been recorded for Fort Hood. Some of these taxa have continual, follow-on surveys (e.g., fish). However, others have not been re-examined for several years (e.g., reptiles and amphibians). Still others are currently undergoing survey (e.g., small mammals) or will soon need follow-on surveys (e.g., bats). Additionally, increased surveys may be needed to detect rare or difficult to detect species. Moreover, many of Fort Hood's ecosystems occupied by non-game wildlife undergo continual change. Some of the changes are natural, such as wildfire and floods, while others are anthropomorphic, such as: forest clearing/thinning, construction of tank trails, and intense military training. Such changes in ecosystems and habitats may result in wildlife population changes and/or habitat shifts. Therefore, continual and/or interval (every 5-10 years) surveys should be conducted for most non-game wildlife taxa, and ecosystem changes should be tracked and determined. It may be impossible to conduct interval surveys for some groups due to the population sizes, diversity, and expertise needed (e.g., insects and arthropods); however, baseline surveys should be conducted.

Program Goals and Objectives

The goals and objective for non-game species management at Fort Hood are provided in **Table 4- 20**.

Table 4-20. Goals and Objectives for Non-Game Management

Goals	Objectives
Continue to collect, add to, and update non-game baseline presence/absence data and assign ecosystem/habitat designation to surveys; re-survey for taxa that has not been examined in 10+ years.	Ensure that scientifically sound and commonly accepted data collection methods and sampling techniques are used to create and update inventories. Partner with universities, research laboratories, (non-) Government agencies, consultants, etc. to conduct specialized research to better understand non-game wildlife distribution, density, behavior, life history. <u>Mammals</u> Continue to monitor and protect medium-large carnivore (fox, coyote, bobcat, and mountain lion) distribution and composition, and ensure supporting prey base and habitat are available. Continue to use camera traps to document terrestrial mammal species presence, activity times, and distribution. Where appropriate, determine density. Continue to trap, identify, and release non-volant small mammals. Investigate feasibility of utilizing baited camera traps. Utilize acoustic detectors to re-survey bat distribution and identification. Re-survey for eastern spotted skunks if the species continues to decline and/or if species is Federally-listed Utilize camera traps to investigate medium-sized mammal use at karst features <u>Fish</u> Continue to survey creeks, rivers, and spring runs for fish. Continue to measure physical and water quality parameters. Begin utilizing boats to survey fish in ponds and lakes and measure water quality parameters. Establish permanent survey points in major creeks and rivers to bi-annually survey fish and measure water quality parameters <u>Invertebrates</u> Continue Monarch tagging program. <u>Reptiles and Amphibians</u> Re-survey, identify, and determine distribution at terrestrial and aquatic sample sites. <u>Birds</u> Continue surveys for mission-sensitive species. Track changes over time to monitor populations trends.
Conduct baseline survey to collect presence/absence data and assign ecosystem/habitat designation to surveys for taxa that have not been examined	Survey, identify, and determine distribution of arthropod groups at terrestrial and aquatic sites.

Goals	Objectives
	Establish transects across the installation in native grassland habitats to survey for Texas Horned Lizard to determine presence, distribution, and abundance. Survey for Northern Bobwhite Quail to determine distribution, population densities and habitat availability and quality. Survey, identify, and determine distribution of fungi.
Conduct public outreach activities and assistance	Continue to educate the public about the benefits of carnivore communities to ecosystems. Continue to work with Pest Management staff, contractors, and Family Housing staff to resolve and understand mammal/wildlife presence in urban areas and insure nuisance and non-native wildlife is removed and released or handled IAW proper procedures (IPMP). Conduct public outreach and provide guidance to building occupants, cantonment residents, and Family Housing staff about safety around mammals and their occurrence in developed areas. Continue educating civilians, Soldiers, contractors, and youth about the MBTA and avian conservation by participating in events (Earth Fest, GIS day, Christmas Bird Count, etc.) Continue providing personnel with MBTA training to enhance avian conservation during the breeding season. Training is conducted as requested and monthly during the Environmental Compliance Officer (ECO) course. Continue enhancing natural resources native garden by partnering with the community during Make a Difference Day. Increase public involvement and create internships with local universities to aid with Monarch tagging efforts and native garden/ grassland restoration projects.

Program Management Units

All MUs (refer to **Figure 2-4**).

Monitoring

Inventory and monitoring data is evaluated at regular intervals to ensure the continued successful management of non-game species at the ecosystem level. Management measures that do not produce the desired objective will be reevaluated to determine the corrective action needed to ensure success.

4.10 Vegetation

4.10.1 Flora and Habitat

There are four dominant vegetation communities at Fort Hood: Grasslands, Forests, Woodlands, and Shrubs (**Figure 4-8**). Grassland Communities are found throughout the installation. Wildfires and training activities, especially in the LFA/impact area and Western Maneuver Area, likely reduce the woody vegetation and allow grasses to dominate. The grasslands are composed primarily of perennial herbaceous species characteristic of mid-grass prairie. Common grasses include native species such as little bluestem (*Schizachyrium scoparium*), hairy grama (*Bouteloua hirsuta*), and sideoats grama (*Bouteloua curtipendula*) and the invasive King Ranch bluestem (*Bothriochloa ischaemum*). Common native forbs are broomweeds (*Amphiachyris* sp.), ragweed (*Ambrosia artemisiifolia*), and snow-on-the-prairie (*Euphorbia bicolor*). Remnant patches of tallgrass prairie vegetation are dominated by native yellow Indiangrass (*Sorghastrum nutans*) and big bluestem *(Andropogon gerardii*) (USACE 1999).

Forest, Woodland, and Shrub Communities are a major component of the installation. Most of these habitats are found on the slopes, canyons, mesas, rolling uplands, and on rolling lowlands and associated canyons; woodlands also occur along and adjacent to riparian zones. Three distinct Forest, Woodland, and Shrub Communities have been classified: Coniferous Forest and Shrub, Deciduous Forest and Shrub, and Mixed Forest and Shrub. Coniferous Forest and Shrub Communities are found throughout the installation and are primarily composed of Ashe juniper (*Juniperus ashei*), the only coniferous species in the area.

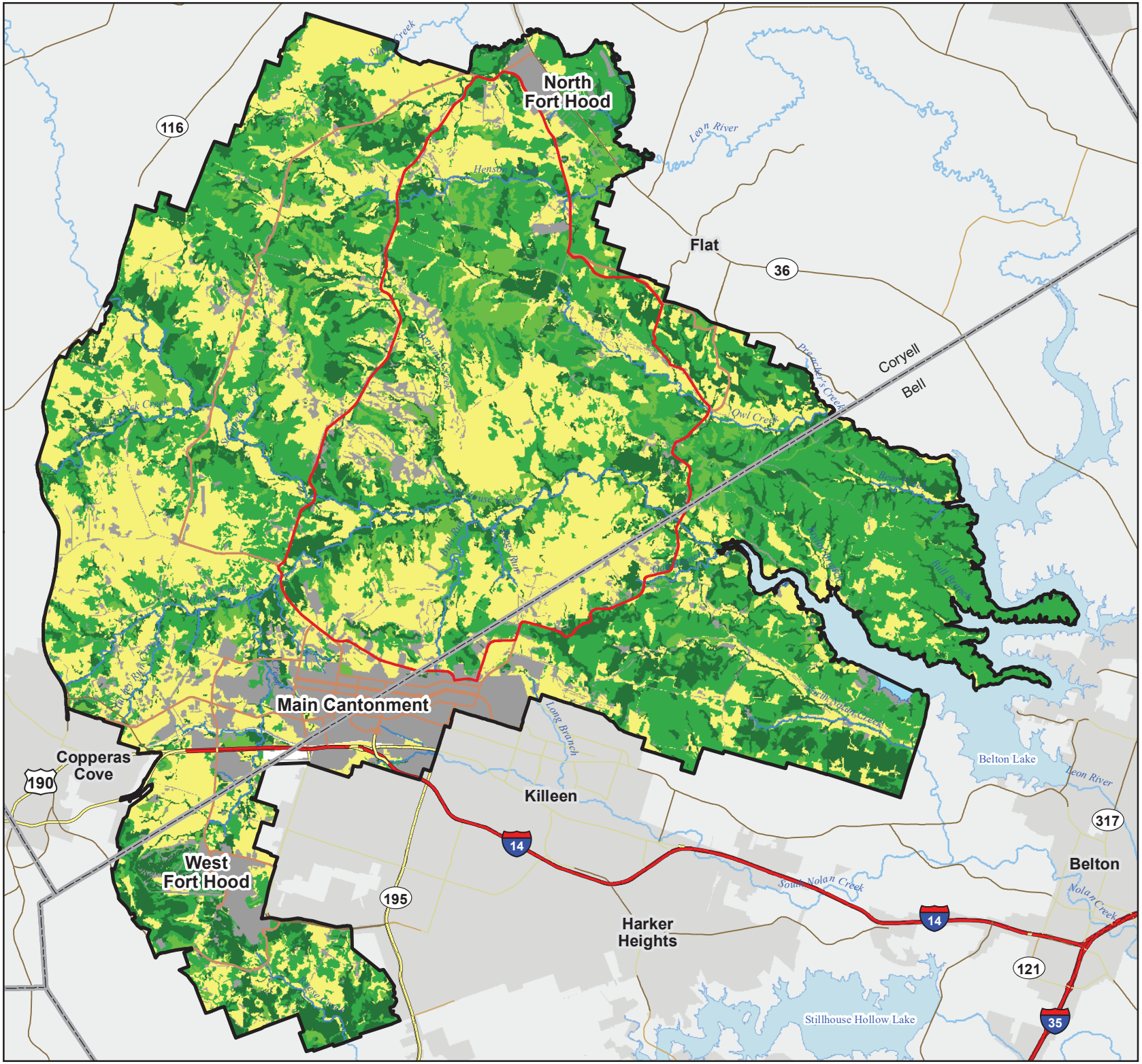
Deciduous Forest and Shrub Communities are composed of broad-leaf trees and shrubs and are found near streams in lowlands and on protected slopes. Tree species representative of this community include plateau live oak (*Quercus fusiformis*), post oak (*Quercus stellata*), pecan (*Carya illinoiensis*), and sycamore (*Platanus occidentalis*).

The most common vegetation community on the installation is the Mixed Forest and Shrub Community. In some areas Ashe juniper dominates over either plateau live oak or Texas oak (*Quercus buckleyi*), and in others the oaks dominate over the Ashe juniper (USACE 1999).

Program Data Management

The NRCS conducted a vegetative resource inventory in 1997 to determine the ecological health of training lands and to recommend livestock carrying capacities for various vegetation communities on Ft. Hood (NRCS 1998). The findings of the vegetative resource inventory indicated that stocking rates were too high on most of the installation and that grazing and training deferments were necessary on all areas void of dense vegetative cover (USACE 2003). An additional finding of the inventory was that rest from military activities and grazing did not necessarily improve site condition. Areas having a lack of military activity and a lack of grazing for 20 years had similarity indices of approximately 25 percent, nearly identical to the indices of areas currently grazed by cattle and used for training. This provides evidence that in the absence of restoration, permanent deferment from military training and livestock grazing is not a solution for improving ecological health (USACE 2003).

Figure 4-8. Vegetative Cover Types



In 2001, the NRCS conducted an inventory in the Western Maneuver Area, the Eastern Training Area, and West Fort Hood to estimate soil erosion rates and determine rangeland health and trend. Sampling was conducted at permanent vegetation monitoring points that had been established for the data gathered in 1997. In the Western Maneuver Areas, both the short- and long-term rangeland trends were found to be declining on most of the sites. In the Eastern Training Area, approximately half of the sites showed downward trends (NRCS 2002). At West Fort Hood, most of the sites exhibited upward trends.

The primary conclusion of the 2001 rangeland health inventory was that declining rangeland health and trends on portions of the installation were the result of increased military training, continuous grazing of livestock without deferment, and the effects of multiyear droughts. The NRCS recommended that livestock and training deferments were needed in much of the Western Maneuver Area and portions of the Eastern Training Area to allow perennial vegetation to increase root biomass and recover (NRCS 2002).

In May 2002, the installation performed a vegetation resource inventory like the one conducted in 1997 (USACE 2003). The primary objective of this inventory was to determine the amount of grazeable forage on the installation and to document the species composition and recommend stocking rates (USACE 2003). Results of this inventory indicated that the amount of perennial forage that could be grazed by cattle was low (< 750 lb/ac) relative to site potential in most of the ecological sites in the Eastern Training Area and in the southern portion of the Western Maneuver Area. In the Eastern Training area, sites that had moderate to high productivity (1,000 to 3,000 lb/ac) were generally dominated by King Ranch bluestem. In the NFH MU, Texas wintergrass (*Stipa leucotricha*) and Virginia wildrye (*Elymus virginicus*), both native cool season species, constituted approximately 60 percent of the grazeable forage, making this area a candidate for seasonal (winter) grazing. In the West Fort Hood MU, the amount of grazeable forage was generally greater than that of other MUs and the sites were dominated by little bluestem.

In 2004, Fort Hood carried out another vegetation survey to assess forage resources (Texas A&M 2004). The methods used were the same as those used in the 2002 inventory, and vegetation data was collected at 114 study points that had been previously established during the 2002 inventory. Several additional points were added in the LFA to collect additional data in areas underrepresented in the 2002 survey. The sampling technique identified plants within survey transects and categorized them according to forage suitability. These data were extrapolated to develop a prediction of the amount of consumable perennial vegetation in each of MUs. The amount of consumable perennial vegetation was then used to calculate recommended grazing levels in animal units per year under four different management options. Recommended installation-wide grazing levels (in animal units) for management options based on a 25 percent harvest efficiency were two to three times higher than management options based on a 750- or 1000-pound-per-acre or greater threshold for residue that considered only grazeable acreage within training areas. Training-related reductions in forage availability were factored into the results. The survey also found that the reduction in training and grazing in the Western Maneuver Area appeared to have resulted in increased biomass production and litter accumulation. Also, two good growing seasons in the previous two years had increased plant litter in all management areas.

Program History

AR 200-1 requires that Army habitat management efforts be accomplished in a manner that conserves and enhances existing flora and fauna consistent with the Army's goal to conserve, protect, and sustain biological diversity while supporting the accomplishment of the military mission. To meet this requirement, activities are directed toward the balanced maintenance of grassland, juniper-oak forest, deciduous forest, riparian forest, shrubland, and wetland ecosystems and restoration of ecosystems determined by NCRMB to be degraded.

The Woody Species Management (WSM) Program, performed through the ITAM Program, removes undesirable, high-density areas of Ashe juniper, mesquite, other hardwoods, and brush throughout the training lands. This allows for maneuvers to occur where it was difficult or impossible before and facilitates more desirable vegetation to grow. However, these actions have the potential to change forest composition, increase erosion, remove resources for wildlife, and remove cover for maneuver and dismount units. WSM also has benefits, such as reducing grassland encroachment and improving areas for black-capped vireo habitat.

Use of herbicides on training areas to control mesquite trees has become a common practice. Fort Hood has approved the basal application of Remedy Ultra on approved vegetation management projects. The approved method includes cutting the trunk and spraying herbicide on the remaining stump. Foliar application is approved on regrowth/new sprouts less than 36 inches tall. Grubbing of vegetation may also be used. No other methods are approved, as foliar (on vegetation greater than 36 inches tall) and aerial methods are believed to allow more drift and affect other species and protected features on the installation. Products and methodology for all projects must be approved by the NCRMB prior to application.

Current Condition

The land that makes up Fort Hood was purchased from the original landowners over a period of time. The former landowners have been allowed to graze the lands through outlease programs arranged first directly with the former owners and later through the CTCA. Since the inception of the original lease, grazing has been concurrent with military training activities on the installation (USACE 2003). Military training has led to disruption of the soil surface, as well as soil compaction, especially when the activities have occurred during wet periods. The lack of grazing deferral after soil disturbance has subsequently led to a decline in the abundance of perennial grass species and has promoted the invasion of short-lived annual plants that have less extensive root systems, thus making the soil less resistant to erosion (USACE 2003).

In addition, military activities in combination with livestock grazing have reduced the presence of the fire fuels required to carry range fires. Wildfires, which are a natural component of grasslands, were suppressed to prevent impacts on structures and to minimize the risk to human life. Lack of fire and overuse by livestock have been found to be primary factors leading to increases in Ashe juniper and other woody plants in the Edwards Plateau (Smeins et al. 1997).

Based on the 2008 vegetation map, as well as current field data (2013 and later) conducted by Fort Hood NRCMB personnel, and supporting NRCS documentation, Fort Hood is 15% forest, 33% woodland, 7% shrubland, and 34% grassland, leaving 11% not vegetated (see **Figure 4-8**). An annotated checklist of the vascular plants of Fort Hood is included in **Appendix C5**.

Since 2000, there have been questions as to whether forested lands are increasing across the installation. This debate has led to the abovementioned WSM Program. Global Forest Watch is a dynamic online forest monitoring tool that uses satellite imagery and other data to monitor both forest growth and loss. The site is a world-renowned resource, and has partners such as Google, ESRI, NASA, and many others. At Fort Hood, the program has allowed personnel to record forest growth and loss across the installation. As depicted in **Figure 4-9**, Fort Hood has lost substantially more forest than was gained. From 2000 to 2016, Fort Hood saw a net loss of 3,506 acres of forest cover (3,610 acres lost, 105 acres gained). Possible causes of loss include WSM, fire, juniper die- off, and flooding/droughts.

Program Goals and Objectives

The primary goals of vegetation management at Fort Hood are to restore and maintain native plant communities (grassland, juniper-oak forest, deciduous forest, riparian forest, shrubland, and wetlands) through the use of integrated ecosystem management principles while accommodating military training needs.

Table 4-21. Goals and Objectives for Vegetation Management

Goals	Objectives
Restore and maintain native plant communities using integrated ecosystem management principles while accommodating military training needs.	Maintain a balance of vegetation communities so that they reflect configurations and types naturally found on the landscape. Use previous NCRMB studies to examine extent and configuration of existing communities so that training needs can be met while ensuring an appropriate representation of vegetation communities on the landscape. NCRMB will determine which ecosystems require restoration. Use NCRMB Agronomist-approved seed mixes for stabilization of bare areas. Improve habitat quality for native species as determined by NCRMB.
Control damage to vegetation from overuse by cattle.	Manage cattle grazing on training lands. Implement cattle grazing deferments on a rotational basis to allow re- vegetation of degraded training areas and riparian buffer zones, and to minimize future erosion. Maintain grazing deferment for a time sufficient to allow re-vegetation of deep-rooted species and improve long-term sustainability of training lands.
Reduce damage to vegetation from training.	<u>NCRMB Objectives</u> Continue to limit all excavation within 50 meters of riparian areas through the Dig Permit process. <u>ITAM Objectives</u> Monitor and evaluate plant responses to maneuver training. Continue to improve and maintain 238 miles of maneuver access trails, thereby allowing military units access to training lands in a manner that reduces erosion and is less damaging to military equipment and to natural resources.

Goals	Objectives
	Harden HATs to enable safe access to hilltops and reduce soil erosion gullies. Use existing roads and openings to the maximum extent possible and use appropriate widths for existing trails (e.g., existing secondary two track trail should have improved secondary trail width). Establish authorized and improved stream crossings so existing riparian corridors will be maintained, improved, and allowed to naturally re-establish and develop. These constructed crossings direct vehicular traffic to appropriate sites and deter the establishment of volunteer crossings, which cause significant damage to riparian areas. Conduct annual survey to identify eroded areas on training lands. Conduct annual vegetation surveys in training areas.
Establish and maintain perennial vegetation on critical and potentially eroding areas.	NCRMB Objectives Continue to coordinate with universities and State, Federal, and non-governmental agencies on ongoing and new research projects to broaden informational database of perennial vegetation on Fort Hood. ITAM Objectives Attempt to restore training areas by seeding up to 500 acres annually with native grass seed to cover bare ground and highly disturbed areas.
Work with universities, State agencies, Federal agencies, and non-governmental organizations to gather basic data on native and non- native plant communities.	Update existing floristic inventory document as additional plant species are found. Maintain a GIS database to facilitate planning, implementation, and post-implementation evaluation of projects.

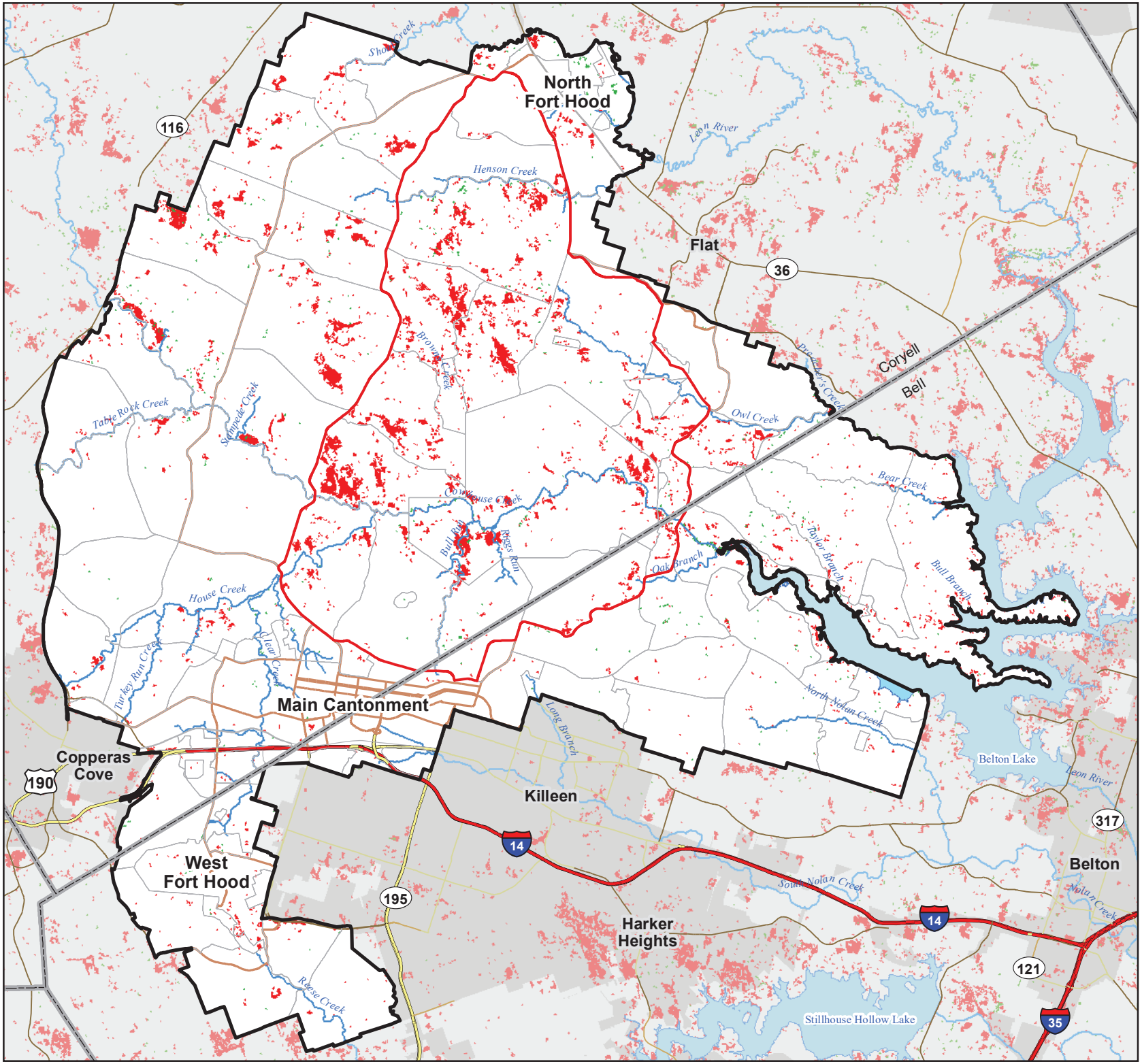
Program Management Units

All MUs (refer to **Figure 2-4**).

Monitoring

The Grazing Management Plan currently under development should include monitoring measures for rangeland vegetation. The ITAM RTLA program will continue to monitor training land conditions.

Figure 4-9. Forest Cover Change (2000-2016)



Additional Data Source: Hansen, M. C., P. V. Potapov, R. Moore, M. Hancher, S. A. Turubanova, A. Tyukavina, D. Thau, S. V. Stehman, S. J. Goetz, T. R. Loveland, A. Kommareddy, A. Egorov, L. Chini, C. O. Justice, and J. R. G. Townshend. 2013. "High-Resolution Global Maps of 21st-Century Forest Cover Change." Science 342 (15 November): 850–53. Data retrieved from: http://earthenginepartners.appspot.com/science-2013-global-forest/download_v1.4.html

4.10.2 Forest/Woodland Management

The Army forest management program is required to support and enhance the immediate and long-term military mission and to meet natural resources stewardship requirements set forth in AR 200-1. Army policy further stipulates that forest resources must be managed for multiple uses, using an ecosystem management approach to optimize the benefits to the installation's natural resources. Technical guidance indicates that installations should implement ecosystem management to support the military mission, while protecting endangered species and their habitat (FORSCOM 1997). Ecosystem management provides a framework for holistic management of the resource rather than focusing emphasis on a single aspect or activity such as commercial timber production or game species management. Fort Hood does not have a commercial timber harvest program.

Program Data Management

The primary focus of forest/woodland management at Fort Hood is to protect and enhance forest/woodland composition and structure to support a healthy ecosystem, protect endangered species habitat, and improve wildlife habitat. The NCRMB geographer manages and maintains GIS data for the program to include vegetation mapping and vegetation changes as a result of ITAM management projects. In addition, NCRMB maintains a database of prescribed burns which affect forest/woodland vegetation for the purposes of protection of golden-cheeked warbler habitat and maintenance of black-capped vireo habitat.

Program History

Oak wilt, a disease caused by the fungus *Ceratocystis fagacearum*, has been identified in the past as a concern on Fort Hood. The fungus is systemic, inhibiting the ability of the vascular system to move water and nutrients upward resulting in wilting of leaves, and ultimately causing the death of the tree. Oak wilt surveys were conducted in 2007 and 2008 on approximately 2,826 acres in Training Area 32, the BLORA, and Training Area 115. A total of 323 oaks were identified as definitely having oak wilt, 94 of which were Texas red oaks and 229 were Plateau live oaks. An additional 214 trees were identified as possibly having oak wilt. There are currently no active oak wilt treatment projects occurring on Fort Hood. Further oak wilt projects will occur as conditions dictate, as determined by NCRMB staff.

In 1997, Fort Hood's ITAM program implemented a Woody Species Management (WSM) program to support heavy maneuver training. In 2009, WSM was expanded to include a dismount thinning plan. In 2017, WSM now consists of thinning and removing Ashe juniper, mesquite, and selected hardwoods and dead vegetation. WSM opens the area to heavy and infantry maneuvers. Areas should be reseeded with a native seed mix, where determined appropriate by NCRMB, and when approved by NCRMB. Work is normally done through the Training Restricted Area Program (TRAP).

Current Condition

To determine if a sustainable forestry program could be established at Fort Hood, the USACE, Fort Worth District, conducted a market feasibility study in 2016 that addressed existing forest products currently found on the training areas. This included stockpiled mulch, tree trimmings, and wood products. The study concluded that there is no realized potential for a financially sustainable forestry program at Fort Hood. The research indicated there are two main forestry resources available at Fort Hood to include Ashe juniper trees used to produce juniper oil and fence

post/staves, as well as a stockpile of juniper/hardwood mulch. However, the current economic environment coupled with local market restrictions creates a situation in which competition among prospective buyers is difficult to achieve (USACE 2016).

An oak wilt monitoring program is needed on Fort Hood to monitor oak wilt effects, as it is unlikely that the disease will ever be eliminated from the ecosystem. Painting of wounds is a method recommended in urban landscapes to prevent insect infestation; however, this is not a practical treatment in the training areas. Another practice is trenching, which involves digging a 4 to 5 feet deep trench about 100 feet outside of infected areas. The objective of trenching is to sever the root masses; therefore, the trench can be immediately refilled. This practice controls the spread of wilt to healthy trees but is only a temporary solution and often proves extremely costly. Because of the size of the training lands, implementing this management approach on a large scale is expensive and impractical.

Although WSM concentrates on creating open spaces at the expense of forest land, it is important to note that Fort Hood must be committed to maintaining the diversity of all plant communities (e.g., forests, grasslands, shrublands) to maintain a sustainable ecosystem. The NCRMB has conducted studies that identify the boundaries of forest land, and where forests should be maintained. Coordination between NCRMB staff and ITAM staff should remain open so that vegetation clearing activities meet both NCRMB and ITAM goals. Examples include clearing juniper from post oak forests rather than red oak forests, and mulching shrubland back to early stages rather than clearing mature forests.

Program Goals and Objectives

The goal and objective for forest/woodland management at Fort Hood are provided in **Table 4-22**.

Table 4-22. Goals and Objectives for Forest/Woodland Management

Goals	Objectives
Protect and enhance forest/woodland composition and structure to support a health ecosystem, protect endangered species habitat, and improve wildlife habitat.	Evaluate potential negative impacts of oak wilt on woodlands. Implement a monitoring program to determine large-scale changes. Initiate control measures where and when necessary as determined by NCRMB staff.

Program Management Units

All MUs (refer to **Figure 2-4**).

Monitoring

Some forest and woodland management efforts are directed at protecting wildlife and endangered species habitat from oak wilt. The provisions prescribed by the 2015 BO (**Appendix B2**) include monitoring the distribution and spread of oak wilt centers and using appropriate measures to limit effects on endangered species, as determined by NCRMB staff. Any future control measures implemented to control oak wilt will be monitored to evaluate their effectiveness in minimizing the impacts on surrounding trees, as well as the cost-effectiveness of implementing these measures installation-wide. Efforts will be to monitor

locations of currently known oak wilt centers and identification of new oak wilt centers on a large scale.

4.10.3 Wildland Fire Management

Wildfire prevention and suppression is a matter of concern for military training and natural resources management at Fort Hood. Wildfires have several undesirable aspects: they interfere with ongoing training activities, they can make training areas unsuitable for training over the short term, and they have direct and indirect impacts on habitats and species. Past wildfires have caused substantial damage to the habitat of the golden-cheeked warbler, as well as damage to training facilities. From an ecological standpoint, there are positive aspects to wildfires provided the fuel loads are not excessive, such as returning nutrients to the soil, releasing the seeds of fire-dependent plant species, increasing diversity, and causing an overall revitalization of habitat. Prior to European settlement, wildfires were common in this region and helped to maintain the ecological balance between grasslands and forest and shrub communities. Prescribed fire can be a useful tool for maintaining healthy vegetation communities, and it also benefits birds of early successional habitats such as the black-capped vireo.

For many years, Army guidance has focused strictly on the suppression of wildfires. Wildfire prevention and suppression involve minimizing fire occurrence by educating personnel and residents of Fort Hood on fire prevention techniques, reducing natural fire fuels, restricting the types of ammunition and pyrotechnics that can be used based on the level of fire danger, being well prepared for fires, and, when necessary, rapidly suppressing and containing the spread of wildfires that do occur.

Program Data Management

Fort Hood has an approved Integrated Wildland Fire Management Plan. In addition, NCRMB maintains a database of prescribed burns which affect forest/woodland vegetation for the purposes of protection of golden-cheeked warbler habitat and maintenance of black-capped vireo habitat.

Program History

Prescribed burns have been used as a land management tool on Fort Hood since the 1970's. Over the past nine years, National Wildfire Coordinating Group (NWCG) certified staff members have assisted the NCRMB in conducting from 7,500 to 37,000 hectares of prescribed burns per year. The Fort Hood prescribed burning program was implemented to help accomplish several objectives. Prescribed burns are used to reduce fuel loads that would otherwise create a potential for wildfires that might destroy golden-cheeked warbler habitat. Such wildfires also create a significant risk for loss of training time for the Army because affected military ranges are placed in cease-fire status. In 2006, ranges had to be shut down for a total of nearly 2,800 hours solely due to wildfires. Other objectives of the prescribed burning program are the management of black- capped vireo habitat, prevention of Ashe juniper encroachment into grasslands, and the maintenance of post oak woodlands' open character. All karst features are protected and excluded from prescribed burns.

Prescribed fires were originally planned and led by NCRMB staff and conducted with the assistance of contracted personnel and equipment. In addition, the local fire department was under

contract during the fire season to stand by with additional equipment in case of escapes and to help with mop-up.

Current Condition

Prescribed burning is an appropriate management tool that is used year-round at Fort Hood in grasslands (when weather and fuel conditions allow) to keep natural succession in early-seral stages, burn dead debris, increase herbage yields, increase the availability of forage, and improve wildlife habitat. Prescribed burning is also used to manipulate habitat for the black-capped vireo, improve open space for military training, and reduce fuel loads to prevent wildfires.

Prescribed burning is controlled by the DES and is conducted by qualified personnel from both DES and NCRMB. The number of acres treated each season depends on weather conditions and the availability of areas not occupied for training. Areas are treated based on desired fire return residuals, which vary based on vegetation community types and management objectives. Areas overgrazed by cattle and heavily used for training require a longer cycle because of the reduced fuel load necessary to achieve positive results.

Most wildfires begin in the LFA. Uncontrolled wildfires are not only potentially detrimental to natural resources and to military training, but they can also threaten areas outside the installation if they cross the boundary. Wildfires occurring during dry periods seriously damage herbaceous plant species and can have a major negative impact on mammals, reptiles, and avian species.

Fort Hood uses a fire danger rating system to alert trainers when pyrotechnic operation should be limited or halted. The system is based on current (daily) weather and the estimated moisture content of vegetation and soil. Details of this rating system can be found in OPLAN 8-93, "Operation Brush Fire" and Fort Hood Regulation 350-40. The fire ratings are as follows:

- Condition Green – No restrictions on training. Troops may use pyrotechnics and incendiary munitions for training.
- Condition Amber – Caution must be taken in the use of pyrotechnics. Aerial flares are not to be used outside the impact area. Other pyrotechnics are to be used only in roadways, on tank trails, in areas clear of vegetation, or in containers.
- Condition Red – No pyrotechnics or incendiary munitions are authorized for training purposes.
- Condition Red with Waiver – Once a risk assessment is conducted by Range Operations Branch and the recommendation for training with waiver is approved by the Director, Range Operations Branch, specific restrictions are imposed on training units.

Under all fire condition ratings, fires are reported to Range Operations Branch by military units or installation personnel. If the fires are within range fans where live-fire training is being conducted, units must cease firing until a fire risk assessment is conducted or control measures are implemented. Range Operations Branch determines the location of the fire and risk to facilities, personnel, or sensitive resources such as endangered species habitat. If Range

Operations Branch determines there is no risk to facilities or habitats, the fire is allowed to burn. Typical examples are fires occurring in the permanently dudded impact area 94, where fires are extremely frequent and fuel loads are low.

As part of the ESMC, Fort Hood established a "let burn" policy for range fires that occur during periods when Fire Danger Rating is Green or Amber. Under Green and Amber ratings, fires will be allowed to burn in all habitat areas within the LFA unless there is obvious threat to personnel or facilities or until changing environmental conditions warrant implementing increased fire control procedures. This "let burn" policy was carried over in the 2010 and the 2015 BOs. The purpose of this modification is to reduce interruption of ongoing live-fire training exercises.

Under this modified procedure, Fort Hood will emphasize the use of annual preventive prescribed fire to maintain buffers near habitat areas in the LFA to enhance training capabilities. Fort Hood will employ firebreaks in association with endangered species habitat to reduce fire risk.

Prescribed fire was applied to 11,279 acres between October 1, 2015 and January 31, 2018. Prescribed fire in support of golden-cheeked warbler management is primarily for hazard reduction, hardwood recruitment, juniper reduction and is usually conducted in areas adjacent to or near habitat.

All prescribed burning occurring during the MBTA nesting season will be reviewed by the NCRMB and will be approved on a case by case basis. Brush pile burning during or mulching during the MBTA season will require nests checks.

Program Goals and Objectives

DES and NCRMB staff plan to increase prescribed burning to improve the ecological condition of the training areas. The goals and objectives (**Table 4-23**) reflect a let-burn policy designed to reduce fuel loads and minimize interruptions of live-fire training exercises, while preserving endangered species habitat and protecting human health and facilities on and off the installation.

Table 4-23. Goals and Objectives for Wildland Fire Management

Goals	Objectives
Protect human life and prevent damage to land and natural resources caused by fire.	Continue the let-burn policy to minimize fuel loads; however, prevent unacceptable damage to natural resources and interference with training, and protect health and safety of personnel. Purchase fire suppression equipment and train personnel, on an as-needed basis. Support DES in suppressing wildfires as the mission requires.

Goals	Objectives
Maintain firebreaks and construct new ones as needed to contain fires originating in the LFA and reduce the risk of fire damage to critical facilities, training activities, and endangered species habitat.	Construct and maintain firebreaks inside of and adjacent to endangered species habitat as required by the ESMC. DPW Maintenance/DPTMS Objectives Maintain the road network in the LFA to provide some fire containment function. Maintain a 25-foot-wide bladed earth firebreak around the Fort Hood boundary, within constraints of erosion control BMP's. Minimize erosion on firebreaks. Maintain a firebreak around critical facilities such as fuel storage areas by controlling the vegetation by mechanical means and herbicides where necessary.
Implement prescribed burning activities to control shrubs and trees, increase availability of forage and improve wildlife habitat, manipulate habitat for the delisted black-capped vireo, improve open space for military training, and reduce fuel loads to reduce the risk of wildfire.	Conduct prescribed burning year-round, as conditions allow, to minimize potential harm to endangered species habitat from training-related fires. The number of acres burned each season will depend on weather conditions and training schedules. Conduct fires in black-capped vireo habitat to maintain patchy habitat structure and to limit the encroachment of juniper and other large trees. Investigate the use of prescribed fires in ecotone boundaries to protect golden-cheeked warbler habitat from catastrophic fires. Conduct prescribed fires (as training schedules and weather conditions allow) to treat grasslands, depending on conditions, burning approximately one fifth of appropriate grasslands on the installation per year. Burning the grasslands will limit woody encroachment on endangered species habitat. Train personnel with S-130 and S-190 basic fire suppression classes, as well as intermediate and advanced fire-fighting techniques as necessary. All personnel serving on the prescribed fire crew must maintain fitness conditions appropriate to their assigned roles, up to and including Red Card certification, and be tested at least annually.
Maintain strategically located installation ponds and create new	Remove vegetation from dam structures to ensure integrity and provide clear flight path for aircraft.
ones as water sources to support aerial firefighting.	Remove accumulated sediment to create sufficient depth for bambi bucket operations. Construct new dams, or maintain existing resources, in areas where limited appropriate water resources exist adjacent to high frequency wildfire areas. Construction of new dams requires coordination and approval through multiple organizations on the installation.

Goals	Objectives
Document wildland fire occurrences.	Map prescribed fires and wildfires promptly using aerial and ground survey methods. Analyze historical occurrences to optimize prescribed fire planning and operations. Continue using the GIS-based prescribed fire prioritization model to aid in prescribed fire planning.

Program Management Units

All MUs (refer to **Figure 2-4**).

Monitoring

To minimize the potential impacts of fires on endangered species habitat, and in accordance with provisions listed in the 2015 BO, Fort Hood will assess the effects of fire on endangered species habitat and will report habitat loss due to wildfire to the USFWS. Fort Hood will also implement minimization measures as outlined in the 2015 BO which will reduce the potential incidence and effect of wildfires to Federally-listed species and their habitat.

4.10.4 Grounds Maintenance

Grounds maintenance and landscaping includes considerations for weed control and urban forestry. It is Army policy that environmentally and economically beneficial landscaping practices be used. These practices are outlined in a Presidential Memorandum dated 26 April 1994. The Presidential Memorandum directs Federal agencies to use landscaping techniques that enhance the local environment and minimize the adverse effects on the environment. The Presidential Memorandum stresses use of regionally native plants and practices that conserve water and prevent pollution. Integrated measures include reducing the use of fertilizers, pesticides, and water use for both economic and environmental benefits.

Program Data Management

Grounds Maintenance is the responsibility of several entities at Fort Hood. DPW – Engineering is responsible for overall landscape planning and development. DPW – Maintenance (Roads & Grounds) is responsible for general grounds improvement and landscaping maintenance. Grounds maintenance services are normally contracted to a commercial enterprise that provides services such as mowing, trimming, edging, irrigation, weed removal, and fertilization. The primarily role of the ENV is to provide technical advice when requested.

Program History

Fort Hood issued a Memorandum of Instruction (MOI) in June 2012 titled "Landscaping on Fort Hood" which established procedures which would allow areas to be landscaped with vegetation native to the Fort Hood region. In addition, Fort Hood also has a Tree Care Ordinance which established a Tree Board (see next section for more information). Copies of these documents are included in **Appendix B4** and **B5**.

Current Condition

As of January 2018, there were approximately 4,274 acres of maintained lands (*i.e.* mowed, landscaped) and that acreage will increase as construction continues and natural areas are converted into buildings, parking lots, yards, etc.

Natural vegetation is retained whenever possible and incorporated into landscaping designs. When landscaping or re-vegetation is required, native vegetation should always be selected if possible. These are plants already adapted to the area and should require the least amount of maintenance. Fort Hood's MOI "Landscaping on Fort Hood" includes a complete list of plants that can be used. Those identified as native species are included in **Table 4-24**. Any species not listed in **Table 4-24** must be approved by the Fort Hood Agronomist prior to planting.

Table 4-24. Native Plant List for Landscaping on Fort Hood

Common Name	Scientific Name
Large Trees	
anacua	*Ehretia anacua*
bald cypress	*Taxodium distichum*
big-tooth maple	*Acer grandidentatum*
black walnut	*Juglans nigra*
bur oak	*Quercus macrocarpa*
cedar elm	*Ulmus crassifolia*
Chinquapin oak	*Quercus muehlenbergii*
escarpment black cherry	*Prunus serotine var. eximia*
lacey oak	*Quercus laceyi*
Monterrey oak	*Quercus polymorpha*
pecan	*Carya illinoenensis*
plateau live oak	*Quercus fusiform*
Shumard oak	*Quercus shumardii*
Texas red oak	*Quercus buckleyi*
Texas white ash	*Fraxinus texensis*
Small Trees	
Anacacho orchid tree	*Bauhinia lunaroides*
Blanco crabapple	*Pyrus ioensis var. texana*
Carolina buckthorn	*Rhamnus caroliniana*
Desert willow	*Chilopsis linearis*
Eve's necklace	*Styphnolobium affine*
little walnut	*Juglans microcarpa*
Mexican plum	*Prunus Mexicana*
Prairie flame-leaf sumac	*Rhus lanceolate*
rusty blackhaw viburnum	*Viburnum rufidulum*
Smoketree	*Cotinus obovatus*
Texas persimmon	*Diospyrus texana*
Texas redbud	*Cercis canadensis var. texensis*
Tall Shrubs	
Bee-brush	*Aloysia gratissima*
Cenizo	*Leucophyllum frutescens*
deciduous holly	*Ilex decidua*
dwarf wax myrtle	*Myrica pusilla*
evergreen sumac	*Rhus virens*
goldenball leadtree	*Leucaena retusa*
false indigo	*Amorpha fruticose*

Common Name	Scientific Name
Mexican buckeye	*Ungnadia speciose*
prickly ash	*Zanthoxylum hirsutum*
roughleaf dogwood	*Comus drummondii*
silktassel	*Gava ovata var. lindheimeri*
Texas kidneywood	*Eysenhardtia texana*
Texas mock orange	*Philadelphus texensis*
Texas mountain laurel	*Sophora secundiflora*
Texas pistache	*Pistacia texana*
wafer-ash	*Ptelea trifoliate*
wax myrtle	*Myrica cerifera*
witch hazel	*Hamamelis virginiana*
yaupon holly	*Ilex vomitoria*
Low Shrubs	
American beautyberry	*Calicarpa americana*
Agarita	*Berberis trifoliate*
black dalea	*Daleo frutescens*
butterfly bush	*Buddleia marrubilifolia*
buttonbush	*Cephalanthus occidentalis*
chili pequin	*Capsicum annuum*
elbowbush	*Forestiera pubescens*
flame acanthus	*Anisicanthus quadrifidus*
fragrant mimosa	*Mimosa borealis*
Gregg dalea	*Dalea greggii*
Gregg sage	*Salvia greggii*
Mexican oregano	*Poliomentha longiflora*
mountain sage	*Salvia regla*
shrubby blue sage	*Salvia ballotiflora*
shrubby boneset	*Ageratina havanensis*
skeleton-leaf goldeney	*Viguiera stenoloba*
skunkbush	*Rhus trilobata*
Texas lantana	*Lantana urticoides*
turk's cap	*Malvaviscus arboreus var. drummondii*
yaupon holly	*Ilex vomitoria*
Zexmenia	*Wedelia texana*
Vines	
Carolina jessamine	*Gelsemium sempervirens*
coral honeysuckle	*Lonicera sempervirens*
crossvine	*Bignonia capreolata*
Lindheimer's morning glory	*Ipomoea lindheimeri*
purple leather flower	*Clematis pitcheri*
trumpet creeper	*Campsis radicans*
Virginia creeper	*Parthenocissus quinquefolia*
white bush honeysuckle	*Lonicera albiflora*
Xerophytes	
devil's shoestring	*Nolina lindheimeriana*
Lechuguilla	*Agave lechuguilla*
pale-leaf yucca	*Yucca pallida*
red yucca	*Hesparaloe parvilfora*
Spanish dagger	*Yucca treculeana*
spice lily	*Manfreda maculosa*
Texas sacahuista	*Nolina texana*
Texas sotol	*Dasylirion texanum*

Common Name	Scientific Name
twist-leaf yucca	*Yucca rupicola*
Perennial Flowers	
aromatic aster	*Aster oblongifolius*
big red sage	*Salvia penstemonoides*
blackfoot daisy	*Melampodium leucanthum*
bushy skullcap	*Scutellaria wrightii*
butterflyweed	*Asclepias tuberosa*
canyon sage	*Salvia lycoides*
cedar sage	*Salvia roemariana*
chocolate daisy	*Berlandiera lyrata*
crimson-eyed rosemallow	*Hibiscus moschuetos*
Damianita	*Chrysactinia mexicana*
Engelmann daisy	*Engelmannia pinnatifida*
fall obedient plant	*Physostegia virginiana*
fluttermill	*Oenothera missouriensis*
frogfruit	*Phyla nodiflora*
gaura	*Gaura lindheimeri*
gayfeather	*Liatris mucronata*
giant blue sage	*Salvia azurea*
goldenrod	*Solidago canadensis*
heath aster	*Aster ericoides*
mealy sage	*Salvia farinacea*
Missouri violet	*Viola missouriensis*
pigeonberry	*Rivina humilis*
pink skullcap	*Scutellaria suffretescens*
ponyfoot	*Dichondra carolinensis*
prairie larkspur	*Delphinium carolinianum*
prostrate lawnflower	*Calyptocarpus vialis*
purple cone-flower	*Echinacea angustifolia*
rain lily	*Cooperia pedunculata*
red columbine	*Aquilegia canadensis*
rock penstemon	*Penstemon baccharifolius*
scarlet penstemon	*Penstemon triflorus*
silver ponyfoot	*Dichondra argentea*
snakeherb	*Dyschoriste linearis*
standing cypress	*Ipomopsis rubra*
sword leaf blue-eyed grass	*Sisyrinchium chilense*
Texas betony	*Stachys coccinea*
Texas rock rose	*Pavonia lasiopetala*
Texas star hibiscus	*Hibiscus coccineus*
tropical sage	*Salvia coccinea*
white avens	*Geum canadense*
wild fox-glove	*Pentemon cobaea*
winecup	*Callirhoe involucrate*
wood-fern	*Thylpteris kunthii*
woolly ironweed	*Vernonia lindheimeri*
woolly stemodia	*Stemodia lanata*
Ornamental Grasses	
big bluestem	*Andropogon gerardii*
big muhly	*Muhlenbergia capilaris*
bull muhly	*Muhlenbergia emersleyi*
bushy bluestem	*Andropogon glomeratus*

Common Name	Scientific Name
Indian grass	*Sorghastrum nutans*
inland sea oats	*Chasmanthium latifolium*
Lindheimer's muhly	*Muhlenbergia lindheimeri*
little bluestem	*Schizachyrium scoparium*
Mexican feathergrass	*Stipa tenuissima*
pine muhly	*Muhlenbergia dubia*
sideoats grama	*Bouteloua curtipendula*
switchgrass	*Panicum virgatum*
Turf Grasses	
blue grama	*Boutelous gracilis*
buffalograss	*Buchloe dactyloides*
Curly mesquite	*Hilaria belangeri*

If non-native species must be planted for some reason, they must be non-invasive. Likewise, when any kind of ground disturbance occurs on the installation, the bare ground should be reseeded with certified weed-free native vegetation. AR 200-1, Section 4.3.10.d.(10)(d) states that invasive species are not to be used in installation landscaping in accordance with Executive Order 13112 Invasive Species.

Fort Hood's Tree Care Ordinance established a Tree Board which is composed of representatives from NCRMB, DPW – Maintenance Division (Roads and Grounds), DPW – Engineering and Services Division, III Corps and the Fort Hood Environmental Law Attorney, Fort Hood Family Housing, the Courses of Clear Creek, BLORA, the Sportsmen's Center, Killeen independent School District, and Central Texas College. The purpose of the Tree Board is to provide the preservation, protection, replacement, proper planting, and proper maintenance of trees located within the cantonment areas of Fort Hood.

The Tree Care Ordinance established a tree removal and replacement policy. All native hardwood trees should be preserved and protected, which is preferred over replacement. If removal of a tree becomes necessary, each tree that is removed must be replaced at required ratios. A 10:1 ratio is required for heritage trees and native hardwood trees with a diameter breast height (DBH) greater than 3 inches, and a 1:1 ratio is required for a landscaping tree planted by or for Fort Hood with a DBH less than 3 inches. Dead or diseased trees not under contract that are a hazard to life or property should be removed and replaced at a ratio of 1:1. Replacement trees must also be maintained (including watering) for one year after planting. Any replacement tree that dies within one year of the planting date must be replaced and maintained for another year. Species of trees for new plantings and replacements must be selected from the species listed in the Installation Design Guide or in the MOI "Landscaping Unit Areas". Any species not found in the approved plant list cannot be planted on Fort Hood without the expressed permission of the Fort Hood Tree Board.

The Tree Care Ordinance also outlines specific exemptions to the replacement policy. These include:

- Trees can be removed within 10 feet of existing Fort Hood utility easements/corridors and replaced at a 1:1 ratio with small landscaping trees/shrubs where applicable as determined by DPW.

- Trees may be removed within the 30-foot clear zone of the cantonment outer perimeter fence as a force protection measure, except for trees which must be retained "for erosion control, passive defense, or for legal reasons". Trees removed in this clear zone are not subject to the tree replacement policy.
- Tree removal as required by Federal Aviation Administration regulations are exempt from the tree replacement policy.

The endangered golden-cheeked warbler does not tend to occur in the immediate vicinity of developed areas. However, persons should coordinate with the NRCMB staff prior to tree/brush trimming and removal during the breeding season of all birds to ensure that they do not remove limbs/trees that support active bird nests. Pesticide application must be coordinated with the DPW Installation Pest Management Coordinator (IPMC). Mowing the tall grasses around the runways tends to attract birds that can become a Wildlife Air Strike Hazard (WASH). This circumstance requires that special planning be done so that WASH hazards are kept at a minimum.

Program Goals and Objectives

The following are grounds maintenance and landscaping goals and objectives.

Table 4-25. Goals and Objectives for Grounds Maintenance

Goals	Objectives
Maintain an aesthetically pleasing cantonment landscape that conserves natural ecosystem functions as feasible.	Ensure that grounds maintenance and landscaping operations are consistent with natural resources goals and objectives. Support DPW in making the best use of existing native trees; conserving floodplains, drainages, and topography; and enhancing aesthetic and structural standards fitting to the area. Provide professional advice to assist the grounds landscaping and maintenance program toward the use of native species. Always discourage the use of invasive, exotic plants.

Program Management Units

Maintained grounds of Fort Hood.

Monitoring

NCRMB will work closely with DPW on maintenance and landscaping operations throughout the installation and will continue to occupy a position on the Tree Board.

4.10.5 Agricultural Leases

One of the most significant natural resources management issues at Fort Hood is the leasing of training land for livestock (cattle) grazing.

Program Data Management

As part of the planning process for the original INRMP, the NRCS conducted a detailed inventory and evaluation of the training areas (NRCS 2002). The purpose of the study was to

determine the general ecological health of the training areas, as well as the stocking rates of individual training areas and management areas, and to recommend changes to protect and restore the ecological health of the training areas.

The stocking rate for each lease period is the number of animal units (AU) that are allowed to graze on a particular Grazing Management Unit (GMU). Animal unit equivalents were developed to standardize AUs among the various kinds and class of bovines. **Table 4-26** presents the AU equivalents used by Fort Hood.

Table 4-26. Animal Unit Equivalents

Kinds/Classes of Bovine	Animal Unit Equivalent
Cow, dry	0.92
Cow, with calf	1.00
Bull, mature	1.35
Cattle, 1 year old	0.60
Cattle, 2 years old	0.80

Stocking rates are based on a stocking rate calculation methodology for each GMU based on the ecological health and trend of the unit, and the potential for soil erosion. Forage will be made available for grazing to the extent practicable, while maintaining the ecological health and hydrological condition of the sites and providing the flexibility to modify stocking rates should the ecological health, trend, or erosion at a GMU improve or decline. The stocking rate calculations methodologies are listed below:

- Conservation Threshold – This approach sets a management objective of maintaining 1,000 lbs/acre of forage residue after grazing.
- Maintenance Threshold – This approach sets a management objective of maintaining 750 lbs/acre of forage residue after grazing.
- 25 Percent Harvest Efficiency – This approach is based on the premise that 50 percent of the forage on a site should be left un-grazed to provide cover for the soils and keep the vegetation healthy. The other 50 percent is made available to the grazing animal, but only half of that (25 percent of the total) is consumed by the animal. The other 25 percent is lost during the act of grazing by the animal and is returned to the soil as litter, trampled, or consumed by insects. Thus, only 25 percent of the forage will be consumed by livestock.

The lease area is inventoried each year in spring to determine the allowable stocking rate for the next year to keep grazing animals in balance with available forage. The forage inventory contractor reports estimated forage production in each GMU to NCRMB; NCRMB incorporates land management requirements such as prescribed burning and the need for grazing deferments to support land rehabilitation efforts and determines appropriate stocking rates by GMU. The current stocking rates for each GMU are listed in **Table 4-27**.

Table 4-27. Stocking Rates and Calculations for each Fort Hood GMU

GMU	Grazeable Acres	Animal Units
Eastern Training Area – North	29,182	207
Eastern Training Area – South	22,614	147
Live-Fire and Impact Area	60,500	750
North Fort Hood	3,798	(swing space)
West Fort Hood	3,856	73
West Fort Hood - Northeast	1,468	(swing space)
West Fort Hood – South	9,363	109
Western Maneuver Area – North	35,045	320
Western Maneuver Area – South	32,108	394
TOTAL		**2,000**

On April 8, 2005, the Department of the Army executed a new lease agreement with the CTCA for the purposes of grazing cattle on the training lands at Fort Hood. As part of the lease agreement, the cattlemen must abide by the provisions in the Land Use Regulations (LUR), included as Exhibit B in the Lease Agreement. The purpose of the LUR is to ensure that all grazing activities are conducted in a manner consistent with national policy intended to do the following:

- Provide for multiple uses of the premises (Fort Hood) for military purposes, wildlife habitat, public recreation, water conservation, and domestic livestock grazing
- Preserve, sustain, and enhance the natural resources of the premises (Fort Hood)

In 2015, a new 5-year lease agreement was signed (see **Appendix B6**), and Fort Hood is currently in the process of preparing a Grazing Management Plan which will allow for a sliding scale of the number of AUs based on yearly evaluations. Updated information on the Grazing Management Plan and data will be available in the next INRMP update.

Program History

The installation has one outlease for cattle grazing. When Fort Hood was established by condemning private lands, the Federal government granted landowners fair market value for the land and a 5-year lease for grazing. The affected landowners formed the CTCA, and the lease to the CTCA has been renewed continuously since its first issuance. The CTCA administers the leasing of the land by the cattlemen, and the leases run for a period of 5 years. Prior to the renewal of a lease, Fort Hood evaluates the conditions of the training lands to determine the level of grazing that can occur without degrading the training lands, impeding the military mission, and endangering the long-term sustainability of Fort Hood's resources.

Fort Hood allows grazing on approximately 197,000 acres of its 218,823 acres. Excluded from the leased acreage are the cantonment areas (NFH, West Fort Hood, and main) and the DOL area west of the main cantonment area. **Figure 4-10** shows the locations of the GMUs on Fort Hood.

Figure 4-10. Grazing Management Units

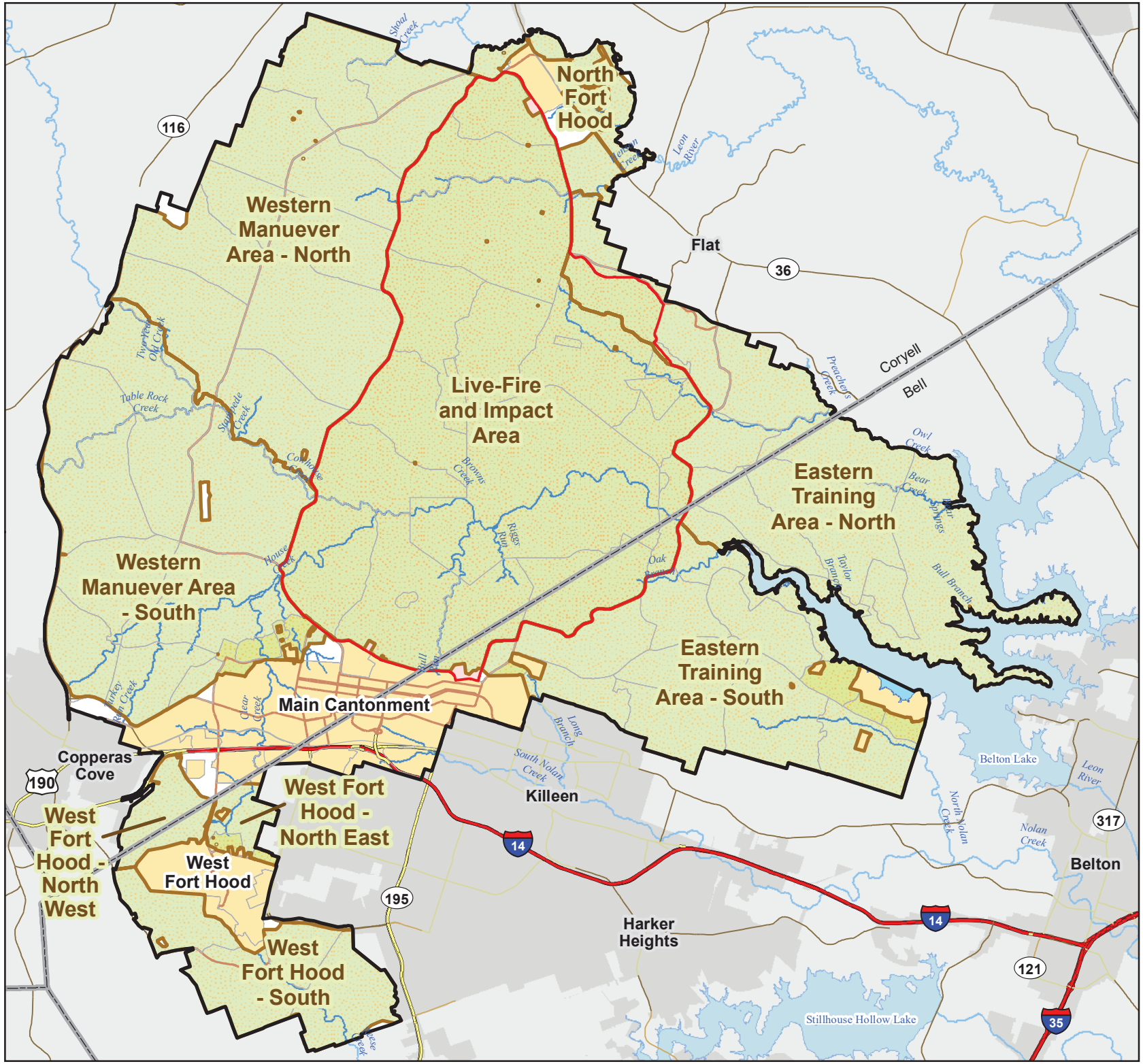


Table 4-28 lists the major grazing management areas, the training areas each management area comprises, and the number of acres in each management unit.

Table 4-28. Grazing Management Units by Training Areas and Acreage

Grazing Management Unit	Training Areas	Acreage
Eastern Training Area – North	8 (partial), 14, 15, 16, 20, 21, 22, 23, 24, 25, BLORA	29,182
Eastern Training Area – South	8 (partial), 30, 31, 32, 33, 34, 35, 36, 112	22,614
Live-Fire and Impact Area	80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93,	60,500
North Fort Hood	10, 11, 12, 13	3,798
West Fort Hood – North	70, 71	5,324
West Fort Hood – South	72, 73, 74, 75	9,363
Western Maneuver Area – North	50, 51, 52, 53, 60, 61, 62, 63, 64, 65, 66	35,045
Western Maneuver Area – South	40, 41, 42, 43, 44, 45, 46, 47, 48	32,108
TOTAL LEASED ACRES		**197,934**

Current Condition

Large portions of the training areas have been subject to excessive sheet and gully erosion in the past. The resulting sediment is detrimental to receiving streams. However, efforts to minimize sedimentation by DPTMS have shown considerable progress. The implementation of MAS has contributed to slowing erosion across the landscape.

An EA of the renewal of the grazing lease noted that ecological conditions at Fort Hood have worsened since the inception of the original grazing lease, and that cattle grazing has the potential to contribute to poor ecological conditions. A Supplemental EA addressed these potential environmental impacts and evaluated several new alternative management actions. A plan to address the erosion problem includes establishing a livestock rotation grazing program.

Program Goals and Objectives

The primary goal of the grazing program at Fort Hood is to permit cattle grazing while ensuring the long-term sustainability of the training lands and unimpeded military training. The goals and objectives of the program are provided in **Table 4-29**.

Table 4-29. Goals and Objectives for Agricultural Leases (Grazing)

Goals	Objectives
Allow cattle grazing to the extent that impacts on training, training lands, and natural resources can be maintained at acceptable levels.	Implement the stocking rate formulas defined in the Supplemental Grazing Environmental Assessment and the approved grazing management plan.
Develop a long-term plan for grazing management.	Develop and implement a Grazing Management Plan.

Goals	Objectives
Evaluate new methodologies for calculating cattle stocking rates.	A predictive forage response model is currently in development by Texas A&M University's Ranching Systems Group that shows promise to assess and predict forage response and fire risk to emerging conditions. Use of this model, if validated and approved by the Department of the Army, is proposed by Texas A&M to be integrated with a multiple model system for assessing and predicting Fire behavior, erosion and forage to assist Fort Hood with land management decisions where cattle grazing coincides with the military training mission. While the model(s) shows merit, a key component of its validated accuracy will be the system's capability to assess and predict forage loss throughout the year due to Fort Hood's military training mission and fluctuating military traffic intensity.
Monitor lessee performance.	Develop a lease surveillance plan to monitor the lessee's performance of work requirements. Design and implement enforceable provisions to ensure that the lessees comply with the stocking rates authorized by the lease.

Program Management Units

The GMUs of Fort Hood are shown on **Figure 4-10**.

Monitoring

Fort Hood is in the process of preparing a Grazing Management Plan (which will be incorporated into **Appendix B** once completed) that will integrate the management of cattle grazing with Fort Hood's mission and environmental stewardship responsibilities. Monitoring measures are being built into the Grazing Management Plan to ensure that grazing at current levels is not jeopardizing the long-term sustainability of the training lands, resulting in irreparable harm to the natural resources, including increased erosion rates, sedimentation in the water bodies, and changes in the character of the rangeland vegetation.

Previous monitoring efforts to evaluate compliance with lease provisions have had limited success. Containment of cattle to designated grazing/training areas is naturally difficult without fencing. A more robust monitoring program must be implemented to ensure compliance and to avoid degradation of the training lands. A lease surveillance plan detailing compliance and monitoring measures could be developed for incorporation into future lease agreements and land use regulations. The lease surveillance plan would identify the lease provisions to be monitored and the way compliance or noncompliance will be determined, documented, and reported.

Measures that could be incorporated into the lease surveillance plan could include the following:

- Identification, counting, and reporting of cattle that interfere with or interrupt training exercises.
- Penalties for repeat offenders should be implemented and enforced.
- Random aerial surveys to monitor cattle locations and numbers. Surveys would be conducted concurrent with other aerial support operations.

The implementation of compliance monitoring would help ensure the protection of Fort Hood's natural resources, minimize environmental damage and degradation, and protect endangered

species habitat. Monitoring and compliance provisions could be incorporated into future grazing leases and land use regulations. Penalties for noncompliance could be established and incorporated into the LUR.

4.11 Integrated Pest Management

The definition of Integrated Pest Management (IPM) is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks. IPM is an effective and environmentally sensitive approach to pest management that relies on education and the implementation of safe and effective practices that minimize risks from pesticides to human health and the environment. IPM programs provide education and use current comprehensive information on the life cycles of pests and their interaction with the environment. IPM takes advantage of all appropriate pest management options including, but not limited to, the judicious use of pesticides.

Program Data Management

In accordance with the AR 200-1 and DoD Instruction 4150.07, DoD Pest Management Program (May 29, 2008), the Army must prepare an Integrated Pest Management Plan (IPMP), which is the framework through which pest management is defined and accomplished by Fort Hood. The IPMP defines and describes essential elements of the pest management program, such as health and environmental safety, installation pests (both arthropods and vertebrates), control procedures, and pesticide storage, transportation, use, and disposal. The Plan is used as a tool to maximize the use of integrated pest management by reducing unnecessary pesticide use, enhancing environmental protection, and maximizing the use of effective target specific reduced risks pesticides and non- chemical techniques. In addition, the Plan provides guidance for the judicious use of both chemical and nonchemical control techniques to achieve effective pest management with minimal environmental contamination. Adherence to the Plan ensures effective, economical, and environmentally acceptable pest management and compliance with pertinent laws and regulations. Fort Hood's IPMP was approved and signed in May 2016. A copy of the IPMP can be found in **Appendix B7** of this document.

Program History

Most pest-related control activities are the responsibility of the DPW. Pest-related activities include: control of potential disease vectors and public health pests (mosquitoes; rodents; ticks; black widow spiders; fire ants; honeybees, hornets, yellow jackets, and wasps; scorpions; snakes; skunks, raccoons, foxes, coyotes, and bats; birds; bed bugs, swallow bugs, and bird mite; and poison ivy, poison oak, and poison sumac); quarantine pests (fire ants and Zebra mussel); real property pests (termites, birds, bats, squirrel and rodents), stored food product pests; noxious and invasive plants; ornamental plants and turf pests; undesirable vegetation; animal pests (squirrels, rodents, armadillos, stray dogs and cats, beaver, nutria, coyotes, deer, wild pigs, and undesirable fish); and household and nuisance pests (rodents, ants, cockroaches, and spiders). The DPW Installation Pest Management Coordinator (IPMC) oversees the installation pest management program and updates the IPMP, monitors all pesticide usage on the installation (including aerial validation plans), and conducts pest control management activities.

Pest management personnel must follow the IPMP and all applicable Federal and State laws and DoD regulations. Before any pesticides are applied, the presence of pest must be determined, and the most effective, safe, and least chemical control procedures be implemented. Non-chemical control efforts will be used to the maximum extent possible. All chemicals used on Fort Hood must be current USEPA approved and registered for use in the State of Texas. Fort Hood employees who apply or oversee the application of pesticides are DoD-certified, and contract personnel should be State certified applicators in the category of work being performed. At no time will pest management operations be done in a manner that may cause harm to personnel or the environment.

Current Condition

DPW – ENV assists in development of the IPMP; ensures consistency of all pest management activities with this INRMP; and compliance with all appropriate environmental regulatory requirements.

The NCRMB has staff that are involved in the performance of numerous pest related control activities. NCRMB personnel perform wildlife control operations throughout the installation. Most of these activities are in areas outside of the main cantonment. Examples of pests they are responsible to control include wild pigs and brown-headed cowbirds. Deer, coyotes, and beaver may also need control on a case-by-case basis. Staff includes one pig trapper, one seasonal cowbird trapper, two wildlife biologists with DoD pesticide applicator training and certification (work mainly in aquatic management outside of cantonment), and two entomologists (one is appointed IMPC that maintains DoD pesticide applicator status in EPA categories 2,3,5,6.7,8 and is IPMC trained and certified. The other maintains the TDA certified applicator status in Category 3A and is DoD IPMC certified). Entomologists provide oversight of pest control practices; editorial review of installation plans, projects, and contracts; perform pest assessments, surveys, and special projects; and provide education and guidance, for implementation of self-help control procedures. Most of the entomology activities and responsibilities are connected to pest management functions in the main cantonment.

Program Goals and Objectives

Pest management practices are accomplished with the coordination of other programs to follow environmental regulations and BMPs. The goal of the pest management program is to protect human health and suppress or prevent damage to real estate and natural resources caused by pests. The objective of the pest management program is to use integrated pest management techniques to eliminate, suppress, or control pests using the judicious use of both chemical and nonchemical control techniques. **Table 4-30** provides a list of the goals and objectives.

Table 4-30. Goals and Objectives for Pest Management

Goals	Objectives
Protect human health and suppress or prevent damage to real estate and natural resources caused by	Use integrated pest management techniques to eliminate, suppress, or control pests with the judicious use of both chemical and nonchemical control techniques.
Provide oversight of installation pest management in accordance with AR-200-1 and DODI 4150.07	Assure compliance with Federal laws, applicable DoD regulations, and Fort Hood's IPMP.

Goals	Objectives
Implement Integrated Pest Management practices.	Continue to provide pest surveillance and monitoring. Provide outreach education in nonchemical and reduced chemical control methods. Encourage the creation of favorable landscape habitats, provide education, and implement control practices in all facilities, to include Fort Hood family housing, that preserve beneficial insects and other wildlife.
Reduce the quantity of pesticides used on the installation and promote more effective pest control practices.	Evaluate the effectiveness of control programs. Implement new pesticide reduction methodologies and equipment initiatives.
Implement pest preventive building construction and maintenance requirements.	Investigate the safety and practicality of providing alternative housing for bats displaced from buildings by bat exclusion projects. Implement the placement of bat houses. Ensure plans for building and renovation procedures contain pest preventive requirements. Perform new construction and renovation projects inspections for pest preventive requirements.
Insure that effective control and management procedures are implemented for urban wildlife that pose a risk to public health or damage to property.	Provide oversight of the trapping and removal of vertebrate animals that are inside or under buildings, near the public, or in environmentally sensitive locations. Provide education to enhance tolerance of and safety around vertebrate animals that reside in urban and residential areas. Assess the need for installation-wide surveys and mapping of pest or invasive species.
Implement effective control and management procedures for invasive vertebrate pests in the cantonment and surrounding natural areas.	Perform studies to evaluate the effects of the invasion of non-native birds (starlings, house sparrows, and pigeons) on the population of the migratory song birds in the cantonment and surrounding areas. Perform assessments of the effects of invasion of the roof rat *(Ratus ratus*) on property damage and native bird population in the surrounding areas.
Implement conservation and safe control of honey bees and other pollinators.	Perform live removal of honey bee swarms and hives in buildings or publics areas that are accessible for safe removal.

Program Management Units

All MUs (refer to **Figure 2-4**).

Monitoring

The monitoring program for the pest management program is detailed in the Fort Hood IPMP.

4.12 Noxious Weeds and Invasive Species

Noxious weeds are plant species known to be detrimental to agricultural crops and are regulated by State and Federal government agencies. Invasive species are non-native plants and animals

whose introduction to the ecosystem causes, or is likely to cause, economic or environmental harm, or harm to human health. Some native plants may also become invasive due to negative environmental conditions or practices (e.g., mesquite due to continuous cattle grazing, and broomweed and Ashe Juniper due to over grazing and other negative environmental conditions).

AR 200-1, Section 4-3.d (10) identifies the Director of DPW as the proponent for invasive species management. Executive Order 13112 Invasive Species (1999) directs Federal agencies to prevent the introduction of invasive species; detect, respond rapidly to, and control populations of invasive species; monitor invasive species; provide for restoration of native species and habitat conditions in ecosystems that have been invaded; conduct research and develop sound control of invasive species; and promote public education on invasive species.

The control of invasive species is a priority for the entomology, agronomy, and wildlife staff in the NCRMB.

Program Data Management

As outlined in **Section 4.11**, Integrated Pest Management, Fort Hood's IPMP was approved and signed in May 2016. A copy of the IPMP can be found in **Appendix B7** of this document.

Program History

The installation supports the National Strategy for Invasive Plant Management and its three goals–prevention, control, and restoration. If any noxious weeds are found on the installation, a high priority for control will be established and control efforts will be maximized. A list of plants introduced to Texas is provided in the IPMP. Weeds on firing ranges, around targets, along fence lines, on road shoulders, on paved surfaces (including runways), and so forth require mechanical and chemical control using appropriate herbicides that are approved by the IPMC. Unwanted plants are controlled mechanically (e.g., mowing, string trimmers) or using mulch materials around ornamental plants. Turf weeds such as dallisgrass (*Paspalum dilatatum*) and crabgrass (*Digitaria ciliaris*) might also require control in improved grounds. Aquatic vegetation control is also occasionally necessary at managed fisheries ponds. Unwanted fish species are also removed from managed fisheries ponds by qualified personnel. Wild pig populations are removed by NCRMB staff primarily with the use of traps and aerial gunning by trained personnel.

Prescribed fire on training lands is used to control Ashe juniper and young mesquite, as well as other plant species. Mechanical and chemical controls are also used. Nuisance plant control on most of the installation cantonment except the golf course is performed by the application of herbicides as chemical edging and trimming in the mowing process by the DPW Work Services Branch's Grounds Maintenance (Mowing) Contractor. Work requests for vegetation control in the cantonment area are handled by the DPW applicators or contracted applicators as needed. The privatized Fort Hood Family Housing Maintenance/Landscape contractor does a small amount of vegetation control, and the DPW mowing contractor uses an herbicide in the mowing process for chemical edging and trimming. Vegetation control projects

in areas outside the cantonment area may also be done by contracts administered by DPW Work Services Branch, ITAM, or DPW ENV-NCRMB.

Current Condition

Two noxious weeds are known to occur on Fort Hood: dodder (*Cuscuta sp.*) and cattail grass (*Setaria pumila*). Invasive plant species of concern to the Fort Hood ecosystem include giant reed (*Arundo donax*), salt cedar (*Tamarix ramosissima*), Chinese tallow tree (*Triadica sebifera*), kudzu (*Pueraria montana* var. *lobata*), mimosa (*Albizia julibrissin*), white mulberry (*Morus alba*), Chinese privet (*Ligustrum sinense*), glossy privet (*Ligustrum lucidum*), Japanese honeysuckle (*Lonicera japonica*), King Ranch bluestem (*Bothriochloa ischaemum*), tree of Heaven (*Ailanthus altissima*), China-berry (*Melia azedarach*), sacred-bamboo (*Nandina domestica*), Johnson grass (*Sorghum halepense*), Chinese pistache (*Pistacia chinensis*), red-tipped photinia (*Photinia serratifolia*), Jerusalem-thorn (*Parkinsonia aculeate*), fire-thorn (*Pyracantha koidzumii*), Japanese rose (*Rosa multiflora*), periwinkle (*Vinca major and V. minor*), common chaste-tree (*Vitex agnus- castus*), jujube (*Ziziphus zizyphus*), field brome (*Bromus arvensis*), rescuegrass (*Bromus catharticus*), cheat grass (*Bromus tectorum*), pampas grass (*Cortaderia selloana*), West India lantana (*Lantana camara*), dallisgrass (*Paspalum dilatatum*), Asian jasmine (*Trachelospermum asiaticum*), elephant ear (*Alocasia spp.*), English ivy (*Hedera helix*), Malta star thistle (*Centaurea melitensis*), nandina (*Nandina domestica*), wisteria (*Wisteria sinensis*), slender-flowered thistle (*Carduus tenuiflorus*), woolly distaff thistle (*Carthamus lanatus*), field bindweed (*Convolvulus arvensis*), bermudagrass (*Cynodon dactylon*), Horehound (*Marrubium vulgare*), yellow sweet clover (*Melilotus officinalis*), Scotch thistle (*Onopordum acanthium*), Callery pear (*Pyrus calleryana*), bastard cabbage (*Rapistrum rugosum*), multiflora rose (*Rosa multiflora*), blessed milk thistle (*Silybum marianaum*), common chickweed (*Stellaria media*), dandelion (*Taraxacum officinale*), spreading hedgeparsley (*Torilis arvensis*), and flannel mullein (*Verbascum thapsus*).

Invasive animals of concern to the Fort Hood ecosystem include wild pigs (*Sus scrofa*), zebra mussels (*Dreissena polymorpha*), fire ants (*Solenopsis invicta*), rasberry crazy ants (*Nylanderia fulva*), and other insect pests addressed in the Fort Hood IPMP. Specific rules for zebra mussels, which apply statewide, can be found on the TPWD website, and at www.texasinvasives.org/zebramussels. All organizations to include military units are required to follow the TPWD clean, drain and dry procedures for zebra mussel decontamination. This requirement is communicated to units requesting water use permits and to attendees of the Fort Hood Environmental Compliance Officer Course. Control measures for all nuisance animals and plants are detailed in the Fort Hood IPMP.

Wild pigs, present within most of the training areas, are a serious ecological problem because they trample vegetation, disturb soils while rooting, degrade aquatic habitats by wallowing, and compete with and prey on native species. There is increased interest by hunters to pursue wild pigs and an increase in those that participate in hunting them outside the deer and turkey seasons. Recreational hunting pressure has been shown elsewhere to be very ineffective at controlling wild pig populations. Fort Hood's goal is to carry out intensive efforts to eradicate and prevent re- establishment of current populations. As such, the installation's trapping program has been implemented and will continue to expand to minimize the impacts of wild pigs to natural resources.

Besides invasives, there are other species which require monitoring and management for Soldier safety. These plants can impact Soldiers by causing minor to major injuries and are capable of inflicting damage to wheeled vehicles and military equipment. Native plants that are often a problem in the range areas due to their invasive qualities include broomweed, Ashe juniper, and mesquite.

Program Goals and Objectives

The goals and objectives for the prevention of new infestations and the control of existing infestations of invasive species are provided in **Table 4-31**.

Table 4-31. Goals and Objectives for Invasive Species Management

Goals	Objectives
Prevent new infestations of invasive species.	Report new infestations of invasive species to natural resources personnel. Use all practical means to control and prevent the spread of zebra mussels from Belton Lake to the ponds and streams on the installation. Require specific procedures for cleaning, draining, and drying of any equipment or vehicle encountering the waters of Belton Lake before entering other waters or training areas. Regular monitoring of installation waters for the spread of zebra mussels.
Prevent the introduction of invasive species.	Prohibit the planting of invasive species in ornamental landscaping, in wildlife supplemental food plots, and in re-vegetation projects per MOI – *Landscaping on Fort Hood*.
Control invasive plant, insect, and mammal species to prevent degradation of training areas with respect to safety, training, and wildlife management.	Control invasive species on improved grounds using mechanical and biological control methods and approved chemical control methods when necessary. Control unwanted aquatic plants in managed fisheries ponds with mechanical (shoreline shaping), physical (water level fluctuations), and biological and chemical methods. Use all practical means to control and prevent spread of wild pigs on the installation. Conduct research to evaluate new ways to control wild pig species. Continue to provide aerial support for wild pig control. Continue to document and map occurrences of exotic/invasive species that are observed during survey efforts or incidentally encountered; use this information to schedule and prioritize management actions for such species.
Conduct restoration activities after invasive species control to repair areas vulnerable to erosion, and to prevent other invasive plants from establishment	Reseed native vegetation in bare soil resulting from mechanical control of invasive plants.

Program Management Units

All MUs (refer to **Figure 2-4**).

Monitoring

Monitoring for invasive species is integrated into the monitoring programs for other resources, such as terrestrial, aquatic, karst, and endangered species habitat; fish; and wildlife, as well as pest management.

4.13 Wildlife Aircraft Strike Hazard

Air operations, aviation safety personnel, and natural resources personnel must work together to reduce the risk of bird and wildlife strikes to aircraft on Fort Food. DoD continually implements and improves aviation safety programs to provide the safest flying conditions possible. One of these programs is the WASH prevention program.

Program Data Management

The Robert Gray AAF WASH Plan is a vital component of the airfield safety and accident prevention program and is administered by the Airfield Manager with the input and guidance of the Airfield Safety Officer. The WASH Plan is applicable to both Robert Gray AAF and Killeen- Fort Hood Regional Airport. A copy of the Plan can be found in **Appendix B8**.

The WASH Plan is designed to: (1) prescribe the development of a Wildlife Hazard Working Group (WHWG) and designate member responsibilities; (2) prescribe procedures for reporting hazardous wildlife activity and altering or discontinuing aircraft operations; (3) develop procedures to identify hazardous wildlife situations and to aid Airfield Management and Air Traffic Control in disseminating information, issuing alerts and limiting or discontinuing aircraft operations when required; (4) prescribe active/passive techniques to disperse wildlife from Robert Gray AAF and decrease the attractiveness of the airfield to wildlife; (5) develop procedures to identify, provide information and eliminate or reduce environmental conditions that attract wildlife to Robert Gray AAF; and (6) identify agencies authorized to initiate or terminate Wildlife Watch Conditions (WWC).

Program History

A WASH program exists at Robert Gray AAF and its vicinity primarily due to resident and migratory bird species. Due to the large expanses of open areas, birds are attracted to the airfield and the vicinity. Daily and seasonal bird movements create various hazardous conditions. In addition to birds, several mammalian and reptilian species pose threats to flight operations. In particular, the grounds surrounding the airfield are covered with Bahia grass that attracts white- tailed deer, wild hogs, coyotes and other wildlife. The WASH program monitors, reports and attempts to eliminate potential WASH problems.

The administration and execution of the Robert Gray AAF WASH Plan requires a collaborative effort from several Fort Hood agencies to minimize wildlife attractants not only on Robert Gray AAF but in the vicinity of the airfield. The WHWG is organized to implement and monitor the WASH Plan. The Garrison Commander/Deputy Garrison Commander is the WHWG chairperson, responsible for the WASH Plan and is the approval authority for all WHWG recommendations. Because the WASH Plan is a part of the Airfield Safety and Accident Prevention Program, the Airfield Safety Officer monitors the effectiveness of the Plan. The WHWG also consists of the Director of Aviation Operations, Airfield Manager, Airfield

Operations Officer, Air Traffic Control Chief, and representatives from DPW, NCRMB, 3rd Weather Squadron, and Killeen-Fort Hood Regional Airport. WHWG meetings occur quarterly unless more meetings are required.

The NCRMB representative on the WHWG is responsible for advising the WHWG on wildlife biology and behavior, habitat requirements or modifications or management schemes in order for them to make informed decisions and minimize aircraft-wildlife strikes; serving as a member of the Robert Gray AAF Wildlife Detection and Dispersal Team (WDDT) and performing all lethal taking of wildlife pursuant to WASH activities; acquiring all necessary State/Federal permits for harassment/depredation of nuisance wildlife and providing permits to the Airfield Manager; and identifying the remains of dead wildlife and ensuring proper disposal of remains pursuant to permits.

Current Condition

The wildlife watch warning system is one of the most critical WASH procedures as it is an immediate exchange of information between Gray Tower, Base Operations, Airfield Management and aircrews concerning the existence and location of wildlife that pose a hazard to aircraft operations. The Airfield Manager may declare specific WWCs based on WDDT, aircrew, and/or Gray Tower observations. The following WWCs are used at Fort Hood to warn aircrew and Robert Gray AAF/Killeen-Fort Hood Regional Airport personnel of the current wildlife threat to aircraft operations.

1. WWC SEVERE – Generally defined as a heavy concentration of birds and wildlife on or immediately adjacent to the active runway or other areas of the airfield that present an immediate hazard to aircraft operations. WWC SEVERE may also be declared when birds/wildlife of any size or quantity present an immediate hazard. Aircrews should thoroughly evaluate mission criticality prior to aircraft operations in WWC SEVERE areas. Landing or departing in WWC SEVERE is likely to result in aircraft damage from a bird/wildlife strike.
2. WWC MODERATE – Wildlife activity near the active runway or other areas of the airfield representing an increased potential for wildlife/aircraft strikes. WWC MODERATE requires increased vigilance by all airfield agencies and caution by aircrews.
3. WWC LOW – Wildlife activity on and around the airfield representing a low potential for wildlife/aircraft strikes.

The WDDT actively patrols Robert Gray AAF on an as-needed basis and uses appropriate active deterrence methods. Prior to the initiation of dispersal actions, the WDDT team leader coordinates the location and methods with the Airfield Management and Gray Tower and ensures the appropriate WWC has been declared prior to dispersal activities on the active runway. Dispersal techniques may include the use of visual deterrents, vehicle horns and sirens, propane cannons, pyrotechnics, and lethal control.

Occasionally, wildlife must be killed to reinforce other animal frightening techniques. Shooting one or two birds from a flock, then following with a volley of pyrotechnics is generally a

very effective strategy for deterrence. Domestic pigeons, European starlings and house sparrows may be removed without permit. All migratory birds (as defined by the MBTA) require an approved fish and wildlife depredation permit prior to removal. NCRMB will coordinate for all depredation permits and will perform all pyrotechnic and lethal control measures on Robert Gray AAF.

Two of the most effective and long-term methods of discouraging wildlife from using the airfield is the removal of attractive habitat features and the maintenance of fences to discourage and/or prevent large mammal access. The Robert Gray AAF WASH Plan outlines the primary means of habitat management to include vegetation maintenance (including drainages and wetlands), the elimination of bare areas and old surfaces, fence maintenance, the elimination of trees and brush within aircraft operating areas, monitoring of perch and nesting sites, and proper storage and collection of organic waste.

Program Goals and Objectives

The goal of the WASH plan is to mitigate human/wildlife conflict, while maintaining varied wildlife populations and habitats.

Table 4-32. Goals and Objectives for WASH Prevention

Goals	Objectives
Minimize WASH-related health risks, safety risks, and environmental damage.	NCRMB Objectives Coordinate the current WASH Plan and WASH reduction guidance with the INRMP for habitat modification, active harassment, and bird awareness education for all personnel. Develop strategies and actions to minimize WASH threats. DPW-Engineering and Maintenance Objectives Maintain airfield turf between 6" and 12" in height. Eliminate bare areas and seed with grass to establish a thick turf. Reseed construction sites as soon as possible after project completion. Properly maintain established ditches with steep sides and trimmed vegetation. Remove vegetation as necessary to prevent standing water on or near the airfield. Routinely remove wetland vegetation to prevent recurrence of aquatic vegetation, reduce the attractiveness of birds, and to prevent heavy vegetation growth from complicating maintenance. Install crisscross rebar/steel in drainage culverts on the upstream side to preclude wildlife access to the airfield. Conduct weekly (at a minimum) checks of the airfield perimeter fence to ensure that there have been no breaches by wildlife, that all gates are secured, that no vegetation has developed on the fence, and that both the internal and external 20' clear zones are clear. Maintain airfield fences and gates with no more than 3" gaps to limit wildlife access. Eliminate, whenever possible, trees and brush inside airfield security fences.

Goals	Objectives
	Monitor sites such as isolated trees, airfield structures, airfield signage, poles, and equipment for birds using them as perches or nesting sites. Store all organic wastes in enclosed containers until collected and removed. Cover all construction containers as well as public trash containers to limit access by birds and other wildlife
Comply with applicable laws and regulations.	The WHWG will review any habitat alterations to ensure that it does not affect the safety of the mission. The WHWG will establish procedures to identify high hazard situations and to aid supervisors and aircrews in disseminating information, issuing alerts and altering or discontinuing flying operations when required. Maintain WASH awareness with all proposed land use activities.

Program Management Units

Robert Gray AAF is in the South (West Fort Hood) MU (refer to **Figure 2-4**).

Monitoring

The NCRMB representative will attend the quarterly WHWG meetings to ensure compliance with all aspects of the WASH Plan and this INRMP.

4.14 Compatible Use Buffers and Conservation Easements

At Fort Hood, as at many U.S. military installations, security considerations and the need for safety buffer zones have limited access and created islands of biodiversity amid seas of ever-expanding residential and industrial development. This development encroaches on both the military mission and the biodiversity that the installations harbor. To address the problem of incompatible development or "encroachment," Congress authorized DoD to partner with "eligible entities" to create "buffers" in the vicinity of bases (10 USC 2684a). The program is named the Readiness and Environmental Protection Initiative (REPI), but the Department of the Army refers to it as the Army Compatible Use Buffer (ACUB) Program. The ACUB Program was created to establish buffer areas around Army installations to limit effects of encroachment and maximize land inside the installation that can be used to support the mission.

The military training mission at Fort Hood is impeded by several forms of encroachment, which DoD defines as "the cumulative result of any and all outside influences that inhibit necessary training and testing." The forms of encroachment affecting the mission at Fort Hood include regulatory encroachment and urban development.

Regulatory encroachment involves the restrictions on training and the effort expended to comply with the provisions described in the ESMC and the BO for management of habitat for the black-capped vireo and the golden-cheeked warbler. Currently, there are no training restrictions in endangered species habitat. Like most military installations, Fort Hood is surrounded by increasing urban and suburban development. As such development occurs, there is increasing potential for conflict between urban residents or business interests and certain aspects of military

training, which are not confined to Army property. For example, noise and smoke produced on Fort Hood might be detected in adjacent urban settings and deemed undesirable there.

Program Data Management

Fort Hood is actively engaged in the ACUB Program to evaluate the feasibility of acquiring conservation easements, purchase of development rights, or other perpetual agreements on surrounding lands that will both provide an effective buffer to encroachment on the military training mission and have a high conservation value. Fort Hood's most recent study was conducted in 2017, a copy of which can be found in **Appendix B9**.

Fort Hood's ACUB Program is maintained by the NCRMB. Natural resources professionals assist in reviewing implementation of the program, as well as, play a supporting role whenever called upon. Fort Hood partners in the ACUB Program include the NRCS and the CLF.

Program History

Under the authority provided in the National Defense Authorization Act of 2003, Fort Hood's ACUB Program was officially established in November 2012. The ACUB Program allows military departments to partner with private landowners to establish conservation easements or buffer areas around active installations to limit the effects of encroachment. These partnerships are beneficial in several ways:

Benefits to Fort Hood:

- Manages development adjacent to, and near Fort Hood
- Protects effective training space to the installation boundaries
- Averts training restrictions
- Mitigates against noise and smoke complaints

Benefits to Fort Hood Community Partners:

- Protects Fort Hood mission and strength
- Does not remove lands from tax base
- Maintains local agricultural and wild lands

Benefits to Landowners:

- Maintains current, compatible land uses
- Provides cash in hand
- Retain rights to ownership and management of land

Current Condition

Fort Hood's conservation partners work directly with willing landowners to secure conservation easements and are also responsible for recording, monitoring, managing, and enforcing the easements. These conservation easements prohibit incompatible development in perpetuity, while keeping the land in private ownership and allowing for traditional land uses such as agriculture,

forestry, and recreation. Fort Hood has secured easements from willing landowners, protecting land through military and partner funds. These areas consist primarily of agricultural and open lands.

Program Goals and Objectives

Fort Hood's partnerships under the ACUB program preserve high-value habitat and limit incompatible development near the installation. The established buffer areas around Fort Hood limits the effects of encroachment and maximizes land inside the installation that can be used to support the installation's mission.

Table 4-33. Goals and Objectives for the ACUB Program

Goals	Objectives
Avoid/limit encroachment and provide long-term sustainability of Army ranges.	Work with NRCS and CLF to maintain easements on off-post land to protect habitat and buffer training without acquiring any new land for Army ownership. Protect private lands outside of Fort Hood through conservation easements in several Priority Areas. Maintain compatible land uses through the implementation of new conservation easements with willing landowners. Increase outreach to expand the partnership base with diverse organizations.

Program Management Units

All Fort Hood and surrounding lands.

Monitoring

CLF will continue working closely with the NCRMB, other Fort Hood personnel, and the NRCS to manage the current lands under easement and to assess the needs for additional land easements under the ACUB program.

4.15 Other Programs

4.15.1 Integrated Training Area Management (ITAM)

AR 350-19, The Army Sustainable Range Program, defines and describes the ITAM program. ITAM is an Army Garrison, DPTMS, Range Operations Branch program that provides training land management capabilities ensuring Army training lands are always accessible, available, and capable of supporting training requirements.

ITAM integrates the mission requirements derived from the Range and Training Land Program (RTLP), with environmental requirements and environmental management practices, and establishes the policies and procedures to achieve optimum, sustainable use of training and testing lands by implementing a uniform land management program. ITAM provides Army range officers with the capabilities to manage and maintain training lands to support maneuver training throughput and mission readiness. The ITAM program is actively managed to respond to changing land conditions, training schedules, mission priorities, and environmental

compliance. Training land management is coordinated through Garrison and IMCOM offices, and project planning is subject to installation coordination and approval. ITAM integrates the training mission requirements in the RTLP and uses installation environmental requirements to formulate best management practices for training land repairs. ITAM coordinates future land repair projects through the installation's Integrated Training Land Management (ITLM) process and submits installation-approved workplans to IMCOM for funding.

ITAM has five components, which work in unison to accomplish the ITAM mission:

- Range and Training Land Analysis (RTLA)
- Land Rehabilitation and Maintenance (LRAM)
- Training Requirements Integration (TRI)
- Sustainable Range Awareness (SRA)
- ITAM Geographic Information Systems (GIS)

Range and Training Land Analysis (RTLA)

The RTLA Coordinator provides RTLA capabilities, recommendations and support to the ITAM Program including LRAM, GIS, TRI, and SRA components, by developing and maintaining an RTLA Plan and an annual report of RTLA monitoring results. The RTLA Coordinator functions as ITAM's scout and becomes the eyes for training land upgrades and repairs. RTLA monitors and assesses land conditions to provide information required to support land management decisions to sustain maneuver training lands capacity, capability and accessibility. RTLA assessments are driven by commander/training needs for the training land. This includes recommending and implementing assessment procedures and technologies, coordinating methodologies for gathering and analyzing data, assessing the condition of training land resources on the installation, making recommendations for the work locations to improve the quantity of training, and incorporating findings into an annual RTLA report.

The RTLA component shares RTLA results with the LRAM and ITAM Coordinators (and with installation agencies) to guide LRAM projects (i.e. erosion, vegetation loss, or maneuver damaged sites). The RTLA Coordinator monitors the effectiveness of LRAM projects to validate LRAM methodologies, techniques, and procedures. RTLA develops and monitors special plots to evaluate LRAM site recovery, vegetation regrowth, returns of undesirable vegetation, and to recommend when areas require new work. The RTLA Coordinator assists the LRAM Coordinator in identifying LRAM work sites, designing LRAM projects, and the development of ITAM Workplan activity packets. RTLA attends Installation Project Review Board (IPRB) meetings to ensure ITAM project sites have not significantly changed, allowing for last minute considerations prior to commencement of work on planned projects.

Land Rehabilitation and Management (LRAM)

LRAM is the land and maintenance component and is a key enabler for sustaining realistic training land conditions and supporting the training missions on the installation. LRAM is a preventive and corrective land rehabilitation and maintenance program that reduces the long-term impacts of training and testing on Installation lands. Its primary function is to maintain training land to ensure land capabilities can support the Army mission. It combines preventive and corrective land

rehabilitation, repair, and/or maintenance practices to reduce the impacts of training and testing on an installation. It includes training area redesign and reconfiguration needed to meet training requirements. LRAM projects are identified by onsite ITAM observations, trainer feedback, DPW feedback, G3 guidance, and Senior Commander (SC) goals. The LRAM Coordinator identifies, plans, and designs projects for work. ITAM projects are prioritized by the ITAM Coordinator and presented, for consultation and coordination, during ITLM meetings with DPTMS, DPW, and DES for discussions and coordination of planned work. Projects are presented to the Garrison Commander (GC) for the installation's approval of each ITAM Workplan.

LRAM designs projects utilizing coordinated and approved ITAM/LRAM methodologies by collecting field data, utilizing GIS maps, and by consulting with subject matter experts across many installation organizations. Final project designs are approved by the ITAM Coordinator and incorporated into the RCMP and ITAM Workplans. LRAM oversees project work from start to completion by regular onsite visits, meetings with Contract Officer Representative (COR), inspections, and acceptance of work project deliverables during final inspections.

Training Requirements Integration (TRI)

The primary focus of TRI is to ensure sustained accessibility to training areas while ensuring adequate training land availability to support training to standards under realistic land conditions, and to provide military trainers and land managers with the necessary technical and analytical information to integrate doctrinally based training and testing within land capabilities. The integration of requirements occurs through continuous consultation among the DPTMS, DPW, natural and cultural resource managers, and other environmental staff members.

ITAM-TRI actively participate in range and land management planning and execution, ensuring mission needs are considered in environmental and facilities planning, and environmental constraints are considered in mission planning. TRI achieves the "training-environmental" balance and interface which is key to the installation and requires continuous interaction and coordination between the operations/training staff and the natural resources management/environmental staff. This ensures wise land use planning and land management and repair decisions are made to meet regulatory compliance and meet training and testing activity requirements. TRI provides training input for developing and updating the INRMP, in accordance with AR 350-19.

TRI utilizes the Training Restricted Area Program (TRAP) as an operational program that provides locations for DPW and ITAM work areas and timeframes of work for unit planning and avoidance. TRAP allows units to utilize active work sections of training areas not currently under construction/repair work and provides a process for units to coordinate with work contractors for Soldier and contractor safety. Trainers can coordinate with workers to refine the active work boundaries for a specific timeframe or contact ITAM to request re-location of work for priority training.

TRI facilitates training planning though the Military Training Excavation Program, where ITAM manages training areas military training excavations and ensures planned dig sites do not impact cultural and real property infrastructure before approving the unit dig requests. ITAM manages

training area (TA) No-Dig overlays for each TA, which are provided to trainers to allow units to plan for needed dig sites to support MRA training. ITAM No dig overlays are available to facility trainer planning prior to units submitting a FH200-10, Excavation request. Commanders' options are supported through the excavation programs by instantly identifying dig restricted areas and provides timely feedback for any unit planning changes needed to support MRA training.

Sustainable Range Awareness (SRA)

The primary goal of SRA is to provide the proactive means to develop and distribute educational materials to trainers/users of training lands to educate them with the intent of avoiding unnecessary and avoidable damage to maneuver training land and natural resources. ITAM has 24 SRA products to provide planning information to trainers to ensure training can be done without impacting environmental or safety concerns. These materials relate the principles of land stewardship and the practices of reducing training impacts to training land infrastructure and assets, including the local natural and cultural resources.

ITAM maintains 14 Leader Checklists (combined into 1 packet) which provide guidance to trainers on various training aspects conducted at Fort Hood. ITAM SRA maintains 2 training SOPs: a SRA SOP entitled 'Enabling Military Training', which address 30 years of training lessons learned and actions approved on the installation in the past, and a Military Training Excavation SOP which provides specific information on various types of training area dig requirements and how to complete FH Form 200-10 permit request.

For SRA, ITAM provides standard and customized maps to support unit training which include: the Fort Hood Military Installation Map (MIM), land navigation maps, maneuver training planning maps, live fire range maps, specific training area maps, excavation map products, and other custom maps and digital data for units. Maps can be requested at ITAM as paper and/or CD/DVD copies, and via the SRP Share point site under the Fort Hood installation pages.

ITAM Geographic Information Systems (GIS)

Through GIS, installations can create, analyze, manage, and distribute standardized geospatial information, products, and services to support range modernization, range operations, training, and the ITAM Program. The Range GIS staff is an ITAM component. There are five programmatic activities for the ITAM GIS program:

1. Contribute to the development and maintenance of an annual ITAM Plan and Workplan, coordinating information technology support, and conducting required travel and training. GIS support functions are inherently iterative, require frequent coordination, reviews, and approvals with Garrison offices, and are subject to individual installation timelines and processes.
2. Provide geospatial analysis and cartographic support to Range Operations.
3. Gather and create geospatial data and perform geospatial analysis to support Range Modernization planning charrettes and Modernization reconfigurations to include range siting.
4. Provide training support products in direct assistance to the execution of training strategies and missions on the installation's ranges and training lands. Develop and maintain

geospatial data, perform geospatial analysis, and create training support cartographic products (maps) in support of unit training.

5. Develop, update, manage, report, and maintain the DAMO-TRS (SRP) proponent SDSFIE Army Adaptation geospatial data layers in accordance with the DAMO-TRS SRP geospatial Data Development Strategy, the SRP geospatial data Quality Assurance Plans (QAPs), and the SDSFIE Army Adaptation. Serve as the installation/site(s) Data Steward for all DAMO-TRS (SRP) proponent geospatial data layers. Coordinate all range and training area related facility data with the installation real property office to ensure correct real property attributes are included in the geospatial data and real property databases. Staff, review, and validate data for each GIS data layer. Develop, maintain, and update Military Installation Map (MIM) with the required data layers to support mission requirements found on SRPWeb. Maintain, develop, and retain a copy of the existing geospatial data to include the creation of the required geospatial data layers to fill the MIM map extent. Digitally plan to update the MIM annually, if needed, unless major changes have not been made to range and training land designations to support training and infrastructure updates.

ITAM Program and the ITLM Group

Fort Hood has been proactive in supporting the long-term sustainment of training lands by integrating the ITAM Program, which functions as the ITLM chair, with the natural resources management program to support training requirements; land stewardship education; and training, environmental, cultural, and conservation management. The Fort Hood Land Sustainment Management Plan (LSMP) is the vehicle for the integration of natural, cultural, range master planning and infrastructure, and ITAM Program objectives outlined in the Installation Sustainment Program.

The responsibilities for sustainment of the training lands and environmental compliance have been divided among DPTMS, Range Operations Branch (ITAM Program); DPW- ENV; DPW Maintenance Division, Roads and Grounds Branch; and DPW Master Planning Branch, and Engineer Branch to work together to maintain, repair, and reconfigure the training lands infrastructure to support readiness training. The Training Lands Committee has established a 25-year sustainment goal. The goals and management activities for the agencies involved have been divided into short-, mid- and long-range plans. The short-range plan involves the ITLM Program to repair and enhance land resources. The ITLM Program manages training land and supports training through the mid- and long-range components of the plan by repairing new maneuver land damage, minimizing erosion, reducing the backlog of training land repairs, and maintaining trail networks.

4.15.2 ITLM Program

Fort Hood is proactive in supporting the long-term sustainment of training lands by integrating the ITAM Program, which functions as the Integrated Training Land Management (ITLM) chair, with DPW, DPTMS and natural and cultural resources management programs. In 2003, the ITLM Committee established its 25-year sustainment goals. The goals and management of activities for the agencies involved have been divided into annual plans to repair, enhance, and sustain the natural and training land resources. The ITLM process manages training land

sustainment and supports training through the agencies plans for repairing maneuver training lands, maneuver/land damage, minimizing erosion, reducing training land repair backlogs, the continuous maintenance requirements for trail networks, and fire prevention. The ITLM group meets regularly to coordinate and approve planned repair projects and to discuss current and upcoming training land management needed for land repair projects. Bi-annually, the ITLM presents an ITAM Workplan to the Garrison Commander for approval, prior to submitting to IMCOM for funding.

To address training and natural resource needs, the ITLM Program has identified the following objectives/goals for improving the training landscape and creating the requisite conditions for the long-term sustainability of the training lands:

- Improve the training landscape to support training and the environment
- Enhance readiness training capabilities through best management practices
- Reduce training obstacles in the primary heavy and infantry brigade combat team (BCT) maneuver training areas
- Reduce soil erosion rates through BMPs
- Identify and select native vegetative cover to reduce vegetation loss and bare ground
- Provide an environment that will remain viable to support current and future maneuver and military readiness activity training while protecting environmental areas
- Improve water quality on the installation

4.15.3 Cultural Resources

Cultural Resources are not discussed in this document. Refer to **Appendix B10** for a complete copy of the Fort Hood Integrated Cultural Resource Management Plan (ICRMP).

Chapter 5 Implementation

5.1 Environmental Awareness

DoD Instruction 4715.3, *Environmental Conservation Program*, May 3, 1996, Paragraph D.1.i. states: "DoD installations may engage in public awareness and outreach programs to educate the public regarding the resources on military lands and DoD efforts to conserve those resources." In this case, the "public" includes both Soldiers and their families living on Fort Hood and in the community, as well as the general public in the region.

Environmental awareness and outreach is essential to long-term sustainability. In general, the more people know about an installation's unique and valuable natural resources and the reasons for protecting those resources, the more responsibly they will act toward them.

Natural resources professionals on Fort Hood conduct numerous environmental education programs for the public. Environmental information is provided in formats suited to each audience, including displays and presentations for local schools and scouting organizations; events such as Earth Day; assistance with service and community projects; and publications in the form of brochures, newsletters, and press releases. Natural resources professionals also assist the Public Affairs Office with information, articles, and interviews when called upon.

It is a goal of the NCRMB to continue to participate in outreach programs or events to explain contemporary natural resources issues and management as time and resources allow. Outreach participation has included involvement with the following organizations: Scout programs, Wounded Warriors, homeschooling associations, Texas A&M University Central Texas, University of Mary-Hardin Baylor, Twin Lakes Audubon Society, and the Fort Hood Sergeant Audie Murphy Club. In addition to working with non-profit organizations, NCRMB staff also participates in events that host hundreds of local children, educating them on the importance of environmental stewardship and exposing them to technologies used for natural resources management.

GIS Day

Nearly 1,300 local 6th graders participate in the annual Killeen GIS Day. The event near Fort Hood is one of the largest in the nation and is held annually during World Geography Week to teach children about geography and conservation. The event includes several city departments, Soldiers demonstrating how they use GIS technology, DPW-ENV staff members, emergency responders, and TPWD employees as well as other entities.

NCRMB contributes by providing interactive presentations about the use of GIS for natural resources management prepared by the on-staff geographer. The NCRMB AIM program also participates by discussing the use of GIS to monitor avian and monarch butterfly populations and track migration.

Earth Day

Fort Hood hosts over 1,000 3rd through 5th graders in an outreach effort through the post's DPW-ENV office. Earth Day begins with a tree planting ceremony. Students rotate to stations learning

about the benefits of biodiversity and clean air and water. The event ends with a display from Zoomagination, a local wildlife rehabilitation program that provides children with an opportunity to see rare and endangered species up close.

NCRMB staff play an active role by creating multiple learning stations and holding a tree planting ceremony with Fort Hood leadership. Each station covers a different area of natural resources conservation. Stations discuss: bat conservation, MBTA and avian nesting ecology, and pollinator science.

Birding Tours

Birding tours are available by advance reservation only and are provided by the natural resources outreach coordinator. The following organizations participate in field trips annually: Twin Lakes Audubon Society, Travis Audubon Society, Central Texas College, Texas A&M University Central Texas, Central Texas Master Naturalists, and Texas Hawking Associations. Tours provide visitors with a chance to view multiple avian species in a wide variety of habitat types. When feasible, tours may offer the opportunity to view endangered songbirds in their natural habitat.

Scout Involvement

NCRMB staff regularly work with eagle scouts, and boy and girl scouts on community enrichment projects. Projects teach children responsible and ethical land stewardship and foresters a deep appreciate and respect for wildlife. The events hosted by NCRMB often include construction or enhancement of natural areas. The NCRMB Native Pollinator gardens serves as a backdrop for hosting such events. Children learn about central Texas flora and fauna with an added opportunity to leave their mark on the community through construction projects. The scouts have built flower beds, planted native plants, and have constructed and painted bird and bat houses. When resources are available the following days are typically used to host such events: Migratory Bird Day, Make a Difference Day, Great Backyard Bird Count, Pollinator Week, BIO Blitz, Earth Day (2016- 2018).

Christmas Bird Count

The AIM program hosts an annual Audubon Christmas Bird Count on the installation. Nature enthusiasts from Fort Hood and surrounding areas take part in this Fort Hood holiday tradition that typically takes place the 2nd or 3rd Thursday in December. Fort Hood's landscape is rich and diverse, being comprised of grasslands, wetlands, woodlands, and shrub lands. This diversity affords us a unique opportunity to observe a wide variety of bird species.

Each year, the Audubon Christmas Bird Count mobilizes over 72,000 volunteer bird counters in more than 2,400 locations across the Western Hemisphere. The Audubon Christmas Bird Count utilizes the power of volunteers to track the health of bird populations at a scale that scientists could never accomplish alone. Data compiled on Fort Hood will record every individual bird and bird species seen in a specified area, contributing to a vast citizen science network that continues a tradition stretching back more than 100 years.

To date, the count on Fort Hood has produced over 7,000 individual avian observations that detected over 100 different species, some of them being rare and undocumented for the area (2016- 2017). More than 60 volunteers from Oncor Energy, Dominion Energy, ACRT Inc.,

Twin Lakes Audubon Society-Belton, Texas A&M University Central Texas, and local homeschooling associations joined Fort Hood biologists to track the number of species seen within a 15 mile-wide radius of the installation.

Environmental Compliance Officer Course

Opportunities to learn about management of Fort Hood's natural resources are also made available to Soldiers and contractors. Fort Hood trains Soldiers, civilians, and contractors as Environmental Compliance Officers (ECOs), who serve as the backbone for their organization's environmental program, overseeing compliance in their areas of operation and providing training to all personnel.

During a 40-hour course, individuals are trained to recognize compliance requirements, as well as understand the intent and rationale behind the requirements for all of Fort Hood's environmental and conservation programs. In FY16, 240 individuals were trained as ECOs. Topics covered include: cultural resources, natural resources, MBTA guidance, entomology, environmental hazards, dig/water permitting, karst management, pest management, and cantonment wildlife.

Awards

The NCRMB's work has garnered local, regional, and national recognition. The following are awards and designations received by the NCRMB teams:

- USFWS Military Conservation Partner Award (2017)
  - The Military Conservation Partner Award is a national award presented annually to a military installation whose efforts result in significant conservation accomplishments by partnering with the USFWS and other conservation agencies.
- National Military Fish and Wildlife Association Model Program Award (2017)
  - Presented to the AIM Program for proactive management of at-risk species.
- Hood Hero Awards
  - Outstanding Commitment to a Job AIM Team (2017)
  - Community Involvement Christmas Bird Count Team (2016-2017)
  - Volunteer in the Communities Make a Difference Day Team (2017)
  - Outstanding Commitment to a Job Wildlife Management Team (2015)
- Tree City USA Arbor Day Foundation (2006-present)
- Partners in Flight Group Investigations Award (2001)
  - For outstanding contributions to bird conservation.
- President's Conservation Achievement Award (1997)
- Important Bird Area Designation American Bird Conservancy
- Texas Organization for Endangered Species Landowner Stewardship Award
  - For long term efforts to seek compatibility between the military mission and conservation of natural resources

5.2 Natural Resources Staff and Training

Fort Hood has a staff of professionally trained natural resources management personnel necessary to implement this INRMP. The University of Illinois (U of I) provides natural resources personnel

and assistance through a cooperative agreement. The personnel that currently constitute the natural resources management staff at Fort Hood, including contract personnel, are listed in **Table 5-1**.

Table 5-1. Fort Hood Natural Resources Management Staff

Permanent, Full-Time Personnel	
Number	Position
Fort Hood NCRMB Staff	
2	Supervisory Natural Resource Specialist (Army
1	Supervisory Wildlife Biologist (Army civilian)
1	Agronomist (Army civilian)
1	Wildlife Biologist (Army civilian)
7	Natural Resource Specialist (Army civilian)
2	Entomologist (Army civilian)
1	Bio Science Specialist (Army civilian)
1	Geographer (Army civilian)
1	Outreach Coordinator (Army civilian)
U of I Staff	
1	Field Biologist - warbler
1	Field Biologist - vireo
1	Field Biologist – wildlife tech
17	Endangered Species seasonal biologists
1	AIM Field Biologist Team Lead
2	AIM Field Biologists
2	AIM Seasonal Biologists

Additional sources of temporary labor, hired with term limitations, include seasonal employees (NCRMB and U of I), other university hires, and outside agency reimbursable hires. However, the natural resources management professionals currently in-house provide the foundation and fulfill the managerial roles necessary to continue the highly successful natural resources program at Fort Hood.

Implementation of several projects discussed in this INRMP will require active outside assistance. This assistance will come from State and Federal agencies, private consortiums and organizations, universities, and contractors. These resources have proven to be the most efficient and cost-effective method for acquiring expertise on a temporary basis, when Army personnel are not available. Some of the parties will be reimbursed for their assistance, as agreed upon in MOUs and contractual agreements, whereas others will supply their assistance in accordance with cooperative agreements.

NCRMB will send at least one person to each of the following annual workshops or professional conferences as appropriate (dependent on availability of funding):

- International Erosion Control Association
- National Military Fish and Wildlife Association annual workshop
- American Society of Agronomists/Arboriculture annual meeting
- North American Natural Resources Conference
- Southeastern Association of Fish and Wildlife Agencies

- TSS Workshop
- The Wildlife Society Conference
- GIS workshops and Training
- American Fisheries Society Annual Workshop
- Society for Range Management
- Speleology conferences and workshops
- Bat/mammalogy conferences and workshops
- Land Trust Alliance conference
- Ornithological conferences and workshops
- Texas Mussel Workshop
- Texas Plant Conservation Conference

Other conferences and workshops will be evaluated for their usefulness, and decisions will be made based on the relevance to ongoing projects and funding availability. Meetings that are especially useful include ornithological workshops, remote sensing training, GIS basic and advanced training, turkey symposia, white-tailed deer symposia, Watchable Wildlife workshops, invasive species symposia, wetlands training, mammalogy workshops, speleology workshops/training, and endangered species training.

Personnel will be trained in their environmental fields. NEPA training will be required of all supervisory personnel, as well as others who review or prepare NEPA documents.

5.3 Knowledge and Information Gaps

5.3.1 Pending Issues

Vegetation – Previously, non-native, invasive vegetation (primarily B Dahl, an old-world bluestem) was planted to revegetate highly eroded areas across the installation. NCRMB began designing a study to evaluate a better approach to revegetation with native grasses and forbs that rebound quickly and protect the landscape from heavy maneuver training. The study will evaluate which plants grow best in the various soil types and required seeding rates to meet desired conditions.

Herbicides – Another study is currently underway to evaluate the effectiveness and necessity of using herbicide to chemically manage grasslands on the installation. This study includes the need to use herbicides on native hardwood trees. The study is being conducted by ERDC. This multi-year study will monitor migration of herbicides within the site through both soil and water resources, as well as track re-growth of treated vegetation.

5.3.2 Unresolved Issues

Grazing – The primary unresolved issue involves the extent of grazing that will occur on Fort Hood lands. The land that makes up Fort Hood was purchased from the original landowners over a long period. The original landowners have been allowed to graze the lands through the out-lease programs, first directly through the owner, and later through the CTCA.

In recent years, the combined effects of military maneuver, a required activity for military readiness, and continuous grazing on the training lands at Fort Hood has adversely affected the military mission, readiness, and training, as well as the current condition and long-term sustainability of the training lands. Because there are no fences to contain cattle, the animals are free to move about the installation with little regard for the actual stocking rates on any one GMU. As a result, the vegetative communities on many of the training areas have been reduced to species types with shallow root systems that are unsuitable for holding soils and preventing or minimizing erosion. Stormwater runoff has severely eroded the training areas, creating extensive gullies that impede vehicle and troop movement. In 2015, a new 5-year grazing lease was executed with terms to annually assess the forage consumable quantity and military training intensity, considering both when determining a stocking rate for the next grazing year. While the lease itself establishes the methodology, one of the key lease terms is to finalize and implement a Grazing Management Plan that clearly defines the approach and procedures used annually to establish a stocking rate with the overall goal of maintaining and improving the ecological condition of military training lands.

Contract review – Another unresolved issue includes contract verbiage to protect environmental and natural resources in projects occurring on Fort Hood. More oversight and review of proposed projects' products and methodologies is needed to ensure that environmental and natural resources aspects are included.

5.4 Funding

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

The Office of the Secretary of Defense considers funding for the preparation and implementation of this INRMP, as required by the Sikes Act, a high priority. The reality, however, is that not all the projects and programs identified in **Chapter 6.0** of this INRMP will receive immediate funding. Consequently, the programs and projects have been screened and only the high-priority projects are included. The prioritization of the projects is based on need, and need is based on a project's importance in moving the natural resources management program closer to successfully achieving its goals. Therefore, projects will be conducted subject to the availability of funding.

Project funding is derived from a variety of sources. Garrison Environmental Requirements Build (GERB) requests for both recurring and nonrecurring projects are submitted to Installation Management Command (IMCOM) for approval. When funding is received, IMCOM distributes funding based on approved projects on the GERB for implementation at the installation level. In addition to GERB funding, programs within NCRMB compete for grants and other award funding. Projects are conducted subject to the availability of funding and personnel to complete required tasks.

Chapter 6 Five-Year Implementation Plan

INRMP Objective	Proposed Project Title	Execution Timeframe	Management Unit (Refer to Figure 2-4)	Monitoring Frequency (Estimate how often the indicator will be observed or measured)
Manage wildlife and fisheries resources within the principles and guidelines of ecosystem management to maintain productive habitats and viable populations of native species.	Ecosystem Plantings	January 2018 - December 2023	LFA, NFH, Northeast, Northwest, South, Southeast, Southwest MUs, and the Cantonment Areas	In cantonment areas as needed/required for tree replacement
	Habitat Delineation	March 2018 - September 2023	LFA, NFH, Northeast, Northwest, South, Southeast, Southwest MUs	Updated annually
	Invasive Species Management and Control	January 2018 - December 2023	LFA, NFH, Northeast, Northwest, South, Southeast, Southwest MUs, and the Cantonment Areas	As needed and approved by NCRMB
	Planning Level Surveys	January 2018 - December 2023	LFA, NFH, Northeast, Northwest, South, Southeast, Southwest MUs, and the Cantonment Areas	As needed
	Vegetation Classification Mapping	March 2019 - October 2020	LFA, NFH, Northeast, Northwest, South, Southeast, Southwest MUs	5 Year Cycle
	Wildlife Management	January 2018 - December 2023	LFA, NFH, Northeast, Northwest, South, Southeast, Southwest MUs	As needed
	Prescribed Burning	November - March	LFA, NFH, Northeast, Northwest, South, Southeast, Southwest MUs	Annually/Seasonally
Prevent the degradation of water quality, protect aquatic and riparian habitats, and identify and restore degraded habitats.	Waters of the U.S. Survey	March 2018 – September 2023	LFA, NFH, Northeast, Northwest, South, Southeast, Southwest MUs, and the Cantonment Areas	Every 5 years
	Native Seed Mix Study	January 2018 - December 2023	Grassland Habitats in the LFA, NFH, Northeast, Northwest, South, Southeast, Southwest MUs, and the Cantonment Areas	As needed for BMP recommendations

INRMP Objective	Proposed Project Title	Execution Timeframe	Management Unit (Refer to Figure 2-4)	Monitoring Frequency (Estimate how often the indicator will be observed or measured)
Provide quality consumptive and non-consumptive recreational opportunities while avoiding impacts on training and maintaining a balanced and diverse ecosystem.	Fisheries Management	January 2018 - December 2023	LFA, NFH, Northeast, Northwest, South, Southeast, Southwest MUs, and the Cantonment Areas	Annually/Seasonally
	Lake and Pond Management	January 2018 - December 2023	LFA, NFH, Northeast, Northwest, South, Southeast, Southwest MUs, and the Cantonment Areas	Annually/Seasonally
Provide special protection and management that leads to the recovery of threatened and endangered species and conserve species of concern and their habitats so that new species are not listed.	Protection and management of Golden-cheeked Warblers	January 2018 - December 2023	LFA, NFH, Northeast, Northwest, South, Southeast, Southwest MUs	Annually/Seasonally
	Protection and management of Black-capped Vireos	March 2018 - September 2023	LFA, NFH, Northeast, Northwest, South, Southeast, Southwest MUs	Annually/Seasonally
	Brown-headed Cowbird Control	March 2018 - September 2023	LFA, NFH, Northeast, Northwest, South, Southeast, Southwest MUs	Annually/Seasonally
	Vegetation Monitoring of Fire Effects in Endangered Species Habitat	January 2018 - December 2023	LFA, NFH, Northeast, Northwest, South, Southeast, Southwest MUs	As needed
	Cave Monitoring	March 2018 - March 2023	LFA, Northeast, Northwest, South, Southeast MUs	Monthly to Annually
	Cave Survey, Mapping, and Inventory	March 2018 - March 2023	LFA, Northeast, Northwest, South, Southeast MUs	Monthly to Quarterly
	Survey of Endemic Cave Salamander	Winter 2022	LFA, Northeast, Northwest, South, Southeast MUs	Quarterly
	Implementation of Karst Management Plan	March 2018 - March 2023	LFA, Northeast, Northwest, South, Southeast MUs	Quarterly
	Warm season bat population monitoring & cold season bat counts	March 2018 - March 2023	LFA, Northeast, Northwest, South, Southeast MUs	Monthly
	Freshwater mussel surveys	March 2018 - October 2023	Fort Hood Streams located in LFA, NFH, Northeast, Northwest, South, Southeast, Southwest MUs, and the Cantonment Areas	Annually

INRMP Objective	Proposed Project Title	Execution Timeframe	Management Unit (Refer to Figure 2-4)	Monitoring Frequency (Estimate how often the indicator will be observed or measured)
	Plains spotted skunk survey	January 2020 – December 2020	Northeast, Northwest, South, Southeast, Southwest MUs	5 Year Cycle
	Monarch Butterfly/Pollinator surveys	March 2018 - November 2023	LFA, NFH, WFH, Northeast, Northwest, South, Southeast, Southwest MUs and Belton Lake	Annually
	Avian Mission-Sensitive Species Surveys	January 2018 - December 2023	LFA, NFH, Northeast, Northwest, South, Southeast, Southwest MUs	Annually
	Whooping Crane Surveys	March 2018 - November 2023	Bodies of water in the Southeast areas and Belton Lake	Annually

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Chapter 7 National Environmental Policy Act Compliance and Integration

7.1 Introduction

This integrated EA is prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 (42 US Code [U.S.C] 4321 et seq.), the Council on Environmental Quality (CEQ) *Regulations Implementing the Procedural Provisions of NEPA* (40 Code of Federal Regulations [CFR] Part 1500-1508), and the Army NEPA Regulation (*Environmental Analysis of Army Actions*; 32 CFR Part 651, 1 January 2007).

Under NEPA and its implementing regulations, Federal agencies are required to consider the environmental impacts of major proposed actions in the form of an EA or EIS. This NEPA analysis records the development process for and evaluates the potential environmental effects of implementing the updated INRMP for Fort Hood. This INRMP updates the 2014-2018 INRMP and specifies the land management practices and adaptive management strategies that will conserve ecological integrity, Army training, and promote the health of Fort Hood's lands.

NEPA regulations collectively establish a process by which the Army considers the potential environmental impacts of its proposed actions and invites the involvement of regulators and interested members of the public prior to deciding on a final preferred course of action. As such, this EA will facilitate the decision-making process regarding this INRMP. This EA will also provide the basis for determining if a Finding of No Significant Impact (FNSI) is appropriate, or if an EIS is required in accordance with the above regulations.

The Army's approach to natural resources management is embodied in its vision of the relationships between its military mission and the natural resources upon which that mission depends. Together, natural resources professionals and military personnel will strive to promote the long-term ecological sustainability of Fort Hood for multiple-use opportunities.

7.2 INRMP and NEPA Integration

Army guidelines recommend that the INRMP and its associated NEPA analysis and documentation be prepared concurrently. Recognizing the efficiencies in cost and time that could be realized from a fully integrated approach to the planning development process, Fort Hood has fully integrated this INRMP and its associated NEPA analysis and documentation into a single report. Combining an INRMP and its associated EA is the preferred approach for integrating environmental analysis and documentation. This approach embraces the intent and spirit of NEPA, as well as the requirements of 32 CFR Part 651 and AR 200-1.

To allow the reader to readily identify elements of the NEPA analysis, **Table 7-1** presents a "road map" to the corresponding EA sections embodied in this document. All remaining sections pertain primarily to the INRMP.

Table 7-1. Road Map Indicating NEPA Analysis and Corresponding INRMP Sections

Required NEPA Analysis	Corresponding INRMP Section
The **Executive Summary** briefly describes the proposed action, environmental consequences, and mitigation	Provided immediately
The **Purpose of and Need for the Proposed Action** summarizes the Proposed Action's purpose, explains why the action is needed, and describes the scope of the environmental impact analysis process.	**Section 7.3**
Scope of Analysis describes the scope of the environmental impact analysis process.	**Section 7.4**
Description of the Proposed Action and Alternatives describes the Proposed Action of implementing the INRMP (i.e., the selected management measures) and alternatives to implementing the Proposed Action.	**Section 7.5**
Affected Environment describes the existing environmental setting.	**Chapters 2.0** and **4.0**
Environmental Consequences identifies potential environmental effects of implementing the Proposed Action and the No Action Alternative.	**Section 7.7**
References provides bibliographical information for cited sources.	**Appendix A**
Agency Correspondence includes the persons and agencies consulted during preparation of this INRMP/EA, recipients of this INRMP/EA, and agency consultation letters.	**Appendix D**

7.3 Purpose of and Need for the Proposed Action

The purpose of updating and implementing the INRMP is to meet the requirements of the Sikes Act (Title 16, U.S.C 670a et seq.) as amended, which provides the primary legal basis for the Secretary of Defense to carry out a program for the conservation and rehabilitation of natural resources on military installations. To facilitate such a program, the Act requires the Secretary of each military department to prepare and implement an INRMP at appropriate military installations throughout the United States under their respective jurisdictions. Moreover, such plans shall be prepared in cooperation with, and reflect the mutual agreement of, the Secretary of the Interior (acting through the Director of the USFWS) and the head of each appropriate State fish and wildlife agency for the State(s) where the military installation is located.

According to the Sikes Act, the INRMPs must address the following:

- The management of land, forests, fish and wildlife, and fish and wildlife-oriented recreation;
- Wetland protection and enhancement;
- Fish and wildlife protection and enhancement or modification;

- Sustainable public use of natural resources and public access for such use (subject to requirements necessary to ensure safety and military security);
- Integration of and consistency among the various activities conducted under the INRMP;
- Natural resources management goals, objectives, and time frames for this Proposed Action;
- Enforcement of applicable natural resources laws (including regulations);

- No net loss of the capability of the installation to support the military mission;
- Other activities as the Secretary of the Army determines appropriate.

Fort Hood has ensured that the 2019-2023 INRMP has met the Sikes Act requirement as listed above. The focus of the INRMP is to be ecosystem based, rather than management for single-species or resource. To ensure that Fort Hood can meet its mission needs now and into the future, the natural resources that provide the training environment must be managed such that they are ecologically sustainable. Updating and implementing the INRMP ensures that desired future conditions, which envision all aspects of a future ecosystem and include conservation and military mission related needs, are integrated and consistent with applicable Federal and State stewardship requirements. Fundamentally, the INRMP represents a proactive approach in assuring training over the long-term continues through the sustainability of natural resources.

7.4 Scope of the Environmental Assessment

This EA provides a detailed comparative analysis of the following alternatives:

> **Proposed Action** – Implement the updated 2019-2023 INRMP defined in **Section 7.5.1** to fulfill the assigned environmental protection requirements of Fort Hood. This is Fort Hood's preferred alternative.
>
> **No Action Alternative** – Continue natural resources management under the 2014-2018 INRMP.

The following resources were identified and analyzed for the Proposed Action and No Action Alternative: land use, air quality, noise, geology, soils, water resources, biological resources, cultural resources, socioeconomics, environmental justice, facilities, and hazardous and toxic materials/wastes. This EA also considers the cumulative effects of the Proposed Action when added to other past, present, and reasonably foreseeable actions within the region.

As specified under NEPA and CEQ Regulations 40 CFR 1500-1508, a monetary cost-benefit analysis is not required as part of the EA. The Proposed Action and its alternatives have been developed based on Federal and State environmental regulations and mission requirements. As such, no quantitative financial assessment has been performed.

7.5 Description of the Proposed Action and Alternatives

7.5.1 Proposed Action

The Proposed Action is to implement the updated 2019-2023 INRMP for Fort Hood. This action would meet the Army's underlying need to train Soldiers in a sustainable setting that complies with current environmental regulations and policies. The proposal includes natural resources management measures involving geographic areas associated with the contiguous properties of the installation. The INRMP is a "living" document that will be modified (adaptively managed) over time. The Proposed Action focuses on a 5-year planning period, which is consistent with the time frame for the management objectives described in the INRMP. The Proposed Action involves putting in place the management goals, objectives, and projects presented in **Chapters 4.0** and **6.0**.

Additional environmental analyses might be required as new management objectives are developed over the long term (beyond 5 years). Implementation of some INRMP related projects might also require evaluation to determine the need for and appropriate level of NEPA documentation.

7.5.2 No Action

The No Action Alternative would not immediately change management direction or the level of management intensity. Under the No Action Alternative, Fort Hood would continue to operate using existing programs and management practices in accordance with the 2014-2018 INRMP. Current management measures for natural resources would remain in effect, and existing conditions would continue as the status quo. The No Action Alternative includes the existing INRMP that has not been updated and would fail to meet the described purpose and need. CEQ regulations prescribe inclusion of a No Action Alternative, which serves as a benchmark against which proposed Federal actions can be evaluated.

7.5.3 Alternatives Eliminated from Further Consideration

The selection of management measures within the INRMP involved a screening analysis of resource-specific management alternatives. The screening analysis involved the use of accepted criteria, standards, and guidelines when available, as well as best professional judgment, to identify management practices for achieving Fort Hood's natural resources management objectives. The outcome of the screening analysis led to the development of the Proposed Action. Obviously, an infinite number of permutations of specific management alternatives are possible. Consistent with the intent of NEPA, this process focused on considering a reasonable range of resource-specific management alternatives and, from those, developing a plan that could be implemented, as a whole, in the foreseeable future. It then omitted from detailed analysis management alternatives deemed to be infeasible.

Management alternatives considered during the screening process, as is the rationale for their being omitted from detailed analysis are summarized as follows.

Conservation Law Enforcement. Fort Hood is a large, open installation that demands intensive vigilance and patrol to ensure compliance with all laws, regulations, and policies. Current Natural Resources Law Enforcement staffing levels are minimally sufficient to provide adequate

protection. Because a less-intensive management approach to law enforcement would not afford a sufficient level of protection and compliance, this approach was not considered.

Soil, Erosion, and Sedimentation. Intensive management measures are proposed for the soil resources on Fort Hood under the Proposed Action. Other soil management alternatives that represented a program consisting of fewer, and less intensive, management measures were considered but rejected. The other management alternatives considered represented the minimum approach to achieving a soil management program that could comply with the guidelines established in AR 200-1. The management alternatives in the minimum approach were aimed at controlling or reacting to erosion, soil loss, and disturbance that could occur, rather than taking the proactive steps necessary to prevent, to the maximum extent practicable, the likelihood of such events occurring. Given that nearly 87 percent of the soils on Fort Hood are vulnerable to erosion, this minimal approach to soil management was rejected. The intensive use of tracked and wheeled vehicles requires continuous vegetative cover, and the ability to sustain this cover over the long term could be jeopardized by a minimal management approach and severe climatological events (e.g., heavy rains and wind). The effort and resources necessary to implement the proposed approach are a prudent investment toward ensuring the long-term sustainability of the soil resources.

Water Resources. A less intensive approach to water resource management was considered but rejected. The CWA has severe regulatory implications for noncompliance that could adversely affect the ability of Fort Hood to support its mission. In addition, potential liability is associated with not knowing the conditions of water from which people catch and eat fish, and drink. These conditions warrant implementing the intensive water monitoring program described under the Proposed Action.

Sensitive Species. Because protection of Federally listed species is mandated by Federal law and protection of State-listed and rare species is required by Army regulation, other management alternatives that would have afforded less protection to these species were not considered. A lower-intensity management approach to listed species would include reducing or easing management for these species altogether. That management approach was rejected because it would not comply with the spirit of AR 200-1 or comply with the agreed-upon provisions of the ESMC and the 2015 BO.

Species that are candidates for Federal listing or are State-listed as threatened, endangered, or of special concern are not protected under the ESA. However, because candidate species might be listed in the future, installations are required to avoid taking actions that result in the need to list these species and are encouraged to participate in conservation agreements with the USFWS. For State-listed species, installations are encouraged to cooperate with State authorities in efforts to conserve these species.

Because Army regulations require protection of Federal and State-listed and rare species, other management alternatives that would have afforded less protection to these species were not considered. A lower-intensity management approach would include reducing or ceasing management for these species and their habitat altogether. That management approach was rejected because it would not comply with proactive management to preclude listing.

Recreation. A management alternative that included more intensive measures to enhance recreational opportunities was considered but rejected. The most resource-efficient management approach is to focus on maintaining and improving the ecological integrity of terrestrial and aquatic habitat. Therefore, a higher-intensity management alternative would not be a prudent use of resources.

Fisheries Management. Restricting access to the riparian and aquatic areas at Fort Hood was considered, but it was rejected because training restrictions in those areas would impede training under realistic conditions. Improving water crossings for all the streams to protect the integrity of the aquatic habitats was also considered. However, the more prudent allocation of resources involves prioritizing stabilization projects based on need. In addition, ground-disturbing activities associated with such projects could contribute additional sediment loads and disturb aquatic habitats during the stabilization process. It is possible to protect, conserve, and enhance the aquatic habitats at Fort Hood to ensure long-term ecological integrity, support healthy fish populations, and provide recreational opportunities without placing undue restrictions on the military mission. Therefore, implementation of these other management alternatives is not necessary.

A more intensive (and traditional) approach to fisheries management, in which management techniques focus on more intensive manipulation of the food chain, gamefish stocks, and increased levels of stocking, was considered. This intensive or traditional approach to fisheries management is costly and less effective in the long term than the approach presented under the Proposed Action. Habitat improvement and protection measures are far more effective than intensive stock manipulation, and they have a higher probability of producing long-term improvements in the quality of recreational fishing at relatively low costs.

Game Management. A lower-intensity approach to game management, in which management techniques would be minimized and implemented on a smaller scale, was considered. Under a lower-intensity management approach, fewer steps would be taken to manage wildlife resources and management would more closely resemble the status quo, or less. Although the effect of such a course of action would be gradual and not immediately apparent, the long-term impacts could be very detrimental to the military mission and to biodiversity. Ultimately, the ability of the installation to manage wildlife populations with accepted scientific methods and support the mission would be impaired. Furthermore, it is conceivable that with a lower-intensity management scheme additional species might become Federally listed, resulting in additional training restrictions. Thus, lower-intensity management was eliminated from further consideration.

Flora and Habitat. A higher-intensity approach to vegetation management, in which management techniques similar to the Proposed Action would be implemented on a larger scale, was considered. Under this alternative, the acreage of training lands defined as critical areas and potential critical areas would be increased and more of these areas would be repaired and revegetated annually. Moreover, additional training lands would be included in the TRAP and tighter restrictions on cattle grazing would be implemented. However, such an increase in the intensity of vegetation management would have an adverse effect on the area of land available for training, and deferment of grazing activities is not possible due to a lack of fencing in the training areas.

As a result of the adverse effects on training, this alternative was eliminated from further consideration.

Under a lower-intensity management approach, fewer steps would be taken to manage vegetation. For example, the area of land in the TRAP would be decreased or the program would be eliminated completely. The effort and resources expended to identify and repair degraded lands would be decreased. This alternative would quickly result in the degradation of the training lands, proving detrimental to the military mission. In addition, increased erosion and sedimentation would adversely affect water resources, aquatic habitat and biological communities, overall biodiversity, and karst habitats and the sensitive species that inhabit them. A lower intensity of management would also subvert Fort Hood's goal of environmental sustainability of its training lands. Thus, lower-intensity vegetation management was also eliminated from further consideration.

Forest/Woodland Management. More intensive management efforts were considered but rejected. More efforts to manage the forests and woodlands at Fort Hood would direct limited funds and resources away from programs requiring more intensive management. Use of herbicides on species other than jujube and mesquite were rejected due to the need to minimize pesticide use as well as the need to allow re-growth of native species in areas where training activities are low.

Wildland Fire Management. The fire management and prescribed burning measures proposed for Fort Hood are those minimally required for effective fire management and protection of endangered species habitat. Other management alternatives that require more or less aggressive fire management were considered but rejected. Because accidental fires result from the use of pyrotechnics and some types of ammunition during training, a more conservative alternative would involve increasing the restrictions on the use of pyrotechnics and ammunition or eliminating their use altogether. This management strategy would place an unacceptable level of restriction on training activities and the military mission, and therefore was rejected. This conservative approach would also attempt to extinguish all wildfires outside the impact area regardless of whether they posed a direct threat to endangered species habitat, human health, or facilities. This approach could allow fuel loads to build to levels that would make it difficult to quickly and safely extinguish future fires. The fires of 1996 occurred during a time when fuel loads were very high and resulted in extremely hot fires that were difficult to contain and extinguish. These extreme wildfires adversely affected training and destroyed a significant amount of endangered species habitat. The let-burn policy will assist in maintaining fuel loads at more manageable levels that should not result in extreme and difficult-to-control fires.

Agricultural Leases. Less intensive management alternatives were considered but rejected. Overuse by cattle in the past has resulted in degraded rangeland vegetative cover, eroded training lands, and numerous interruptions of training exercises. Applying a more liberal use of training lands for grazing could adversely affect the long-term sustainability of training lands and increase interruptions of training. Measures to protect the golden-cheeked warbler are required to ensure compliance with the ESA and BO.

More intensive management alternatives were also considered but rejected. Fort Hood has had a long-standing relationship with the local cattlemen and is committed to providing multiple uses

of its resources. More conservation management alternatives are not necessary provided that overuse does not adversely affect the long-term sustainability of the training lands and that sediment loads to the water resources serving the surrounding communities do not degrade water quality, aquatic habitat, and water supply capacity.

Integrated Pest Management. The pest management measures in use at Fort Hood, as described in the IPMP, are relatively low in intensity. Lowering that intensity further would not provide sufficient control of invasive species and nuisance animals, which would create a potential for those species to adversely affect Fort Hood and increase human health risks. More intensive pest management measures would result in increased usage of pesticides. This would be counterproductive and counter-directive to the Army's goal of reducing pesticide usage. More aggressive efforts to eliminate pests such as exotic and invasive species might further reduce their populations in targeted areas, but the small incremental benefit would not offset the significant implementation costs. Therefore, higher-intensity management approaches were also dropped from further consideration.

Noxious Weeds and Invasive Species. Intensive invasive species management measures have resulted in increased usage of pesticides and herbicides, as well as hunting and trapping of feral animals. More aggressive efforts to eliminate exotic and invasive species might further reduce their populations in targeted areas, but the benefit would not offset the significant implementation costs. Therefore, higher-intensity management approaches were dropped from further consideration.

Application of this screening process in developing the Proposed Action (implementation of the management measures contained in the 2019-2023 INRMP), eliminated the need to define and evaluate hypothetical alternatives to plan implementation. As a result, less-intensive and more- intensive management measures were eliminated from further consideration, and this EA formally addresses only two alternatives, the Proposed Action (implementation of this INRMP) and the No Action Alternative.

7.6 Statement of Preferred Alternative

According to 40 CFR Section 1502.14(e), the Army must identify its preferred alternative. This statement serves as identification of the "Proposed Action" as Fort Hood's preferred alternative.

7.7 Affected Environment and Environmental Consequences

This section identifies potential direct, indirect, and cumulative effects of the Proposed Action and No Action Alternative on each resource.

This is a "focused EA," consistent with guidance issued by the CEQ at 40 CFR 1501.7(a)(3). In considering environmental and socioeconomic resources and conditions, the Army has determined that certain resources would not be affected by either the Proposed Action or No Action Alternative and, therefore, do not need to be evaluated in detail. The following resources would not be measurably affected by the Proposed Action or the No Action Alternative.

Air Quality. No effects would be expected. The primary concern regarding air quality and potential environmental effects pertains to increases in pollutant emissions; exceedances of National Ambient Air Quality Standards and other Federal, State, and local limits; and impacts on existing air permits. Potential effects on existing pollutant emissions are precluded by the fact that the Proposed Action does not involve any activities that would contribute to changes in existing air quality. Therefore, there would be no effects regarding air quality as a result of implementing the Proposed Action.

Noise. No effects would be expected. The primary concern regarding noise and potential environmental effects pertains to increases in sound levels, exceedances of acceptable land use compatibility guidelines, and changes in public acceptance (i.e., noise complaints). However, potential effects are precluded by the fact that the Proposed Action does not involve any activities that would affect noise conditions. Therefore, there would be no effects regarding noise levels or sound quality as a result of implementing the Proposed Action.

Floodplains. No effects would be expected. The primary concern regarding floodplains is construction within and loss of floodplain capacity. The Proposed Action does not involve any activities that would involve construction within the floodplains of Fort Hood; therefore, there would be no effects as a result of implementation of the Proposed Action.

Coastal Zone Contingency. No effects. Congress enacted the Coastal Zone Management Act to protect the coastal environment from growing demands associated with residential, recreational, commercial, and industrial uses. According to the Texas General Land Office, Fort Hood is not located in the Texas Coastal Zone.

Socioeconomic Resources. No effects would be expected. The Proposed Action would not involve any activities that would contribute to changes in population, housing, industry earnings and employment, or personal income.

Environmental Justice. No effects would be expected. Implementation of the Proposed Action would not create any advantage or disadvantage for any group or individual and would not create disproportionately high or adverse human health or environmental effects on children or minority or low-income populations at, or surrounding Fort Hood.

Facilities. No effects would be expected. All facilities would continue to be maintained and operated in accordance with required permits and capabilities of the systems. Under the Proposed Action, the demand for utilities and roads would not be expected to increase and therefore would not adversely affect existing facilities.

Hazardous and Toxic Materials. No effects would be expected. All hazardous and toxic materials would continue to be handled in accordance with Federal laws and Army regulations, including the Resource Conservation and Recovery Act; the Federal Insecticide, Fungicide and Rodenticide Act; the Toxic Substances Control Act; and AR 200-1. Thus, no adverse effects regarding the generation of hazardous and toxic materials would be expected under the Proposed Action.

7.7.1 Land Use

The current land uses at Fort Hood are outlined in **Section 2.2** of the INRMP.

Effects of the Proposed Action

Beneficial effects would be expected. Under the Proposed Action, Fort Hood would continue to pursue and implement an effective ACUB, which would limit urban sprawl and reduce potential encroachments on the military mission.

Effects of the No Action Alternative

Moderate adverse effects would be expected. Without pursuit of the ACUB program as proposed in the INRMP, urban sprawl could be expected to continue along Fort Hood's borders resulting in further encroachments on the military mission.

7.7.2 Soils

Soils, sedimentation, and erosion are discussed in detail in **Section 4.4**.

Effects of the Proposed Action

Beneficial effects would be expected. By implementing a comprehensive soil resource management program, impacts on soils associated with erosion and sedimentation on Fort Hood would be minimized. As part of the Proposed Action, existing sites where erosion has been determined to be a problem would be addressed through the RCMP and the TRAP Program. In addition, monitoring soil conditions to identify potential problem areas, implementing conservation measures, improving the type and area of vegetative cover, managing cattle grazing, and, when possible, avoiding activities likely to result in erosion would minimize potential impacts on the soil resource and result in a reduction in erosion at Fort Hood.

Effects of the No Action Alternative

No effects would be expected. Current resource management measures would continue to monitor soil conditions and erosion and sedimentation rates on the installation and evaluate conservation measures to reduce these rates. In addition, the RCMP and TRAP Program would continue to address problematic erosion sites.

7.7.3 Water Resources

The current condition of water resources at Fort Hood are discussed in detail in **Section 4.6**.

Effects of the Proposed Action

Water Quality. Beneficial effects would be expected. Implementing a comprehensive sampling and assessment plan and developing a database would allow Fort Hood to readily track the status and trends of water and habitat quality in the training areas and provide a methodology for evaluating the effectiveness of BMPs. The Proposed Action also facilitates the identification of problem areas with high erosion and sedimentation and maintains protective riparian buffer zones to prevent degradation of water resources and aquatic habitats.

Surface Water. Beneficial effects would be expected. The assessment of aquatic habitats at Fort Hood would provide a basis for developing a management program that would both protect

and enhance these habitats on the installation. Assessment of aquatic habitats would also provide a baseline that could be used in tracking the conditions and trends of these habitats, which would allow management practices to be applied where and when needed. The continued observance of riparian buffers around surface water bodies at Fort Hood would provide protection to habitats both in and adjacent to the resource. Where impacts on aquatic habitats occur as a result of mission activities, management objectives would provide for the timely mitigation of the impacts. Beneficial effects could be expected as a result of the development of a plan to monitor and control aquatic vegetation before it becomes a significant problem.

Wetlands. Beneficial effects would be expected. Implementation of the Proposed Action would protect wetlands by providing a basis to evaluate and monitor habitat conditions through the development of a wetlands management plan. Maintaining buffers would continue to minimize potential impacts on wetlands associated with adjacent activities. Additional efforts would be made to reduce impacts on wetlands by planning mission activities, when possible, in a manner consistent with wetland protection objectives. Where current activities might be affecting wetland functions, efforts would be made to identify the types and sources of impacts; where applicable, restoration of affected habitats would be implemented.

Effects of the No Action Alternative
No effects would be expected. Current resource management measures would continue to monitor and enhance water quality aquatic habitat, and wetlands on the installation.

7.7.4 Sensitive Species

Federally-listed threatened and endangered species and other species, not Federally-listed, that are declining and appear to be in need of conservation in order to sustain Fort Hood's military mission in the near-term or foreseeable future are discussed in detail in **Section 4.7**.

Effects of the Proposed Action
Beneficial effects on all Federally listed species at Fort Hood would be expected. Current natural resources management practices do meet the minimum requirements of the ESA and limit incidental take of endangered species and their habitat to the minimum necessary to implement projects on the installation and consider the loss of habitat due to wildfire. Implementation of the Proposed Action would provide additional and expanded protection and management for these species. Furthermore, these species would be treated with added importance and valued for their contributions to the unique natural heritage of Fort Hood.

An emphasis on mechanical, cultural, and biological techniques to manage invasive/exotic species would reduce the overall probability that listed species are harmed, directly or indirectly, by the spreading of invasive/exotic species. Use of the pest management techniques outlined in the integrated pest management guidance would be expected to protect sensitive species in and around specific project sites. No pest management operation that has the potential to adversely affect protected species or their habitats would be conducted without prior coordination with the USFWS. Actions for natural resources management under this alternative would be more proactive than reactive and would be expected to allow fewer impacts than the other alternatives.

Effects of the No Action Alternative
No effects would be expected. The current management of Federally listed endangered species would continue in accordance with the ESMC and the 2015 BO issued by USFWS.

7.7.5 Fish and Wildlife

Current MBTA management, fish and wildlife management, game management, and non-game management at Fort Hood is discussed in detail in **Sections 4.8** and **4.9**.

Effects of the Proposed Action
All the projects composing the Proposed Action are designed to mimic or enhance natural processes and would be expected to enhance fish and wildlife resources in general. There is a high potential for beneficial results from these management activities. The Proposed Action would provide management of fish and wildlife resources at Fort Hood on an integrated basis. The INRMP uses an ecosystem management strategy to achieve biological diversity while emphasizing the use of native species for restoration activities. The programs incorporated into various management plans under this INRMP include protection from wildfires, monitoring of a variety of plants and animals, and minimization and repair of damage to habitats from training activities.

Beneficial effects would also be expected to terrestrial habitat. From this perspective, implementation of the Proposed Action would result in improved terrestrial habitat conditions for wildlife because maintaining a high level of habitat diversity is a priority of the INRMP. Implementation of the Proposed Action would result in improved quality of perennial cover, expansion of native species, and control of non-native invasive species at Fort Hood.

Effects of the No Action Alternative
No effects would be expected. Current resource management measures would continue to maintain and potentially increase the abundance and biodiversity of wildlife, protect and enhance wildlife habitats (aquatic, riparian, wetland, and terrestrial), and increase the quality and complexity of the habitat.

7.7.6 Vegetation

Current vegetation cover types and management activities are discussed in detail in **Section 4.10**.

Effects of the Proposed Action
Moderate adverse impacts to vegetation would be anticipated as the result of the WSM Program implemented by ITAM. However, implementation of the Proposed Action, which limits construction that includes, but is not limited to, land maintenance, repairs, restoration, and reconfiguration, during the endangered species and migratory bird nesting seasons, would minimize adverse effects to these species. Loss of vegetation would be a temporary adverse effect, as vegetation re-growth would occur.

Effects of the No Action Alternative
Moderate adverse impacts to vegetation as described for the Proposed Action would continue under the No Action Alternative as a result of the continuation of the existing WSM Program.

7.7.7 Cultural Resources

The status of cultural resources is discussed in detail in **Section 4.15.3**.

Effects of the Proposed Action

Beneficial effects on the cultural resources at Fort Hood would be expected. The primary concern regarding these resources pertains to protecting prehistoric and historic sites within the boundaries of Fort Hood. Implementation of the Proposed Action provides for consultation and coordination with the Cultural Resources Manager prior to the initiation of any activity that might affect historic or cultural resources. The purpose of the consultation is to determine whether historic or cultural resources are in close proximity to the proposed activity and whether the activity would have the potential to adversely affect those resources. Under the Proposed Action, the probability of disturbing potential cultural resources would be greatly reduced.

Effects of the No Action Alternative

No effects would be expected. The current management of cultural resources on the installation would continue in accordance with the ICRMP. The existing INRMP also requires consultation and coordination with the Cultural Resources Manager prior to the initiation of any activity that might affect historic or cultural resources.

7.7.8 Cumulative Effects

In 40 CFR 1508.7, the CEQ defines *cumulative effects* as the "impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions regardless of what agency (Federal of non-Federal) or person undertakes such other actions."

Several proposed projects on and near Fort Hood warrant identification:

- Mission Training Center, estimated completion date January 2020
- OTC Lab and Test Building, estimated completion date Spring 2019
- Infantry Platoon Battle Course, estimated completion date Fall 2019
- Clabber Creek Range Projects, estimated completion date April 2018
- Renovation of 1CD HQ, Building 28000, estimated completion date fall 2018 (construction), spring 2019 (equipment, furnishings and accreditation)
- Renovation of H-Frame Barracks, 9200 Block, four barracks with central energy plant, estimated completion date fall 2018
- Renovation of Hangar 90033, estimated completion date summer 2018
- Renovation of 1st CAV Washrack, estimated completion date summer 2018
- Replacement of Georgetown Road Bridge at Cowhouse Creek, estimated completion date February 2018
- Robert Gray AAF Runway Repairs, estimated completion date June 2018
- Renovation of Rolling-Pin Barracks, 21000/41000 (5 barracks), estimated completion date Fall 2019

The USFWS has recognized that Fort Hood is critical to the recovery of the black-capped vireo and the golden-cheeked warbler and that conservation and protection of habitat for these species is essential to recovery. In addition, Fort Hood's endangered species biologists conduct important research on these endangered songbirds that can be used to further recovery efforts for the species and provide a greater understanding of the ecology of the warbler and vireo. Fort Hood has submitted and continues to receive REPI funds.

Fort Hood's karst habitats are home to karst/cavernicole species that are endemic to Fort Hood. Because Fort Hood is the only location currently known for these rare species, it is possible that without proactive management, monitoring and protection, the species, their habitat, and surface processes could become candidates for listing under the ESA. This could then lead to increased restrictions on training activities at Fort Hood.

Implementation of the INRMP would result in a comprehensive environmental strategy for Fort Hood that represents compliance, restoration, prevention, and conservation; improves the existing management approach for natural resources on the installation; and meets legal and policy requirements consistent with national natural resources management philosophies. Over time, adoption of the Proposed Action would enable Fort Hood to achieve its goal of maintaining ecosystem viability and ensuring the sustainability of desired future conditions.

Fort Hood can be viewed as an island of generally stable, well-managed natural systems surrounded by areas of varying levels of growth and development. Although growth and development can be expected to continue in the areas surrounding Fort Hood, the environmental effects, although possibly adversely affecting natural resources within the ecoregion, would not be expected to result in cumulatively adverse effects on these resources when added to the effects of activities associated with the proposed management measures contained in the INRMP.

7.8 Comparison of Alternatives and Conclusions

This section provides a summary matrix of the potential effects of the Proposed Action and the No Action Alternative. By including this matrix, this EA complies with CEQ's 40 Most Frequently Asked Questions (Number 7) and 40 CFR Part 1502.14. This section presents the environmental, cultural, and socioeconomic effects of the alternatives in comparative form, thus sharply defining issues and providing a clear basis for choice among options by the decision-maker and the public (40 CFR Part 1502.14). This matrix is drawn from the Environmental Consequences analysis (**Section 7.7**).

In summary, the EA findings are consistent with the goals of the natural resources management program to ensure the long-term sustainability of desired military training area conditions; to maintain, protect, and improve ecological integrity; to protect and enhance biological communities, particularly sensitive, rare, threatened, and endangered species; to protect the ecosystems and their components from unacceptable damage or degradation; and to identify and restore degraded habitats. The management measures recommended by the INRMP, if implemented, would directly and positively affect the health and condition of natural resources at Fort Hood.

Table 7-2. Potential Environmental Effects of the Alternatives

Technical Resource Area	No Action Alternative	Proposed Action
Air Quality	No effects	No effects
Noise	No effects	No effects
Floodplains	No effects	No effects
Texas Coastal Zone	No effects	No effects
Socioeconomic Resources	No effects	No effects
Environmental Justice	No effects	No effects
Facilities	No effects	No effects
Hazardous and Toxic Materials	No effects	No effects
Land Use	Short-term, less than significant adverse effects	Long-term, beneficial effects
Soils	No effects	Long-term, beneficial effects
Water Resources	No effects	Long-term, beneficial effects
Sensitive Species	No effects	Long-term, beneficial effects
Fish and Wildlife	No effects	Long-term, beneficial effects
Vegetation	Short-term, less than significant adverse effects	Short-term, less than significant adverse effects
Cultural Resources	No effects	Long-term, beneficial effects
Cumulative Effects	Adverse effects	Long-term, beneficial effects

Analysis of the existing (baseline) conditions identifies no serious environmental concerns. In addition, AR 200-1 requires installations to conduct a major revision of "all parts" of their INRMPs every 5 years. An annual review has been required to track any changes and evaluate effectiveness with the USFWS and appropriate State agencies. Each INRMP must be reviewed for operation and effect at least every 5 years. Therefore, implementation of the No Action alternative is not favored.

The evaluation performed within this EA concludes that there would be no significant adverse effects, either individually or cumulatively, to environmental, cultural, or socioeconomic resources as a result of the implementation of the Proposed Action. Overall, beneficial impacts are anticipated. This EA's analysis determines, therefore, that an EIS is unnecessary for implementation of the Proposed Action, and that a FNSI is appropriate (see **Appendix E**). This EA recommends implementation of the Proposed Action.

7.9 Interagency Coordination and Review

Once the INRMP was been drafted, this EA was used as a tool to inform decision makers and the public of the likely environmental and socioeconomic consequences of implementing the Proposed Action and alternatives. In addition, Fort Hood provided for public participation in the NEPA process to promote open communication and better decision making.

Public Participation. Public notices were published in the *Killeen Daily Herald* newspaper. All documents were posted on the Fort Hood website (http://www.hood.army.mil/DPW/) under the public notices section. Requests for further information on this EA/draft FNSI and comment submissions were directed to the NEPA Program-ENV Division, Directorate of Public Works, Building 4622 Engineer Drive, Fort Hood, Texas 76544 or email charlotte.f.baldwin.civ@mail.mil or timothy.w.buchanan2.civ@mail.mil.

Decisions to be Made. The decision maker will consider both the environmental and socioeconomic impacts analyzed in this EA, along with all other relevant information, such as public issues of concern that arise during the comment period, prior to making a final decision. If the decision maker determines there are no significant impacts, that decision will be documented in the final FNSI, which will be signed no earlier than 30 days after the publication of this EA and draft FNSI. If the decision maker determines that the decision could have significant impacts, the Army may initiate a NOI to complete an EIS to conduct additional analysis.

Appendix A. References

A1. List of Acronyms
A2. List of Literature Cited
A3. Summary of Changes to INRMP

A1. List of Acronyms

AACC	Area Access Control Center
AAF	Army Airfield
ACUB	Army Compatible Use Buffer
AIM	Adaptive and Integrated Management
AOU	American Ornithological Union
AR	Army Regulation
ATV	All-terrain Vehicle
AU	animal units
BCR	Bird Conservation Region
BCT	brigade combat team
BGEPA	Bald and Golden Eagle Protection Act
BLORA	Belton Lake Outdoor Recreation Area
BMPs	Best Management Practices
BO	Biological Opinion
BREC	Blackland Research Center
CAT	Critical Area Treatment
CEQ	Council on Environmental Quality
CIP	Common Installation Picture
CLEO	Conservation Law Enforcement Officer
CLEP	Conservation Law Enforcement Program
CLF	Compatible Lands Foundation
COR	Contract Officer Representative
CTCA	Central Texas Cattlemen's Association
CWA	Clean Water Act
DBH	diameter breast height
DES	Directorate of Emergency Services
DFMWR	Directorate of Family, Morale, Welfare, and Recreation
DoD	Department of Defense
DPTMS	Directorate of Plans, Training, Mobilization, and Security
DPW	Directorate of Public Works
EA	Environmental Assessment
ECO	Environmental Compliance Officer
EIS	Environmental Impact Statement
EMB	Environmental Management Branch
ESA	Endangered Species Act
ESMC	Endangered Species Management Component
ENV	Environmental Division
°F	degrees Fahrenheit
FHCRM	Fort Hood Cultural Resource Management
FNSI	Finding of No Significant Impact
FY	Fiscal Year
GC	Garrison Commander
GIS	Geographic Information Systems
GMU	Grazing Management Units
GPS	Global Positioning System

HPC	Historic Property Component
ICRMP	Integrated Cultural Resources Management Plan
IGI&S	Installation Geospatial Information & Services
INRMP	Integrated Natural Resources Management Plan
IMCOM	Installation Management Command
IPM	Integrated Pest Management
IPMC	Installation Pest Management Coordinator
IPMP	Integrated Pest Management Plan
IPRB	Installation Project Review Board
ITAM	Integrated Training Area Management
ITLM	Integrated Training Land Management
LFA	Live-Fire Area
LRAM	Land Rehabilitation and Maintenance
LSMP	Land Sustainment Management Plan
LUR	Land Use Regulations
MAS	Maneuver Access Structure
MBTA	Migratory Bird Treaty Act
MCOC	munitions constituents of concern
METL	Mission Essential Task List
MOI	Memorandum of Instruction
MOU	Memorandum of Understanding
MU	Management Unit
NCRMB	Natural and Cultural Resources Management Branch
NEPA	National Environmental Policy Act
NFH	North Fort Hood
NFWF	National Fish and Wildlife Foundation
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWCG	National Wildfire Coordinating Group
OACSIM	Office of Assistant Chief of Staff for Installation Management
PIF	Partners in Flight
PTRCI	properties of traditional religious and cultural importance
QAP	Quality Assurance Plans
RCMP	Range Complex Master Plan
REC	Record of Consideration
REC	Recreation Equipment Checkout
REPI	Readiness and Environmental Protection Initiative
RTLA	Range and Training Land Assessment
SAIA	Sikes Act Improvement Act
SC	Senior Command
SDE	Spatial Database Engine
SDSFIE	Standards for Facilities, Infrastructure, and Environment
SOC	Species of Concern
SRA	Sustainable Range Awareness
SWMP	Storm Water Management Plan
SWPPP	Stormwater Pollution Prevention Plan
TAMUS	Texas A&M University System

TCEQ	Texas Commission on Environmental Quality
TPDES	Texas Pollutant Discharge Elimination System
TPWD	Texas Parks and Wildlife Department
TRAP	Training Restricted Area Program
TRI	Training Requirements Integration
U of I	University of Illinois
USACE	U.S. Army Corps of Engineers
USACERL	U.S. Army Construction Engineering Research Laboratory
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WASH	Wildlife Air Strike Hazard
WDDT	Wildlife Detection and Dispersal Team
WFHTC	West Fort Hood Travel Camp
WHWG	Wildlife Hazard Working Group
WSM	Woody Species Management
WWC	Wildlife Watch Conditions

A2. List of Literature Cited

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A3. Summary of Changes to INRMP

(Changes since 2016-2017 Update)

Section	Page	Change
Cover		Dates changed to reflect coverage period. New cover designed.
Executive Summary		Rewritten and updated.
All sections	All pages	INRMP format has been changed based on new U.S. Army Environmental Command template.
1.4	1-5	Goals and objectives integrated into table format per new template (see Table 1-2).
1.5	1-7	Section revised based on new USFWS guidance (*Guidelines for Coordination on Integrated Natural Resources Management Plans [June 2015]*) and DoD guidance (*Guidelines for Streamlined INRMP Review [July 2015]*).
2.0 and 4.0		NCRMB GIS staff updated all figures throughout document to reflect most current data.
2.2.3	2-5	Moved Management Units section from "Prescriptions" section in previous INRMP. Updated Table 2-2 to reflect most current GIS data.
2.4	2-9	Brief overviews of climate, topography, hydrology, and ecoregions included in INRMP per new template.
2.5.2	2-10	Overview of the installation's history included in INRMP per new template. Information extracted from Fort Hood ICRMP.
2.6	2-11	Installation users and missions updated and incorporated into table format per new template (see Table 2-3).
3.1	3-3	Table 3-1 added per new template.
3.2	3-6	Information regarding external stakeholders incorporated into Table 3-2 per new template.
3.3	3-8	Internal Integration is a new section per template.
4.1	4-1	Geospatial Information System is a new section per template.
4.3	4-6	Climate Change is a new section per template.
4.4	4-9	NRCS references checked and updated. Sedimentation incorporated into this section per new template. Tank Trail Improvement and Critical Area Treatment added to bullets in Program History. 2017 RTLA report data incorporated into the Current Conditions.
4.5	4-18	Geology separated from soils section per new template. Section refers to Section 4.7.2 (Species of Concern) for karst management actions.
4.6	4-25	Permit information updated in Program History.

Section	Page	Change
4.7.1	4-27	Section revised to reflect currently listed threatened and endangered species information and data, including BCV as a delisted species. Smooth pimpleback mussel added to Table 4-8. Current Conditions section revised to reflect current population estimates for GCW and BCV.
4.7.2	4-34	Section revised to reflect current species of concern information and data. The previous INRMP had Karst Management as a separate section. Karst management has been integrated into this
4.8	4-41	Migratory Bird section expanded from previous INRMP. Inventory and Monitoring, Tables 4-12, 4-13 and Goals and Objectives added per new template.
4.8.1	4-47	Bald and Golden Eagle Protection Act is a new section per template.
4.9.2	4-52	Fish stocking record/table updated for FY 2017 (see Table 4-16).
4.9.4	4-58	Non-Game Management is a new section per template.
4.10.1	4-69	Vegetation cover and forest cover change acreages updated to reflect current data.
4.10.2	4-72	Results of 2016 USACE Forest Market Study added to Program Data Management section. "Conduct assessment to determine the viability of a Forestry Program on Fort Hood" removed from Table 4-22 as a goal and objective.
4.10.4	4-78	Ground Maintenance is a new section per template.
4.10.5	4-86	Table 4-28 updated with new acreage numbers.
4.11	4-89	Pest Management section expanded from previous INRMP version.
4-12	4-91	Malta star thistle, rescuegrass, slender-flowered thistle, woolly distaff thistle, field bindweed, bermudagrass, Horehound, yellow sweet clover, Scotch thistle, Callery pear, bastard cabbage, multiflora rose, blessed milk thistle, common chickweed, dandelion, spreading hedgeparsley, and flannel mullein added to invasive plant species of concern. Discussion regarding wild pigs incorporated into this section.
4.13	4-95	WASH is a new section per template.
4.14	4-98	Compatible Use Buffers and Conservation Easements is a new section per template.
5.1	5-1	Environmental Awareness is a new section per template.
5.2	5-4	Table 5-1 revised with updated personnel numbers.
6.0	6-1	Table reformatted per new template. Projects updated/new projects added.
7.0	7-1	Required NEPA documentation (EA) moved to a separate chapter of the INRMP and rewritten to address impacts for implementation of this INRMP.
Appendices		Reorganized per new template. List of Acronyms added to Appendix A1. Literature Cited updated in Appendix A2. Appendix B updated with new component plans and saved as a separate file because of file size (and per template recommendation). Appendix C updated with new species lists. Appendix D reserved for consultation. Appendix E new FNSI.

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Appendix B. Associated and Component Plans

B1. Endangered Species Management Component
B2. 2015 Biological Opinion
B3. Karst Management Plan
B4. MOI for Landscaping
B5. Tree Care Ordinance
B6. 2015 Grazing Lease
B7. Integrated Pest Management Plan
B8. RGAAF Wildlife Air Strike Hazard Plan
B9. Installation Compatible Use Zone Study
B10. Integrated Cultural Resources Management Plan
B11. 2017 Range Complex Master Plan

Appendix B is a separate file and can be sent to reviewers upon request. Requests should be directed to:

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Supervisor, Wildlife Management Team 254-287-1088
amber.l.dankert.civ@mail.mil

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Appendix C. Native Species on Fort Hood

C1. Bird Species

ABUNDANCE & PROBABILITY CODES

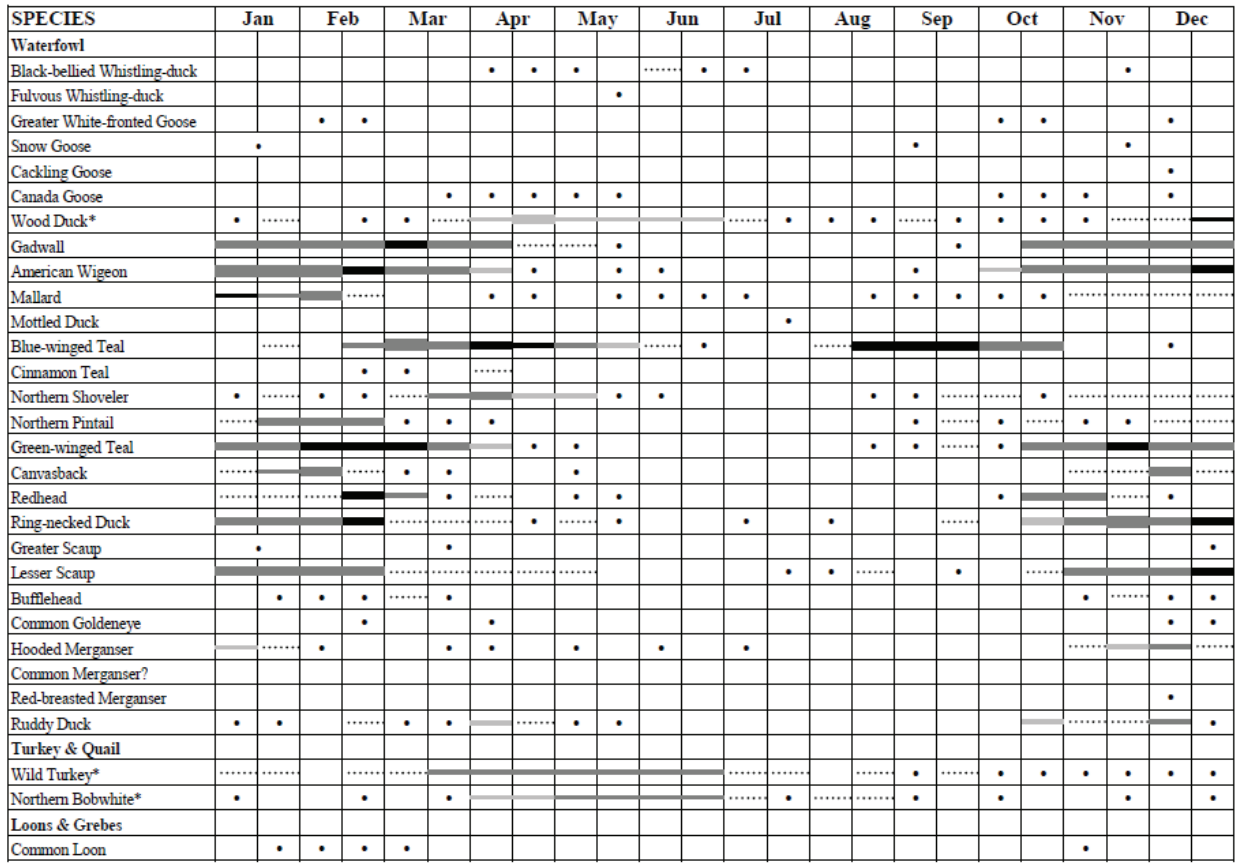
ABUNDANCE

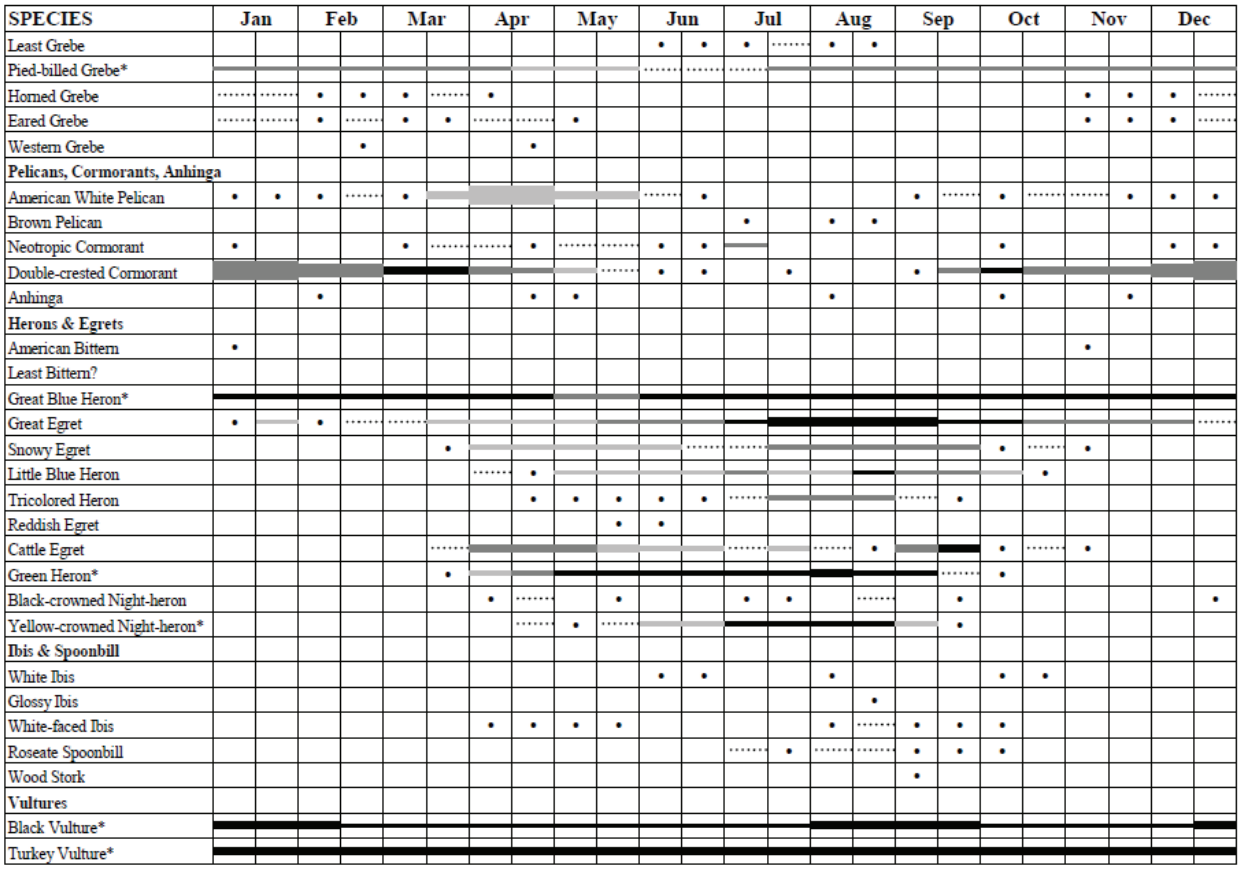
The average number of individuals to be expected in the appropriate habitats(s)

	Probability of Locating Typical Numbers		
	High	Medium	Low
	>70%	30-70%	<30%
101+ Birds			
51-100 Birds			
11-50 Birds			
1-10 Birds			

Additional Codes

• • • • • •	Casual - Not reported annually, typically reported every 2-5 years.
•	Accidental - Typically only 2-3 records
?	Has been reliably reported/documented on Fort Hood, but data on exact date of occurrence are missing.
*	Has been documented as breeding on Fort Hood.
c	Found primarily, if not almost exclusively, in cantonment areas.
c	More abundant and likely to be encountered in or near cantonment areas.

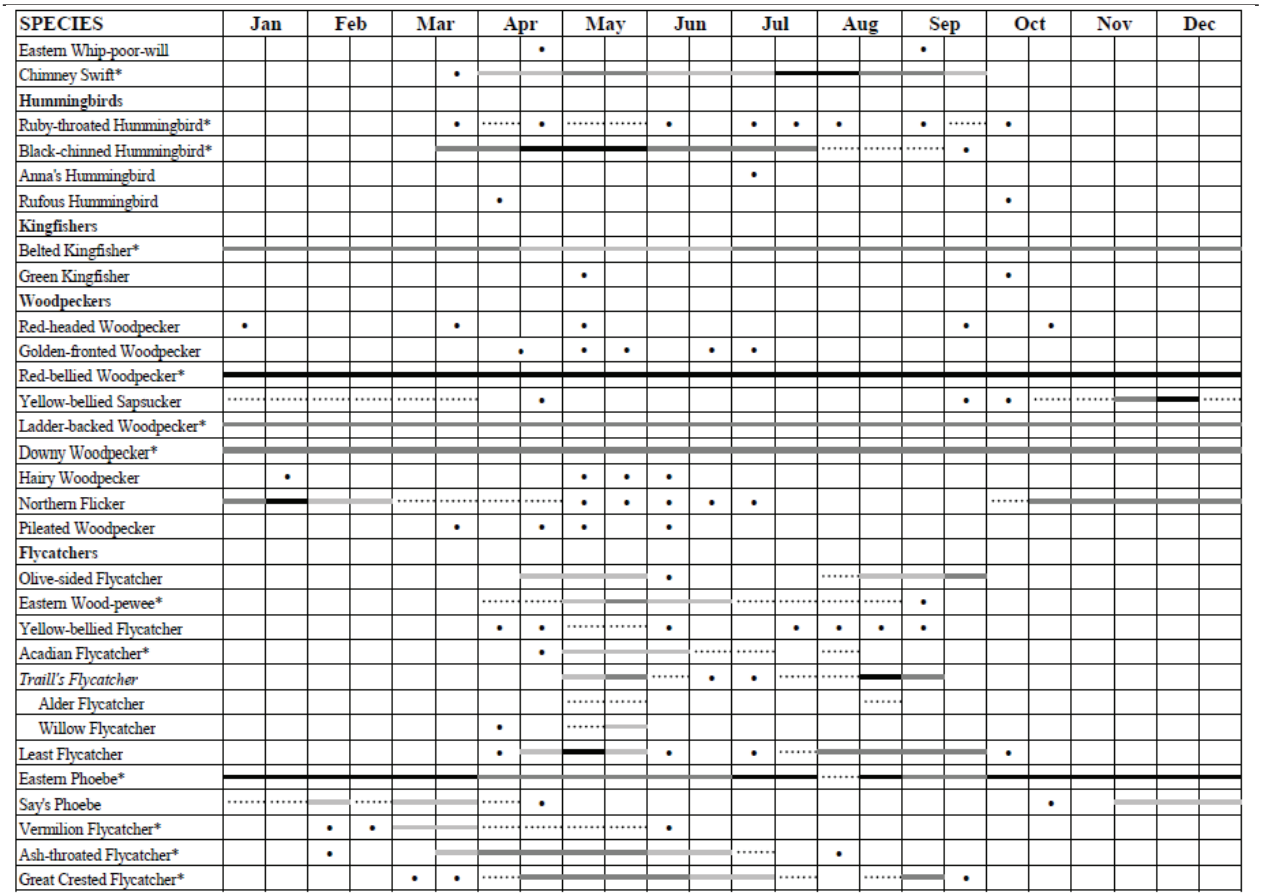

SPECIES
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Waterfowl
Black-bellied Whistling-duck
Fulvous Whistling-duck
Greater White-fronted Goose
Snow Goose
Cackling Goose
Canada Goose
Wood Duck*
Gadwall
American Wigeon
Mallard
Mottled Duck
Blue-winged Teal
Cinnamon Teal
Northern Shoveler
Northern Pintail
Green-winged Teal
Canvasback
Redhead
Ring-necked Duck
Greater Scaup
Lesser Scaup
Bufflehead
Common Goldeneye
Hooded Merganser
Common Merganser?
Red-breasted Merganser
Ruddy Duck
Turkey & Quail
Wild Turkey*
Northern Bobwhite*
Loons & Grebes
Common Loon

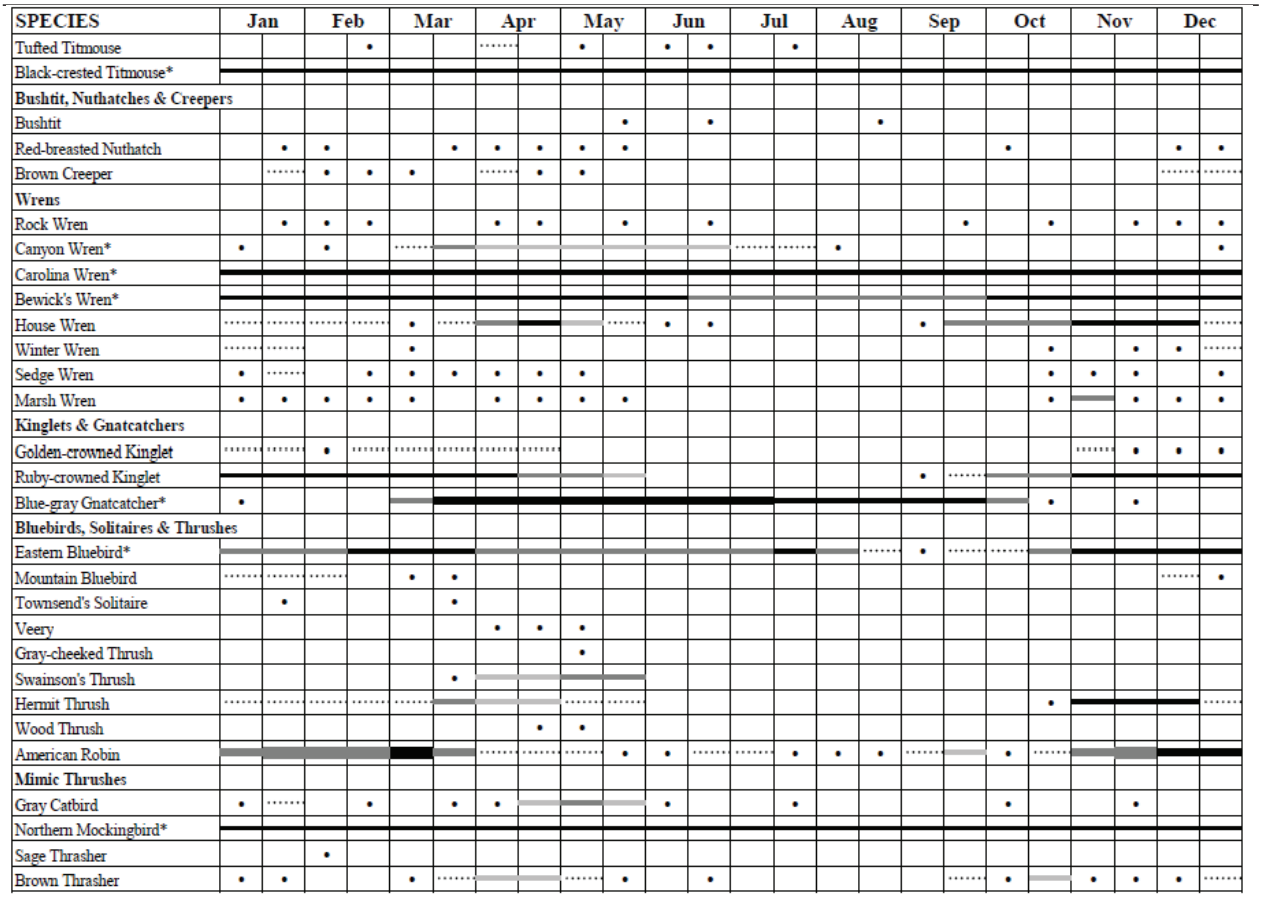

SPECIES
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Least Grebe
Pied-billed Grebe*
Horned Grebe
Eared Grebe
Western Grebe
Pelicans, Cormorants, Anhinga
American White Pelican
Brown Pelican
Neotropic Cormorant
Double-crested Cormorant
Anhinga
Herons & Egrets
American Bittern
Least Bittern?
Great Blue Heron*
Great Egret
Snowy Egret
Little Blue Heron
Tricolored Heron
Reddish Egret
Cattle Egret
Green Heron*
Black-crowned Night-heron
Yellow-crowned Night-heron*
Ibis & Spoonbill
White Ibis
Glossy Ibis
White-faced Ibis
Roseate Spoonbill
Wood Stork
Vultures
Black Vulture*
Turkey Vulture*

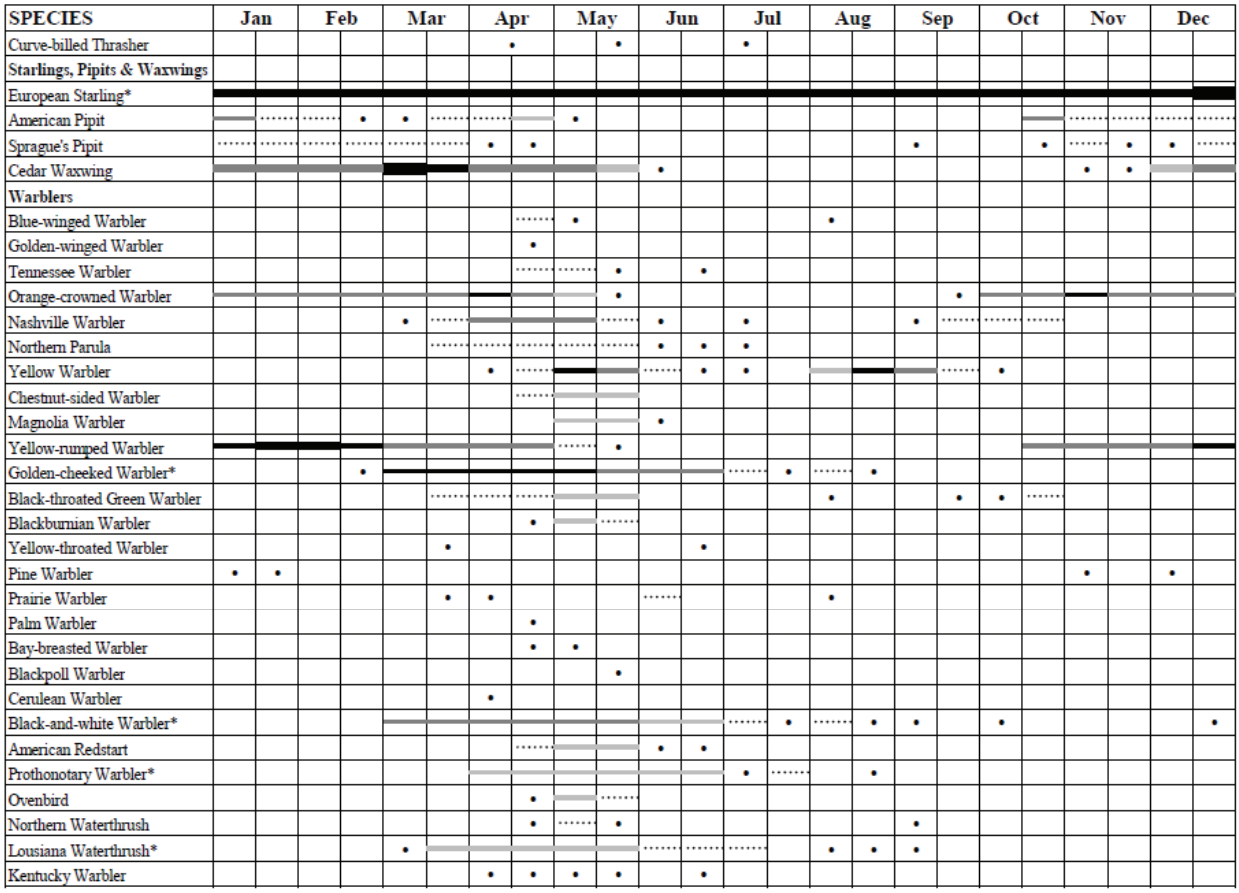
SPECIES	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Osprey, Kites & Harrier																								
Osprey										•														
Swallow-tailed Kite										•					•									
White-tailed Kite			•		•	•	•	•	•			•	•			•								•
Mississippi Kite							•							•			•	•						
Northern Harrier									•					•		•	•							
Eagles & Hawks																								
Bald Eagle	•		•						•	•	•	•	•	•	•	•	•		•		•	•	•	•
Sharp-shinned Hawk											•		•		•	•	•						•	
Cooper's Hawk*																						•		•
Harris's Hawk							•		•															
Red-shouldered Hawk*				•													•	•	•	•				
Broad-winged Hawk*						•					•		•		•		•	•	•		•			
Swainson's Hawk*					•										•		•			•				
Zone-tailed Hawk				•					•															
Red-tailed Hawk*																								
Ferruginous Hawk								•																
Golden Eagle															•									
Falcons																								
Crested Caracara*		•	•						•		•	•					•	•			•	•	•	
American Kestrel*										•	•			•										
Merlin				•	•										•	•	•				•		•	
Peregrine Falcon														•	•	•				•				
Prairie Falcon	•	•	•	•	•													•			•		•	
Rails & Cranes																								
Sora		•	•	•		•									•	•				•	•		•	•
Common Moorhen	•									•	•		•	•			•				•			
American Coot																	•							
Sandhill Crane		•	•			•													•			•		•
Whooping Crane						•	•														•			
Shorebirds																								
Black-bellied Plover							•		•						•									
American Golden-plover								•	•															

SPECIES	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Snowy Plover														•	•		•	•						
Semipalmated Plover									•							•	•							
Killdeer*																								
Black-necked Stilt									•	•		•				•								
American Avocet							•	•	•	•						•	•	•		•				
Spotted Sandpiper			•										•									•		
Solitary Sandpiper						•				•								•		•				
Greater Yellowlegs																								
Willet									•				•	•	•	•		•	•					
Lesser Yellowlegs	•				•					•	•				•								•	
Upland Sandpiper									•	•	•						•	•						
Whimbrel								•																
Long-billed Curlew						•	•						•	•			•	•						
Hudsonian Godwit											•													
Marbled Godwit																	•							
Red Knot									•															
Sanderling									•							•		•						
Semipalmated Sandpiper									•					•	•		•	•		•				
Western Sandpiper							•		•					•	•			•						
Least Sandpiper		•	•				•				•													
White-rumped Sandpiper																								
Baird's Sandpiper														•			•	•	•					
Pectoral Sandpiper					•						•							•	•	•				
Dunlin															•		•							
Stilt Sandpiper										•					•		•	•						
Buff-breasted Sandpiper																	•							
Short-billed Dowitcher														•	•	•								
Long-billed Dowitcher				•		•	•				•				•	•			•		•		•	
Wilson's Snipe									•							•	•	•						
American Woodcock*	•	•			•				•												•		•	
Wilson's Phalarope							•									•	•			•		•		
Gulls & Terns																								
Laughing Gull						•	•	•	•	•				•										
Franklin's Gull											•									•		•		

SPECIES	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Black-legged Kittiwake																					•			
Bonaparte's Gull									•													·····		
Ring-billed Gull									·····	•										·····				
Least Tern									•															
Caspian Tern									•							•								
Black Tern									•			•			•			•						
Common Tern																	•							
Forster's Tern	·····	·····	·····	·····						·····						•	•	•		·····	•	·····		
Pigeons & Doves																								
Rock Pigeon*C																								
Eurasian Collared-dove*C		•			·····		·····	·····	·····	·····	·····	·····	•	·····	•	•	·····	•	•		•	•		
White-winged Dove* c																								
Mourning Dove*																								
Inca Dove*						•	·····	•	•	·····	•		•									•		
Common Ground-dove*	•						·····				·····	·····	·····	•	•	•	•					•		
Parrots																								
Monk Parakeet											•													
Cuckoos																								
Black-billed Cuckoo									·····	•														
Yellow-billed Cuckoo*								•						·····	•	•	•							
Greater Roadrunner*	•	·····	•	·····													•	•		•	•			
Groove-billed Ani							•			•														
Owls																								
Barn Owl																					•			
Eastern Screech-owl*	•	·····	•	•	·····						·····	·····	·····	·····	·····	•			•	·····		·····	·····	·····
Great Horned Owl*	·····	·····	·····	·····	•	·····	·····	·····	·····	·····	•	·····	·····	•			•	•	•			•	·····	•
Burrowing Owl		·····	·····	·····		•												•	•	·····	·····	·····		
Barred Owl*		•				•	·····	·····	·····	·····	·····	·····	·····	•		•	•	•	•					•
Long-eared Owl						•			•													•		
Short-eared Owl	•	·····	·····	•		•													•				•	•
Nightjars & Swifts																								
Common Nighthawk*							•												•	•	•		•	
Common Poorwill*					•	•	•		•	•	•	•	•	•			•	·····				•		
Chuck-will's-widow*							·····				·····	·····	·····	•	•	·····	·····							


SPECIES
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Eastern Whip-poor-will
Chimney Swift*
Hummingbirds
Ruby-throated Hummingbird*
Black-chinned Hummingbird*
Anna's Hummingbird
Rufous Hummingbird
Kingfishers
Belted Kingfisher*
Green Kingfisher
Woodpeckers
Red-headed Woodpecker
Golden-fronted Woodpecker
Red-bellied Woodpecker*
Yellow-bellied Sapsucker
Ladder-backed Woodpecker*
Downy Woodpecker*
Hairy Woodpecker
Northern Flicker
Pileated Woodpecker
Flycatchers
Olive-sided Flycatcher
Eastern Wood-pewee*
Yellow-bellied Flycatcher
Acadian Flycatcher*
Traill's Flycatcher
Alder Flycatcher
Willow Flycatcher
Least Flycatcher
Eastern Phoebe*
Say's Phoebe
Vermilion Flycatcher*
Ash-throated Flycatcher*
Great Crested Flycatcher*
SPECIES
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Great Kiskadee
Couch's Kingbird
Western Kingbird*
Eastern Kingbird
Scissor-tailed Flycatcher*
Shrikes
Loggerhead Shrike*
Vireos
White-eyed Vireo*
Bell's Vireo*
Black-capped Vireo*
Yellow-throated Vireo*
Plumbeous Vireo
Blue-headed Vireo
Warbling Vireo
Philadelphia Vireo
Red-eyed Vireo*
Jays, Crows & Ravens
Blue Jay*
Western Scrub-jay*
American Crow*
Common Raven
Larks
Horned Lark*
Swallows
Purple Martin
Tree Swallow*
Northern Rough-winged Swallow*
Bank Swallow
Cliff Swallow*
Cave Swallow*
Barn Swallow*
Titmice & Chickadees
Carolina Chickadee*


SPECIES
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Tufted Titmouse
Black-crested Titmouse*
Bushtit, Nuthatches & Creepers
Bushtit
Red-breasted Nuthatch
Brown Creeper
Wrens
Rock Wren
Canyon Wren*
Carolina Wren*
Bewick's Wren*
House Wren
Winter Wren
Sedge Wren
Marsh Wren
Kinglets & Gnatcatchers
Golden-crowned Kinglet
Ruby-crowned Kinglet
Blue-gray Gnatcatcher*
Bluebirds, Solitaires & Thrushes
Eastern Bluebird*
Mountain Bluebird
Townsend's Solitaire
Veery
Gray-cheeked Thrush
Swainson's Thrush
Hermit Thrush
Wood Thrush
American Robin
Mimic Thrushes
Gray Catbird
Northern Mockingbird*
Sage Thrasher
Brown Thrasher


SPECIES
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Curve-billed Thrasher
Starlings, Pipits & Waxwings
European Starling*
American Pipit
Sprague's Pipit
Cedar Waxwing
Warblers
Blue-winged Warbler
Golden-winged Warbler
Tennessee Warbler
Orange-crowned Warbler
Nashville Warbler
Northern Parula
Yellow Warbler
Chestnut-sided Warbler
Magnolia Warbler
Yellow-rumped Warbler
Golden-cheeked Warbler*
Black-throated Green Warbler
Blackburnian Warbler
Yellow-throated Warbler
Pine Warbler
Prairie Warbler
Palm Warbler
Bay-breasted Warbler
Blackpoll Warbler
Cerulean Warbler
Black-and-white Warbler*
American Redstart
Prothonotary Warbler*
Ovenbird
Northern Waterthrush
Lousiana Waterthrush*
Kentucky Warbler

SPECIES	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Mourning Warbler							•	•	·····							•	·····	•						
MacGillivray's Warbler								•	·····	·····								•						
Common Yellowthroat				·····		·····					·····	•			•		•	·····	·····	·····	·····	•	•	•
Hooded Warbler						•	·····	•	•	•								•						
Wilson's Warbler					•		·····	·····								•			•					
Canada Warbler								•	·····	·····							•							
Yellow-breasted Chat*															•	•	·····			•				
Tanagers																								
Summer Tanager*																	·····	·····						
Western Tanager									•	•								•						
Scarlet Tanager						•	•	•				•	•											
Sparrows																								
Spotted Towhee										•	•	·····	•					•						
Eastern Towhee		·····	·····	·····	·····	·····	·····	·····	·····	•	•										•		•	·····
Canyon Towhee							•	•	•	•	•													
Cassin's Sparrow*	•	•	•							·····	·····	·····	•											
Rufous-crowned Sparrow*		•	•	•	•							·····			·····			•					•	
Chipping Sparrow										·····	·····		•											
Clay-colored Sparrow				•						•								•		•				•
Field Sparrow*												·····	•	·····	•	•		•	·····					
Vesper Sparrow									·····	•	•							•	•					
Lark Sparrow*	·····	·····	·····																	•	·····	•	·····	·····
Lark Bunting			·····							•									•			•		•
Savannah Sparrow																	•	·····	·····					
Grasshopper Sparrow*	·····	·····	·····	·····	·····						·····	•	•					•		·····	·····	·····		
Le Conte's Sparrow	·····	·····	·····	·····	·····	·····	•	•	•												•	•	·····	
Fox Sparrow	·····	·····	•	·····	•	•															·····	•		·····
Song Sparrow						·····	·····	·····	•	·····	•		•											
Lincoln's Sparrow									·····	·····		•							•					
Swamp Sparrow	•	·····				•	·····													·····	·····	·····	·····	•
White-throated Sparrow										·····	•													
Harris's Sparrow	·····	·····		·····	·····	·····															·····			
White-crowned Sparrow											•													
Dark-eyed Junco							•		•															

SPECIES	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
McCown's Longspur			·····	•	•																			
Lapland/Smith's Longspur	•	•																						
Chstnt-collared Longspur	·····	·····	·····	·····	·····	•	•														•	·····	•	•
Cardinals, Grosbeaks & Buntings																								
Northern Cardinal*																								
Pyrrhuloxia																							•	
Rose-breasted Grosbeak								·····																
Black-headed Grosbeak								•	•	•														
Blue Grosbeak*							·····						·····	·····	·····	·····	•							
Lazuli Bunting*						•	·····	·····		·····	·····	·····	•	•			•							
Indigo Bunting*															·····	•	•	·····	•	·····				
Painted Bunting*							•									·····	•	•						
Dickcissel*							•							·····	•	·····	•							
Blackbirds & Orioles																								
Bobolink								•	•															
Red-winged Blackbird*																								
meadowlark sp.																								
Eastern Meadowlark*																		•	•					
Western Meadowlark	•	·····	·····	•	•		•	•	•	•		•								•	•	•		•
Yellow-headed Blackbird				•		•	·····				·····	•	·····	·····	•	•		•	•					
Rusty Blackbird					•	•																		
Brewer's Blackbird					•	•	·····	•		•											•			
Common Grackle*	•	•	•	•	·····								·····	·····	·····	•	•		•	·····	·····	•		•
Great-tailed Grackle*C																								
Shiny Cowbird										•	•													
Bronzed Cowbird*			•	•		•	·····				·····	·····	·····	•		•								
Brown-headed Cowbird*	·····	·····	·····		·····									·····	·····	•		•	·····	·····		•	•	
Orchard Oriole*						•	•						·····		·····	·····								
Bullock's Oriole								•	·····															
Baltimore Oriole							•			·····	•					•	·····							
Scott's Oriole									•															
Finches & Weavers																								
Purple Finch								•		•												•		
House Finch*																								

SPECIES	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Pine Siskin	•	·····	•	•		•	·····	·····	•	•										•	•	•	•	•
Lesser Goldfinch*		·····		•		•	·····	·····					·····	·····		•	•	·····	•	·····			•	
American Goldfinch									·····	•	•	•	•	•						•	·····	·····		
Evening Grosbeak							•																	
House Sparrow*C																								

C2. Fish Species

Ichthyofauna of Fort Hood

*Possible = Species possibly occurs, presence not verified

Lepisosteidae	
Lepisosteus oculatus	Longnose Gar
Lepisosteus osseus	Spotted Gar
Clupeidae	
Dorosoma cepedianum	Gizzard Shad
Dorosoma petenense	Threadfin Shad
Cyprinidae	
Campostoma anamalum	Central Stoneroller
Cyprinella lutrensis	Red Shiner
Cyprinella venusta	Blacktail Shiner
Cyprinus carpio	Common Carp
Notemigonus crysoleucas	Golden Shiner
Notropis buchanani	Ghost Shiner
***Notropis oxyrhynchus**	**Sharpnose Shiner-possible**
Notropis stramineus	Sand Shiner
***Notropis texanus**	**Weed Shiner--- possible**
Notropis volucellus	Mimic Shiner
Pimephales promelas	Fathead Minnow
Pimephales vigilax	Bullhead Minnow
***Carassius auratus**	**Goldfish----- possible**
Notropis shumardi	Silverband Shiner
Catostomidae	
Carpoides carpio	River Carpsucker
Ictiobus bubalus	Smallmouth buffalo
Moxostoma congestum	Gray Redhorse
Characidae	
***Astyanax mexicanus**	**Mexican tetra--- possible**
Ictaluridae	
Ameiurus melas	Black Bullhead
Ameiurus natalis	Yellow Bullhead
Ictalurus punctatus	Channel Catfish
Noturus gyrinus	Tadpole Madtom
Pylodictis olivaris	Flathead Catfish
***Ictalurus furcatus**	**Blue Catfish--- possible**
***Noturus nocturnus**	**Freckled Madtom— possible**

Atherinidae

Labidesthes sicculus	Brook Silverside
Menidia beryllina	Inland Silverside

Poeciliidae

Gambusia affinis	Western Mosquitofish

Fundulidae

Fundulus notatus	Blackstripe Topminnow
****Fundulus grandis***	**Gulf killifish--- possible**
****Fundulus zebrinus***	**Plains killifish--- possible**

Moronidae

Morone chrysops	White Bass
****M. chrysops x M. saxatilis***	**Hybrid Striped Bass- possible**
****Morone saxatilis***	**Striped Bass- possible**

Centrarchidae

Lepomis Auritus	Redbreast Sunfish
Lepomis cyanellus	Green Sunfish
Lepomis gulosus	Warmouth
Lepomis humilis	Orangespotted Sunfish
Lepomis macrochirus	Bluegill
Lepomis megalotis	Longear Sunfish
Lepomis microlophus	Redear Sunfish
****Lepomis miniatus***	**Redspotted Sunfish-- possible**
Lepomis punctatus	Spotted Sunfish
Micropterus punctulatus	Spotted Bass
Micropterus salmoides	Largemouth Bass
Pomoxis annularis	White Crappie
****Micropterus dolomieu***	**Smallmouth Bass-- possible**
****Pomoxis nigromaculatus***	**Black Crappie--- possible**
Micropterus treculii	Guadalupe Bass

Percidae

Etheostoma spectabile	Orangethroat Darter
Percina carbonaria	Texas Logperch
Percina sciera	Dusky Darter
****Percina macrolepida***	**Bigscale Logperch--- possible**
****Stizostedion vitreum***	**Walleye--- possible**

Sciaenidae

Aplodinotus grunniens	Freshwater Drum

Cichlidae

Oreochromis aurea	Blue Tilapia

Total species verified by capture & observation = 45

Total species possible (currently not verified) = 15

Grand total = 60

C3. Amphibians and Reptiles

Herpetofauna of Fort Hood

Possible = Species possibly occurs, presence not verified

Amphibians

Bufonidae

Anaxyrus debilis	Eastern Green Toad
Anaxyrus punctatus	Red-Spotted Toad
****Anaxyrus speciosus***	**Texas Toad---possible**
Anaxyrus woodhousii	Woodhouse's Toad
Incilius nebulifer	Gulf Coast Toad

Hylidae

Acris crepitans blanchardi	Blanchard's Cricket Frog
Pseudacris clarkii	Spotted Chorus Frog
Pseudacris streckeri	Strecker's Chorus Frog
****Hyla chrysoscelis***	**Cope's Gray Treefrog---possible**
****Hyla cinerea***	**Green Treefrog---possible**
****Hyla versicolor***	**Gray Treefrog---possible**

Craugastoridae

****Craugastor augusti***	**Barking Frog---possible**

Eleutherodactylidae

Syrrhophus marnockii	Cliff Chirping Frog

Microhylidae

Gastrophryne olivacea	Great Plains Narrowmouth Toad

Scaphiopodidae

Scaphiopus couchii	Couch's Spadefoot Toad

Ranidae

Lithobates berlandieri	Rio Grande Leopard Frog
Lithobates catesbeianus	Southern Bullfrog
Lithobates sphenocephalus	Southern Leopard Frog

Plethodontidae

Plethodon albagula	Western Slimy Salamander

Reptiles

Gekkonidae

Hemidactylus turcicus	Mediterranean Gecko

Crotaphytidae

Crotaphytus collaris collaris	Eastern Collared Lizard

Phrynosomatidae

Cophosaurus texanus texanus	Texas Earless Lizard
Phrynosoma cornutum	Texas Horned Lizard
Sceloporus olivaceus	Texas Spiny Lizard
****Holbrookia lacerata lacerata***	**Plateau Earless Lizard---possible**
****Sceloporus undulates consobrinus***	**Texas Spiny Lizard---possible**
****Urosaurus ornatus ornatus***	**Eastern Tree Lizard---possible**

Polychrotidae

Anolis carolinensis carolinensis	Green Anole

Scincidae

Eumeces tetragrammus brevilineatus	Short-Lined Skink
Eumeces fasciatus	Five-Lined Skink
Scincella lateralis	Ground Skink
****Eumeces obsoletus***	**Great Plains Skink---possible**

Teiidae

Cnemidophorus gularis gularis	Texas Spotted Whiptail Lizard
Cnemidophorus sexlineatus veridis	Sixlined Racerunner

Leptotyphlopidae

Leptotyphlops dulcis dulcis	Plains Blind Snake

Colubridae

Coluber constrictor flaviventris	Eastern Yellowbelly Racer
Diadophis punctatus arnyi	Prairie Ringneck Snake
Heterodon platirhinos	Eastern Hognose Snake
Lampropeltis calligaster calligaster	Prairie Kingnake
Lampropeltis getula holbrooki	Speckled Kingsnake
Masticophis flagellum testaceus	Western Coachwhip
Nerodia erythrogaster transversa	Blotched Water Snake
Nerodia rhombifera rhombifera	Diamondback Water Snake
Opheodrys aestivus	Rough Green Snake
Pantherophis obsoleta lindheimeri	Texas Rat Snake
Pantherophis emoryi	Great Plains Rat Snake
Pituophis catenifer sayi	Bullsnake
Salvadora grahamiae lineata	Texas Patch-nosed Snake
Sonora semiannualata semiannualata	Variable Ground Snake
Storeria dekayi texana	Texas Brown Snake
Tantilla gracilis	Flat-headed Snake
Thamnophis cyrtopsis ocellatus	Eastern Black-necked Garter Snake
Thamnophis proximus rubrilineatus	Red-striped Ribbon Snake

Tropidoclonion lineatum	Lined Snake
Virginia striatula	Rough Earth Snake
****Lampropeltis getula splendida***	**Desert Kingsnake---possible**
****Rhinocheilus lecontei tessellatus***	**Texas Long-Nosed Snake---possible**
****Thamnophis marcianus marcianus***	**Checkered Garter Snake---possible**
****Thamnophis sirtalis annectens***	**Texas Garter Snake---possible**

Elapidae

Micrurus tenere	Texas Coral Snake

Viperidae

Agkistrodon contortrix laticinctus	Broad-Banded Copperhead
Crotalus atrox	Western Diamond-backed Rattlesnake

Chelydridae

Chelydra serpentina serpentine	Common Snapping Turtle

Emydidae

Pseudemys texana	Texas River Cooter
Terrapene ornata ornata	Ornate Box Turtle
Trachemys scripta elegans	Red-Eared Slider

Kinosternidae

Kinosternon flavescens flavescens	Yellow Mud Turtle
**Kinosternon sububrum hippocrepis*	Mississippi Mud Turtle---possible
****Sternotherus odoratus***	**Common Musk Turtle---possible**

Trionychidae

Apalone muticus	Smooth Softshell Turtle
Apalone spiniferus pallidus	Spiny Softshell Turtle

Total species verified by capture & observation = 56

Total species possible (currently not verified) = 15

Grand total = 71

C4. Mammal Species

Possible = Species possibly occurs, presence not verified

Didelphidae	
Didelphis virginiana	Virginia Opossum
Dasypodidae	
Dasypus novemcinctus	Nine-Banded Armadillo
Soricidae	
Cryptotis parva	Least Shrew
Talpidae	
****Scalopus aquaticus***	**Eastern Mole---possible**
Vespertilionidae	
***Eptesicus fuscus**	**Big Brown Bat---possible**
Lasiurus borealis	Eastern Red Bat
Lasiurus cinereus	Hoary Bat
Lasionycteris noctivagans	Silver-Haired Bat
Myotis velifer incautus	Cave Myotis
Nycticeius humeralis	Evening Bat
Perimyotis subflavus	Tri-Colored Bat
Molossidae	
Tadarida brasiliensis mexicana	Mexican Free-Tailed Bat
Canidae	
Canis latrans	Coyote
Urocyon cinereoargenteus	Common Gray Fox
Vulpes vulpes	Red Fox
Procyonidae	
Bassariscus astutus	Ringtail
Procyon lotor	Northern Raccoon
Mustelidae	
Lontra canadensis	Northern River Otter
****Mustela frenata***	**Long-Tailed Weasel---possible**
****Mustela vison***	**American Mink---possible**
Taxidea taxus	American Badger
Mephitidae	
Conepatus leuconotus	Hog-Nosed Skunk
Mephitis mephitis	Striped Skunk

Spilogale putorius	Eastern Spotted Skunk
Felidae	
Lynx rufus	Bobcat
Puma concolor	Mountain Lion
Suidae	
Sus scrofa	Feral Pig
Cervidae	
Odocoileus virginianus	White-Tailed Deer
Sciuridae	
Sciurus niger	Eastern Fox Squirrel
****Spermophilus mexicanus***	**Mexican Ground Squirrel---possible**
Spermophilus variegatus	Rock Squirrel
Heteromyidae	
****Chaetodipus hispidus***	**Hispid Pocket Mouse---possible**
Perognathus merriami	Merriam's Pocket Mouse
Castoridae	
Castor canadensis	American Beaver
Muridae	
Baiomys taylori	Northern Pygmy Mouse
****Microtus pinetorum***	**Woodland Vole---possible**
Neotoma floridana	Eastern Woodrat
Peromyscus attwateri	Texas Mouse
****Peromyscus leucopus***	**White-Footed Mouse---possible**
Peromyscus maniculatus	Deer Mouse
Peromyscus pectoralus	White-Ankled Mouse
Reithrodontomys fulvescens	Fulvous Harvest
Mouse *Reithrodontomys montanus*	Plains Harvest Mouse
Sigmodon hispidus	Hispid Cotton Rat
Erethizontidae	
Erethizon dorsatum	North American Porcupine
Myocastoridae	
Myocastor coypus	Nutria
Leporidae	
Lepus californicus	Black-Tailed Jackrabbit
****Sylvilagus aquaticus***	**Swamp Rabbit---possible**
Sylvilagus floridanus	Eastern Cottontail

Total species verified by capture & observation = 40

Total species possible (currently not verified) = 9

Grand total = 49

C5. Vascular Plants

ANNOTATED CHECKLIST OF THE VASCULAR PLANTS OF FORT HOOD, TEXAS

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ABSTRACT

Fort Hood Military Reservation consists of 88,742 hectares in Bell and Coryell counties, Texas. This annotated checklist documents 1,014 taxa in 896 species, 513 genera, and 120 families. There are 848 native taxa and 166 introduced. Twelve taxa have a global or state ranking. Two taxa are endemic to north central Texas, *Yucca pallida* and *Croton alabamensis* var. *texensis*, and 40 are endemic to Texas.

RESUMEN

La Fort Hood Military Reservation consiste en 88,742 hectáreas en los condados de Bell y Coryell, Texas. Este catálogo anotado documenta 1,014 taxa de 896 especies, 513 géneros, y 120 familias. Hay 848 taxa nativos y 166 introducidos. Doce taxa tienen estatus de protección global o estatal. Dos taxa son endémicos del centro-norte de Texas, *Yucca pallida* y *Croton alabamensis* var. *texensis*, y 40 son endémicos de Texas.

INTRODUCTION

Fort Hood Military Reservation, located in central Texas (Fig. 1), is 88,742 hectares. There is no agreement as to what vegetation region defines this part of Texas. Diggs et al. (1999) place it within the Lampasas Cut Plain. LBJ School of Public Affairs (1978) considers it to be in the Edwards Plateau Ecoregion. Others have placed it in the Cross Timbers and Prairies (Gould 1962; Correll & Johnston 1979; Diggs et al. 1999) and in the Blackland Prairie (Mahler 1988). The flora shows affinities to all of these ecoregions.

The Army acquired the lands of Fort Hood by eminent domain beginning in 1942. Prior to this, the lands of Fort Hood were privately held and used for livestock grazing and crop production. Fort Hood is an Army base used primarily for military training, including large-scale troop and ground vehicle maneuvers, live fire weapons and aviation training. There are over 45,000 active duty Army personnel, as well as Army National Guard personnel training on Fort Hood. The land is also managed for multiple use, including recreation, fishing, hunting, and livestock grazing.

The first known checklist of Fort Hood was compiled by CEMML (1994). It was based on an inventory of the Fort Hood Herbarium (HOOD) and additional field collections during 1992–1993. The list documented 642 taxa. However, 67 of these were deleted from the list, as follows: 29 names were synonyms, 28 were corrected to a taxa already listed, and 10 lacked vouchers and were out of range. Thus, the number of taxa was reduced to 575.

The purpose of this present study is to update the checklist and provide information on frequency of occurrence and habitat for each taxon.

SITE DESCRIPTION

Fort Hood is located in Bell and Coryell counties, from 31.0105 N to 31.3929 N and 97.4676 W to 97.9121 W. Elevation ranges from 180 m to 375 m above mean sea level. Terrain varies from riparian corridors, alluvial bottomlands, rolling grasslands, steep slopes and canyons, and flat topped mesas. The underlying geology is Edwards Limestone, Comanche Peak Limestone, Walnut Clay, Paluxy Sand, and Glen Rose Limestone. Soils are classified as clay loam, silty clay, sandy loam, and limestone rock outcrop (NRCS 2009b).

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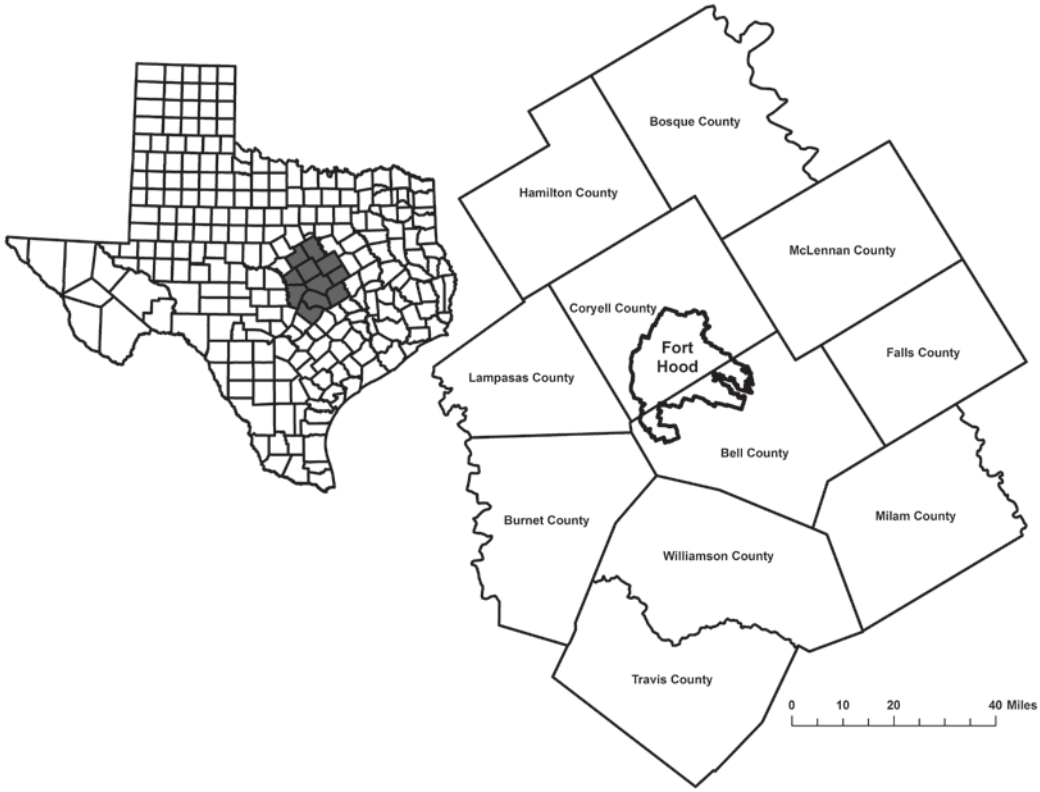

Fig. 1. Location of Fort Hood Military Reservation in Texas with surrounding counties.

The climate is characterized by long, hot summers and mild winters. Mean high temperature for July is 35°C, with a low of 23°C. January mean high and low are 15°C and 5°C, respectively. Annual precipitation averages 69 cm, with most rain falling in the spring and fall (Weatherbase 2009).

Historic vegetation likely consisted of tall- or mixed-grass prairies, oak savannas, oak shrublands, oak-juniper woodlands, riparian forests, and floodplain forests (Bray 1904; Palmer 1920; Tharp 1939; Gehlbach 1988; Van Auken et al. 1979, 1980, 1981). Fire plays a role in these communities and many native plants are fire adapted (Bray 1904; Smeins 1980; Reemts & Hansen 2008).

Current vegetation is classified as forest (8%), woodland (40%), shrubland (6%), grassland (34%), and not vegetated/developed (12%), with 35 associations described and 70 classes (Teague & Reemts 2007). Major forest communities include *Quercus buckleyi-Fraxinus texensis-Juniperus ashei* Forest and *Acer grandidentatum-(Quercus muehlenbergii)/Carex edwardsiana* Lampasas Cutplain Forest. Woodlands are primarily *Quercus fusiformis-Quercus buckleyi-Ulmus crassifolia/Schizachyrium scoparium* Woodland and *Quercus stellata-(Quercus marilandica, Ulmus crassifolia)/Schizachyrium scoparium* Woodland, *Juniperus ashei-Quercus sinuata* var. *breviloba* Woodland, and *Prosopis glandulosa/Bouteloua curtipendula-Nassella leucotricha* Woodland. Shrublands are dominated by *Quercus sinuata* var. *breviloba* Shrubland. Grassland areas include disturbed herbaceous vegetation and *Schizachyrium scoparium-Bouteloua curtipendula-Nassella leucotricha* Herbaceous Vegetation (Teague & Reemts 2007).

No federally listed plant species are known to occur on Fort Hood. However, three federally listed birds are known on Fort Hood. These include, the golden-cheeked warbler (*Dendroica chrysoparia*), the black-capped vireo (*Vireo atricapillus*), and the bald eagle (*Haliaeetus leucocephalus*). Golden-cheeked warbler is a

neotropical migrant songbird that nests only in central Texas. Its preferred habitat consists of old-growth mixed woodlands, where Ashe juniper is mature enough to have shredding bark (Pulich 1976; Kroll 1980; Ladd & Gass 1999; Dearborn & Sanchez 2001; Baccus et al. 2007). Black-capped vireo is also a neotropical migrant songbird. Its preferred habitat consists of low, scrubby clumps of mainly deciduous species, with low Ashe juniper cover and open spaces in between clumps (Graber 1961; Grzybowski et al. 1994; Grzybowski 1995). Bald eagle is a winter resident on the eastern side of the installation, along the shores of Belton Lake.

METHODS

Additional field collecting was conducted from 1995 to 2010. Voucher specimens were collected according to standard collecting methods. Material was keyed with appropriate floras (Bailey 1949; Stanford 1976; Correll & Johnston 1979; Diggs et al. 1999; FNA 1993+) and compared to specimens at BAYLU, HOOD, TEX, and LL. Specimens were deposited at HOOD, with some specimens and duplicates located at BAYLU, CMML, HABAYC, HPC, LL, MO, SWT, TAES, and TEX. Herbarium searches yielding additional taxa were conducted at HABAYC, HPC, LL, and TEX. Nomenclature follows NRCS (2009a), with the following exceptions: *Buchnera floridana*, *Centaurium muehlenbergii*, and *Phlox villosissima* follow Turner et al. (2003) and *Mirabilis latifolia* follows FNA (1993+). Native is defined as native to Texas, and introduced is defined as introduced to Texas (as list in Nesom 2009).

The checklist includes all native and introduced taxa known to occur on the lands of Fort Hood. Many ornamental species, planted by the previous land owners, have naturalized or persisted, and are thus included in this checklist. However, plantings of ornamental species in the garrison areas are not included.

RESULTS

This study documents an additional 439 taxa to the checklist of Fort Hood, bringing the total to 1,014 taxa (species and below) in 896 species, 513 genera, and 120 families. This represents 43% of the 2,376 taxa recorded for north central Texas (Diggs et al. 1999). There are 3,793 voucher specimens in the Fort Hood Herbarium (HOOD). Seven hundred ninety-eight are presumed new county records, with 245 records from Bell County and 553 from Coryell County.

Families with the greatest number of taxa are the Poaceae (151), Asteraceae (133), Fabaceae (80), Cyperaceae (42), Euphorbiaceae (37), and Lamiaceae (26). These six families comprise 46.3% of the flora. Other large families include Apiaceae (23), Brassicaceae (21), Onagraceae (20), Rosaceae (20), Scrophulariaceae (20), and Apocynaceae (19). Genera with the greatest number of taxa are *Carex* (13), *Cyperus* (12), *Dichanthelium* (11), *Eragrostis* (11), *Juncus* (10), *Chamaesyce* (9), *Dalea* (8), *Quercus* (8), *Panicum* (8), *Allium* (7), *Croton* (7), *Euphorbia* (7), *Gaura* (7), and *Paspalum* (7).

There are 166 taxa introduced to Texas in 165 species (Nesom 2009) recorded, comprising 16.4% of the flora of Fort Hood. Twelve taxa (Table 1) have a global or state ranking (Carr 2005; Poole et al. 2007), representing 1.2% of the flora. *Opuntia engelmannii* var. *linguiformis*, which is ranked G5T1QS1, is not included in Table 1, because I am certain it was planted, as it is only found at a few old homesites. Two taxa are endemic to north central Texas (Diggs et al. 1999), *Yucca pallida* and *Croton alabamensis* var. *texensis*. Taxa that are endemic to the state and restricted to the Edwards Plateau (Carr 2007) include *Argythamnia simulans*, *Astragalus wrightii*, *Carex edwardsiana*, *Chaetopappa bellidifolia*, *Monarda punctata* ssp. *punctata* var. *intermedia*, *Muhlenbergia involuta*, *Parthenocissus heptaphylla*, *Passiflora affinis*, *Prunus serotina* var. *eximia*, *Styrax platanifolius* ssp. *platanifolius*, *Vitis monticola*, and *Yucca rupicola*.

The following taxa are endemic to Texas but not restricted to the Edwards Plateau Ecoregion (Carr 2007): *Amphiachyris amoena*, *Arabis petiolaris*, *Argemone aurantiaca*, *Astragalus reflexus*, *Castilleja purpurea* var. *lindheimeri*, *Clematis texensis*, *Cryptantha texana*, *Dalea hallii*, *Dalea tenuis*, *Daucosma laciniata*, *Dichondra recurvata*, *Lechea san-sabeana*, *Lesquerella recurvata*, *Malvastrum aurantiacum*, *Matelea edwardsensis*, *Nolina lindheimeriana*, *Pectis angustifolia* var. *fastigiata*, *Pediomelum cyphocalyx*, *P. hypogaeum* var. *scaposum*, *P. latestipulatum* var. *appressum*, *Phlox roemeriana*, *Ruellia drummondiana*, *Salvia engelmannii*, *Silphium albiflorum*, *Tradescantia edwardsiana*, *T. humilis*, *Tridens congestus*, and *Verbesina lindheimeri*.

Table 1. Ranked taxa documented in the flora of Fort Hood, Texas.

Species	Rank
Matelea edwardsensis	G3G4S3S4
Cucurbita pepo var. *texana*	G3S3
Cuscuta exaltata	G3S3
Croton alabamensis var. *texensis*	G3T2S2
Astragalus reflexus	G3S3
Dalea hallii	G3S3
Pediomelum cyphocalyx	G3G4S3S4
Clematis texensis	G3G4S3S4
Agalinis densiflora	G3S2
Styrax platanifolius ssp. *platanifolius*	G3T3S3
Hexalectris nitida	G3S3
Festuca versuta	G3S2S3

The following are comments on unusual or interesting plant distributions. *Isoetes butleri* has few reports from Texas. *Cyperus eragrostis* is known in Texas only from Harris County. *Cynanchum barbigerum* is at the northern limit of its distribution.

The following taxa are at the western limit of their distribution: *Acmella oppositifolia* var. *repens*, *Andropogon virginicus*, *Botrychium virginianum*, *Carex corrugata*, *Carex lurida*, *Claytonia virginica*, *Commelina diffusa*, *Cyperus erythrorhizos*, *Cyperus pseudovegetus*, *Dichanthelium depauperatum*, *Dichanthelium malacophyllum*, *Diodia virginiana*, *Elephantopus carolinianus*, *Eragrostis hirsuta*, *Erechtites hieraciifolia*, *Eryngium hookeri*, *Euonymus atropurpurea* var. *atropurpurea*, *Gaura longiflora*, *Helianthemum rosmarinifolium*, *Ilex vomitoria*, *Juncus dichotomus*, *Juncus effusus* var. *solutus*, *Juniperus virginiana*, *Leersia virginica*, *Lespedeza procumbens*, *Lespedeza repens*, *Paspalum floridanum*, *Phryma leptostachya*, *Pleopeltis polypodioides* ssp. *michauxiana*, *Polygala incarnata*, *Ranunculus fascicularis*, *Scirpus pendulus*, *Scleria ciliata*, *Scleria oligantha*, *Senna marilandica*, *Stylosanthes biflora*, *Thelypteris kunthii*, *Trepocarpus aethusae*, *Tridens congestus*, *Viola bicolor*, *Vitis vulpina*, and *Zanthoxylum clava-herculis*.

The following taxa are at the eastern limit of their distribution: *Ammoselinum popei*, *Asclepias engelmanniana*, *Astrolepis integerrima*, *Chamaesaracha coniodes*, *Dalea nana* var. *nana*, *Juniperus pinchotii*, *Maurandella antirrhiniflora*, and *Wedelia texana*.

DISCUSSION

When compared to other floristic studies within the Edwards Plateau, Fort Hood has a higher number of taxa. For example, 583 taxa were found in central and western Bell County (Beaty 1978), 693 taxa at Mason Mountain Wildlife Management Area, Mason County (Singhurst et al. 2007), 728 taxa at Balcones Canyonlands National Wildlife Refuge, Burnet, Travis, and Williamson counties (BCNWR 2008), and 725 taxa at Kerr Wildlife Management Area, Kerr County (Singhurst et al. 2010). This high number of taxa occurring on Fort Hood is likely a result of its large size, its location at the intersection of three ecoregions, the large number of plant communities, and the inclusion of persisting cultivated species.

The number of taxa documented at Fort Hood is compatible to other large-sized military installations. Fort Benning (2005) reported 1,350 taxa at Fort Benning, Georgia (73,650 ha), Anderson (2007) reported 1,132 taxa at White Sands Missile Range, New Mexico (830,000 ha), Fort Bliss (2001) reported 1,200 taxa at Fort Bliss, Texas and New Mexico (453,250 ha), and Sorrie et al. (2006) reported 1,185 taxa at Fort Bragg, North Carolina (60,140 ha).

Texas endemics comprise 4.1% of the flora. This is similar to the 4.0% reported for the flora of north central Texas (Diggs et al. 1999), but lower than 5.9% reported for Travis County (Carr 2004). There is a high percentage of introduced taxa (16.3%), but lower than 17.7% reported for north central Texas (Diggs

et al. 1999). This compares favorably with Fort Bragg, North Carolina, which has 16.8% introduced taxa (Sorrie et al. 2006). However, other military bases had much lower numbers of introduced taxa. White Sands Missile Range, New Mexico has 11.4% introduced (Anderson 2007) and Fort Benning, Georgia has 4.4% (Fort Benning 2005).

ANNOTATED CHECKLIST OF VASCULAR PLANT TAXA

Taxa are arranged by divisions, with flowering plants subdivided into classes. Within these groups, taxa are listed alphabetically by family, genus, species, and infraspecific rank. Taxa that are endemic to Texas are listed in **bold** font. Common names follow NRCS (2009a). Taxa are defined as native to Texas or introduced, and duration is given. Frequency of occurrence is given as: rare, very difficult to find and limited to one or a few locations; occasional, difficult to find but found in several locations; frequent, widely scattered and not difficult to find; and common, easily found in most habitats. Brief habitat descriptions are given and the most recently collected specimen is listed for each county with collector and number. Specimens representing presumed new county records are listed in **bold** font. Specimens are located at the Fort Hood Herbarium (HOOD) unless otherwise noted.

The following abbreviations are used for collectors: **BH** = Bryan Hummel; **BRJ** = B.R. Jones; **BT** = Billie L. Turner; **CC** = Chuck Coffey; **CLGY** = C.L. & G. York; **CLY** = C.L. York; **CR** = Charlotte Reemts; **GG** = Greg Gust; **JC** = John Cornelius; **JJ** = Joye Johnson; **JS** = John Stone; **JW** = J.K. Wipff; **KSNH** = K. Schulz & N. Hastings; **KSRS** = K.A. Schulz & R.M. Smith; **LH** = Laura Hansen (**LS** = Laura Sanchez); **RKGL** = R. Krohn & G. Liburn; **RTBS** = Ross T. Bowlin Sherwood; **SEW** = Simon E. Wolff; **SKJ** = Sheila K. Jackson; **SJC** = Sgt. J. Cohn; **SMKL** = Schulz, Morrison, Krohn, & Liburn; **VM** = V. Morrill; and **WRC** = W.R. (Bill) Carr.

LYCOPODIOPHYTA

Isoetaceae

Isoetes butleri Engelm., limestone quillwort. Native, perennial. Rare in seasonally seeping limestone soil. Bell Co.: **LH 4916**, Coryell Co.: **CR 68**

EQUISETOPHYTA

Equisetaceae

Equisetum hyemale L. var. *affine* (Engelm.) A.A. Eat., scouring-rush horsetail. Native, perennial. Rare in moist soil along rivers and creeks. Bell Co.: **LS 760**, Coryell Co.: **LH 6031**

PTERIDOPHYTA

Aspleniaceae

Asplenium resiliens Kunze, black-stem spleenwort. Native, perennial. Frequent on limestone in mesic wooded canyons. Bell Co.: LS 4597, Coryell Co.: LS 2634

Dryopteridaceae

Cyrtomium falcatum (L. f.) C. Presl, Japanese net-vein holly fern. Introduced, perennial. Occasional on mesic limestone cliffs and sinkhole openings, naturalized. Bell Co.: **LS 4651**, Coryell Co.: **LS 2648**

Woodsia obtusa (Spreng.) Torr. ssp. *occidentalis* Windham, western cliff fern. Native, perennial. Rare on sandy Pleistocene terrace deposits of the Leon River. Coryell Co.: **LS 3383**

Marsileaceae

Marsilea vestita Hook. & Grev., hairy waterclover. Native, perennial. Frequent in seasonally damp soil. Bell Co.: LH 5177, Coryell Co.: LH 5163

Ophioglossaceae

Botrychium virginianum (L.) Sw., rattlesnake fern. Native, perennial. Rare in mesic wooded canyons. Bell Co.: LS 4245, Coryell Co.: **LH 5851**

Polypodiaceae

Pleopeltis polypodioides (L.) Andrews & Windham ssp. *michauxiana* (Weatherby) Andrews & Windham, resurrection fern. Native, perennial. Rare on limestone boulders in mesic wooded canyon. Bell Co.: **LS 2106**

Pteridaceae

Adiantum capillus-veneris L., common maidenhair. Native, perennial. Frequent on seeping limestone in riparian areas and mesic wooded canyons. Bell Co.: LS 1974, Coryell Co.: **LS 3968**

Argyrochosma dealbata (Pursh) Windham, powdery false cloak fern. Native, perennial. Occasional on dry limestone rimrock at upper edges of wooded canyons and slopes. Bell Co.: LS 3979, Coryell Co.: **LH 5066**

Astrolepis integerrima (Hook.) Bentham & Windham, hybrid cloak fern. Native, perennial. Rare on limestone in mesic wooded canyons. Bell Co.: **LH 5400**, Coryell Co.: **LH 5259**

Cheilanthes alabamensis (Buckley) Kunze, Alabama lip fern. Native, perennial. Frequent on limestone in mesic wooded canyons. Bell Co.: LS 2107, Coryell Co.: LS 2067

Cheilanthes horridula Maxon, rough lip fern. Native, perennial. Rare on limestone in mesic wooded canyons. Bell Co.: LH 5538, Coryell Co.: **LH 6564**

Pellaea atropurpurea (L.) Link, purple cliff-brake. Native, perennial. Frequent on limestone in mesic wooded canyons. Bell Co.: JS 4228, Coryell Co.: **LS 2749**

Thelypteridaceae

Thelypteris kunthii (Desv.) Morton, Kunth's maiden fern. Native, perennial. Frequent in shade along banks of creeks and seeping limestone of mesic canyons. Bell Co.: LS 2720, Coryell Co.: **LS 3967**

CONIFEROPHYTA

Cupressaceae

Juniperus ashei Buchh., Ashe's juniper. Native, perennial. Common in most habitats, especially rocky limestone. Bell Co.: GG 345, Coryell Co.: LS 2083

Juniperus pinchotii Sudworth, Pinchot's juniper. Native, perennial. Rare on dry rocky limestone slopes. Bell Co.: LH 6241

Juniperus virginiana L., eastern red-cedar. Native, perennial. Occasional along wooded riparian corridors. Bell Co.: **LH 4918**, Coryell Co.: **LH 6303**

Platycladus orientalis (L.) Franco, Oriental arbor-vitae. Introduced, perennial. Rare at old homesites and cemeteries, cultivated, persisting. Coryell Co.: **LS 2597**

Taxodium distichum (L.) Rich., bald cypress. Native, perennial. Rare along banks of a fishing pond, possibly a waif. Coryell Co.: **LH 6736**

MAGNOLIOPHYTA: Dicotyledonae

Acanthaceae

Dicliptera brachiata (Pursh) Spreng., branched foldwing. Native, perennial. Occasional in moist soil along wooded rivers and creeks. Bell Co.: LH 5130, Coryell Co.: **LH 5450**

Dyschoriste linearis (Torr. & A. Gray) Kuntze var. *linearis*, snakeherb. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LH 5907, Coryell Co.: LS 2421

Justicia americana (L.) Vahl, American water-willow. Native, perennial. Common along banks of rivers and creeks. Bell Co.: LS 2499, Coryell Co.: LS 2553

Ruellia drummondiana (Nees) A. Gray, Drummond's wild petunia. Native, perennial. Frequent in shade along riparian corridors. Bell Co.: LS 1979, Coryell Co.: **LS 4467**

Ruellia humilis Nutt., fringe-leaf wild petunia. Native, perennial. Frequent in partial shade of woodlands. Bell Co.: **LS 3962**, Coryell Co.: **LS 2872**

Ruellia metziae Tharp, Metz's wild petunia. Native, perennial. Frequent in grasslands and limestone outcrops. Bell Co.: **LH 5067**, Coryell Co.: **LH 5041**

Ruellia nudiflora (Engelm. & A. Gray) Urban var. *nudiflora*, violet wild petunia. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 2932, Coryell Co.: **LS 3974**

Ruellia nudiflora (Engelm. & A. Gray) Urban var. *runyonii* (Tharp & F.A. Barkley) B.L. Turner, Runyon's wild petunia. Native, perennial. Frequent in grasslands and open woodlands. Bell Co.: **LH 5052**, Coryell Co.: **LH 5298**

Aceraceae

Acer grandidentatum Nutt. var. *sinuosum* (Rehder) Little, canyon maple. Native, perennial. Occasional in mesic limestone canyons. Bell Co.: LS 4482, Coryell Co.: LS 4624

Acer negundo L. var. *negundo,* box-elder. Native, perennial. Common along wooded riparian corridors. Bell Co.: LH 5619, Coryell Co.: **LS 3403**

Amaranthaceae

Alternanthera caracasana Kunth, mat chaff-flower. Native, perennial. Occasional in sandy soil and disturbed areas. Bell Co.: LH 6059, Coryell Co.: LH 5464

Amaranthus albus L., tumbleweed. Introduced, annual. Occasional on banks of creeks and other disturbed areas. Bell Co.: LS 2920, Coryell Co.: **LS 4473**

Amaranthus blitoides S. Watson, prostrate pigweed. Introduced, annual. Occasional in disturbed areas. Bell Co.: CLGY 54437 (TEX), Coryell Co.: LH 6159

Amaranthus palmeri S. Watson, carelessweed. Native, annual. Occasional along roadsides and in disturbed areas. Coryell Co.: **LS 3898**

Amaranthus polygonoides L., tropical amaranth. Native, annual. Rare on sandy Pleistocene terrace deposits and disturbed areas. Bell Co.: **LH 6065**

Amaranthus retroflexus L., red-root amaranth. Introduced, annual. Rare in disturbed areas. Bell Co.: CLGY 55269 (HABAYC), Coryell Co.: **LS s.n.**

Amaranthus tuberculatus (Moq.) Sauer, rough-fruit amaranth. Native, annual. Rare in disturbed areas. Bell Co.: SJC T41 (LL)

Froelichia gracilis (Hook.) Moq., slender snake-cotton. Native, annual. Occasional on sandy Pleistocene terrace deposits. Bell Co.: CLGY 55109 (HABAYC), Coryell Co.: **LH 6154**

Gossypianthus lanuginosus (Poir.) Moq. var. *lanuginosus*, cotton-flower. Native, perennial. Occasional in sandy soil and disturbed areas. Bell Co.: **CLGY 54340** (HABAYC), Coryell Co.: **LS 4474**

Iresine rhizomatosa Standl., Juda's bush. Native, perennial. Rare on sandy Pleistocene terrace deposits of the Leon River. Coryell Co.: **LH 5544**

Anacardiaceae

Rhus glabra L., smooth sumac. Native, perennial. Rare, known from one old homesite, cultivated, persisting. Bell Co.: LS 3425

Rhus lanceolata (A. Gray) Britton, flame-leaf sumac. Native, perennial. Common in most habitats, especially in sunny disturbed areas. Bell Co.: LS 2919, Coryell Co.: LS 2615

Rhus trilobata Nutt., skunkbush sumac. Native, perennial. Common on rocky limestone slopes and mesatops. Bell Co.: LS 2202, Coryell Co.: **LS 2637**

Rhus virens Lindh. ex A. Gray var. *virens*, evergreen sumac. Native, perennial. Common on rocky limestone slopes and mesatops. Bell Co.: GG 344, Coryell Co.: LH 5330

Toxicodendron radicans (L.) Kuntze ssp. *verrucosum* (Scheele) Gillis, poison-ivy. Native, perennial. Common in most woodlands. Bell Co.: **LS 2221**, Coryell Co.: LS 2663

Apiaceae

Ammoselinum popei Torr. & A. Gray, plains sand-parsley. Native, annual. Rare in shade along banks of creeks. Bell Co.: **LH 5838**

Bifora americana Benth. & Hook. f. ex S. Watson, prairie-bishop. Native, annual. Common in grasslands. Bell Co.: LS 2323, Coryell Co.: LS 2533

Chaerophyllum tainturieri Hook. var. *dasycarpum* Hook. ex S. Watson, hairy-fruit chervil. Native, annual. Common in most habitats, especially shaded areas. Bell Co.: LS 2336, Coryell Co.: LS 2264

Chaerophyllum tainturieri Hook. var. *tainturieri,* chervil. Native, annual. Common in most habitats, especially shaded areas. Bell Co.: LS 2214, Coryell Co.: LS 2245

Cyclospermum leptophyllum (Pers.) Sprague ex Britton & P. Wilson, slim-lobe celery. Introduced, annual. Frequent in damp soils and gravelly alluvium. Bell Co.: LS 3254, Coryell Co.: **LS 2546**

Cymopterus macrorhizus Buckley, big-root wavewing. Native, perennial. Rare in grasslands on rocky limestone. Bell Co.: **LH 6716**,Coryell Co.: **LS 2122**

***Daucosma laciniata* Englem. & A. Gray,** meadow parasol. Native, annual. Rare in partial shade at woodland edges. Bell Co.: LH 6618

Daucus carota L., wild carrot. Introduced, biennial. Occasional along roadsides, rapidly spreading. Bell Co.: **LH 6636**, Coryell Co.: **LH 4901**

Daucus pusillus Michx., rattlesnake-weed. Native, annual. Common in grasslands and disturbed areas. Bell Co.: LS 2477, Coryell Co.: **LS 2437**

Eryngium hookeri Walp., Hooker's eryngo. Native, annual. Rare in damp soil of open grassland. Bell Co.: LH 5282

Eryngium leavenworthii Torr. & A. Gray, Leavenworth's eryngo. Native, annual. Common in grasslands and disturbed areas. Bell Co.: LH 5280, Coryell Co.: **LS 2001**

Hydrocotyle prolifera Kellogg, whorled marshpennywort. Native, perennial. Common along banks of creeks and other damp areas. Bell Co.: LS 2711

Hydrocotyle umbellata L., water-pennywort. Native, perennial. Common along banks of creeks and other damp areas. Bell Co.: **LS 4289**, Coryell Co.: LH 5556

Hydrocotyle verticillata Thunb. var. *verticillata*, whorled water-pennywort. Native, perennial. Common along banks of creeks and other damp areas. Bell Co.: LS 1963, Coryell Co.: **LS 1942**

Limnosciadium pumilum (Engelm. & A. Gray) Mathias & Constance, prairie dogshade. Native, annual. Rare in mud around a pond. Bell Co.: **LH 5909**

Polytaenia nuttallii DC., prairie-parsley. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 2387, Coryell Co.: **LS 1906**

Sanicula canadensis L., black snakeroot. Native, perennial. Common in shade along riparian corridors. Bell Co.: LS 2801, Coryell Co.: **LS 2546**

Spermolepis divaricata (Walter) Raf. ex Ser., rough-fruit scale-seed. Native, annual. Occasional on sandy soils and post oak woodlands. Bell Co.: CLY s.n. (HABAYC), Coryell Co.: **LH 6797**

Spermolepis echinata (Nutt. ex DC.) A. Heller, beggar's-lice. Native, annual. Occasional on sandy soil and post oak woodlands. Coryell Co.: **LH 6798**

Spermolepis inermis (Nutt. ex DC.) Mathias & Constance, spreading scale-seed. Native, annual. Common in grasslands and open woodlands. Bell Co.: **LS 3259**, Coryell Co.: **LH 6799**

Torilis arvensis (Huds.) Link, spreading hedge-parsley. Introduced, annual. Common in disturbed areas. Bell Co.: LS 2574, Coryell Co.: LS 2417

Torilis nodosa (L.) Gaertn., knotted hedge-parsley. Introduced, annual. Frequent in disturbed areas and lawns. Bell Co.: LS 1788, Coryell Co.: **LS 2555**

Trepocarpus aethusae Nutt. ex DC., whitenymph. Native, annual. Rare in shade along banks of creeks. Bell Co.: **LH 6051**, Coryell Co.: **LH 6549**

Apocynaceae

Amsonia ciliata Walter, Texas blue-star. Native, perennial. Frequent in grasslands on rocky limestone. Bell Co.: **LS 4647**, Coryell Co.: **LH 5897**

Amsonia longiflora Torr. var. *salpignantha* (Woodson) S.P. McLaughlin, trumpet slimpod. Native, perennial. Rare in grasslands on dry rocky limestone. Bell Co.: LS 4654

Apocynum cannabinum L., Indian-hemp. Native, perennial. Frequent along banks of creeks and other damp areas. Bell Co.: **LS 3279**, Coryell Co.: LH 5947

Asclepias asperula (Decne.) Woodson ssp. *capricornu* (Woodson) Woodson, antelope-horns. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 2198, Coryell Co.: LS 1900

Asclepias engelmanniana Woodson, Engelmann's milkweed. Native, perennial. Rare in seasonally seeping limestone grasslands. Bell Co.: **LH 5156**

Asclepias oenotheroides Cham. & Schltdl., side-cluster milkweed. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 2767, Coryell Co.: **LS 3309**

Asclepias texana A. Heller, Texas milkweed. Native, perennial. Rare in wooded canyons and slopes. Bell Co.: **LS 4391**

Asclepias verticillata L., whorled milkweed. Native, perennial. Rare on sandy soils and post oak woodlands. Bell Co.: LS 742, Coryell Co.: **LS 2609**

Asclepias viridiflora Raf., wand milkweed. Native, perennial. Frequent in grasslands and open woodlands over dry rocky limestone. Bell Co.: **LH 5044**, Coryell Co.: **LS 4423**

Asclepias viridis Walter, green milkweed. Native, perennial. Frequent in grasslands. Bell Co.: **LS 2846**, Coryell Co.: **LS 3389**

Cynanchum barbigerum (Scheele) Shinners, bearded swallow-wort. Native, perennial. Occasional on limestone slopes and mesatops, climbing onto shrubs. Bell Co.: **LS 4481**

Cynanchum racemosum (Jacq.) Jacq. var. *unifarium* (Scheele) E. Sundell, talayote. Native, perennial. Occasional in post oak woodlands and sandy alluvium, climbing onto shrubs. Coryell Co.: **LH 5457**

Funastrum crispum (Benth.) Schltr., wavy-leaf twinevine. Native, perennial. Frequent in open woodlands, climbing onto shrubs. Bell Co.: **LS 3261**, Coryell Co.: **LS 1492**

Funastrum cynanchoides (Decne.) Schltr. ssp. *cynanchoides*, fringed twinevine. Native, perennial. Rare in sandy soils and disturbed areas, climbing onto shrubs. Coryell Co.: **LH 6158**

Matelea biflora (Raf.) Woodson, purple milkvine. Native, perennial. Frequent in grasslands, especially over sand. Bell Co.: **LS 3249**, Coryell Co.: LS 1426

***Matelea edwardsensis* Correll,** Plateau milkvine. Native, perennial. Common on rocky limestone slopes and mesatops, climbing onto shrubs and trees. Bell Co.: LS 2332, Coryell Co.: LS 2669

Matelea gonocarpos (Walter) Shinners, anglepod. Native, perennial. Frequent on mesic limestone slopes and canyons, climbing onto shrubs and trees. Bell Co.: LH 5112, Coryell Co.: **LS 3392**

Matelea reticulata (Engelm. ex A. Gray) Woodson, net-vein milkvine. Native, perennial. Common on rocky limestone slopes and mesatops, climbing onto shrubs and trees. Bell Co.: JS 4221, Coryell Co.: LH 5008

Vinca major L., big-leaf periwinkle. Introduced, perennial. Frequent near old homesites, cultivated, naturalized. Bell Co.: LS 4595, Coryell Co.: **LS 4611**

Aquifoliaceae

Ilex decidua Walter, deciduous holly. Native, perennial. Common along banks of creeks, in mesic canyons, and in woodlands. Bell Co.: LS 2517, Coryell Co.: LH 4664

Ilex vomitoria Aiton, yaupon. Native, perennial. Occasional in woodlands. Bell Co.: **LH 5678**, Coryell Co.: **LS 3541**

Aristolochiaceae

Aristolochia serpentaria L., Virginia Dutchman's pipe. Native, perennial. Frequent on limestone in mesic wooded canyons. Bell Co.: LS 1498, Coryell Co.: LH 4905

Asteraceae

Achillea millefolium L., western yarrow. Native, perennial. Occasional in open woodlands. Bell Co.: CLGY 55074 (HABAYC), Coryell Co.: **LS 2565**

Acmella oppositifolia (Lam.) R.K. Jansen var. *repens* (Walter) R.K. Jansen, opposite-leaf spotflower. Native, perennial. Rare in shade along riparian corridors. Coryell Co.: **LH 5307**

Ageratina havanensis (Kunth) King & H.E. Robins., shrubby boneset. Native, perennial. Rare on limestone in mesic wooded canyons. Bell Co.: LH 5006

Ambrosia artemisiifolia L., common ragweed. Native, annual. Common in disturbed grasslands, especially in sandy soil. Bell Co.: LS 2974, Coryell Co.: LS 2960

Ambrosia psilostachya DC., western ragweed. Native, perennial. Common in disturbed grasslands. Bell Co.: LS 2953, Coryell Co.: LS 2913

Ambrosia trifida L. var. *texana* Scheele, Texas giant ragweed. Native, annual. Common in disturbed areas, especially in moist soil. Bell Co.: **LS 2997**, Coryell Co.: **LS 3441**

***Amphiachyris amoena* (Shinners) Solbrig**, Texas broomweed. Native, annual. Common in disturbed grasslands. Bell Co.: CLGY 53145 (HABAYC)

Amphiachyris dracunculoides (DC.) Nutt., common broomweed. Native, annual. Common in disturbed grasslands. Bell Co.: LH 6264, Coryell Co.: LH 6260

Anthemis cotula L., stinking chamomile. Introduced, annual. Rare at an old homesite, cultivated, not persisting. Bell Co.: SEW 3515 (TEX)

Aphanostephus skirrhobasis (DC.) Trel. var. *skirrhobasis*, Arkansas lazy daisy. Native, annual. Frequent in sandy soils and post oak woodlands. Coryell Co.: LH 6610

Arnoglossum plantagineum Raf., Indian plantain. Native, perennial. Frequent in sandy soils and post oak woodlands. Bell Co.: LH 5929, Coryell Co.: **LH 5877**

Artemisia ludoviciana Nutt. ssp. *mexicana* (Willd. ex Spreng.) Keck, Mexican sagebrush. Native, perennial. Common in partial shade at woodland edges. Bell Co.: LH 5525, Coryell Co.: LS 2093

Baccharis neglecta Britton, Roosevelt-weed. Native, perennial. Common in disturbed areas. Bell Co.: LS 2993, Coryell Co.: LS 3442

Baccharis texana (Torr. & A. Gray) A. Gray, prairie false willow. Native, perennial. Rare in a post oak woodland. Bell Co.: LH 6245

Bidens frondosa L., beggar-ticks. Native, annual. Common along banks of creeks and ponds. Bell Co.: **LH 6161**, Coryell Co.: **LS 4501**

Brickellia cylindracea A. Gray & Engelm., gravel-bar brickellbush. Native, perennial. Common on rocky limestone slopes and mesatops. Bell Co.: LH 6240, Coryell Co.: LH 5328

Brickellia eupatorioides (L.) Shinners var. *texana* (Shinners) Shinners, prairie kuhnia. Native, perennial. Common in limestone grasslands. Bell Co.: LH 5532, Coryell Co.: LS 4494

Calyptocarpus vialis Less., straggler daisy. Native, perennial. Common in shaded disturbed areas, especially along riparian corridors. Bell Co.: LS 1789, Coryell Co.: **LS 2829**

Carduus nutans L., nodding plumeless thistle. Introduced, annual or biennial. Rare on roadside shoulder, seeded area, cultivated, persisting. Bell Co.: **LH 5894**

Carduus tenuiflorus W. Curtis, slender bristle-thistle. Introduced, annual or biennial. Occasional in disturbed areas. Bell Co.: LS 2776, Coryell Co.: LH 5754

Carthamus lanatus L., woolly distaff thistle. Introduced, annual. Occasional in disturbed grasslands. Bell Co.: **LH 4966**, Coryell Co.: WRC 17589

Centaurea americana Nutt., American basket-flower. Native, annual. Common in grasslands and disturbed areas. Bell Co.: LH 6602, Coryell Co.: **LS 2433**

Centaurea melitensis L., Maltese star-thistle. Introduced, annual. Frequent in disturbed areas. Bell Co.: LS 2764, Coryell Co.: LH 6476

Chaetopappa asteroides Nutt. ex DC., common least daisy. Native, annual. Frequent in grasslands and open woodlands. Bell Co.: LS 1676, Coryell Co.: LH 5675

***Chaetopappa bellidifolia* (A. Gray & Engelm.) Shinners,** dwarf white aster. Native, annual. Frequent on rocky limestone mesatops, and in mesic riparian corridors and canyons. Bell Co.: LH 5939, Coryell Co.: **LH 5063**

Chloracantha spinosa (Benth.) G.L. Nesom, Mexican devilweed. Native, perennial. Rare on damp soil and roadside ditches. Bell Co.: **LS 2992**, Coryell Co.: **LH 6249**

Cirsium texanum Buckley, Texas thistle. Native, biennial or perennial. Common in grasslands and open woodlands. Bell Co.: LH 5931, Coryell Co.: LS 2440

Cirsium undulatum (Nutt.) Spreng., wavy-leaf thistle. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 3298, Coryell Co.: LS 3285

Cirsium vulgare (Savi) Ten., bull thistle. Introduced, biennial. Rare in disturbed areas. Bell Co.: **LH 6066**

Conoclinium coelestinum (L.) DC., blue mistflower. Native, perennial. Common on damp soil along banks of creeks and ponds. Bell Co.: LS 1984, Coryell Co.: **LS 4502**

Conyza canadensis (L.) Cronquist var. *canadensis*, Canadian horseweed. Native, annual. Common in gravelly alluvium and disturbed areas. Bell Co.: LH 5289, Coryell Co.: LH 6071

Conyza canadensis (L.) Cronquist var. *glabrata* (A. Gray) Cronquist, horseweed. Native, annual. Common in gravelly alluvium and disturbed areas. Bell Co.: LS 2921, Coryell Co.: LS 4508

Coreopsis tinctoria Nutt., plains coreopsis. Native, annual. Common in grasslands. Bell Co.: LS 2762, Coryell Co.: **LS 2746**

Coreopsis wrightii (A. Gray) H.M. Parker, rock tickseed. Native, annual. Frequent in grasslands and open woodlands. Bell Co.: **LH 5906**, Coryell Co.: **LH 6545**

Crepis pulchra L., small-flower hawk's-beard. Introduced, annual. Rare on disturbed roadside shoulders. Bell Co.: **LH 5893**, Coryell Co.: **LH 5840**

Dracopis amplexicaulis (Vahl) Cass., clasping coneflower. Native, annual. Occasional on sandy Pleistocene terrace deposits. Bell Co.: LS 2793, Coryell Co.: **LH 5943**

Dysodiopsis tagetoides (Torr. & A. Gray) Rydb., marigold dogweed. Native, perennial. Frequent in grasslands on dry rocky limestone. Bell Co.: LS 3574, Coryell Co.: LS 4432

Echinacea angustifolia DC., blacksamson echinacea. Native, perennial. Rare in grasslands on dry rocky limestone. Coryell Co.: **LS 2403**

Eclipta prostrata (L.) L., pieplant. Native, annual. Common along banks of creeks and other damp areas. Bell Co.: LS 2938, Coryell Co.: **LS 4396**

Elephantopus carolinianus Raeusch., leafy elephantopus. Native, perennial. Occasional in shade along riparian corridors. Bell Co.: **LS 1960**, Coryell Co.: **LS 4436**

Engelmannia peristenia (Raf.) Goodman & C.A. Lawson, Engelmann's daisy. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 2497, Coryell Co.: GG 368

Erechtites hieraciifolia (L.) Raf. ex DC., American burnweed. Native, annual. Rare in disturbed bottomlands. Coryell Co.: SMKL 488 (CMML)

Erigeron modestus A. Gray, plains fleabane. Native, perennial. Common on rocky limestone slopes and mesatops. Bell Co.: LH 5609, Coryell Co.: **LH 5608**

Erigeron philadelphicus L., Philadelphia fleabane. Native, perennial. Common along banks of creeks and other damp areas. Bell Co.: LS 4656, Coryell Co.: **LS 2256**

Erigeron strigosus Muhl. ex Willd. var. *strigosus*, prairie fleabane. Native, annual. Common in grasslands and open woodlands. Bell Co.: LS 2308, Coryell Co.: LH 5670

Erigeron tenuis Torr. & A. Gray, slender fleabane. Native, annual or biennial. Common in open woodlands. Bell Co.: LS 3572, Coryell Co.: **LS 2081**

Eupatorium serotinum Michx., white boneset. Native, perennial. Common along banks of creeks and other damp areas. Bell Co.: LS 2990, Coryell Co.: **LS 4468**

Evax prolifera Nutt. ex DC., big-head evax. Native, annual. Common in disturbed grasslands. Bell Co.: LS 1686, Coryell Co.: LS 2261

Evax verna Raf., many-stem evax. Native, annual. Common in disturbed grasslands. Bell Co.: LH 4961, Coryell Co.: **LH 4898**

Gaillardia pulchella Foug. var. *pulchella*, Indian-blanket. Native, annual. Common in grasslands. Bell Co.: LH 6474, Coryell Co.: **LS 2426**

Gaillardia suavis (A. Gray & Engelm.) Britton & Rusby, rayless gaillardia. Native, perennial. Rare in open woodlands. Bell Co.: CLGY 54340 (HABAYC), Coryell Co.: **LH 5751**

Gamochaeta antillana (Urban) Anderberg, delicate everlasting. Introduced, annual. Occasional on sandy Pleistocene terrace deposits. Bell Co.: LH 6803

Gamochaeta pensylvanica (Willd.) Cabrera, Pennsylvania everlasting. Introduced, annual or biennial. Occasional on sandy Pleistocene terrace deposits. Coryell Co.: **LS 1908**

Gamochaeta purpurea (L.) Cabrera, spoon-leaf purple everlasting. Native, annual. Occasional on sandy Pleistocene terrace deposits. Coryell Co.: **LH 5674**

Grindelia lanceolata Nutt. var. *texana* (Scheele) Shinners, Texan gumweed. Native, perennial. Common in disturbed grasslands. Bell Co.: LS 3960, Coryell Co.: LS 4427

Grindelia nuda Wood var. *nuda*, curlytop gumweed. Native, annual. Frequent in disturbed grasslands. Bell Co.: **LS 2984**, Coryell Co.: **LS 2099**

Gutierrezia texana (DC.) Torr. & A. Gray var. *texana,* Texas broomweed. Native, annual. Common in disturbed grasslands. Bell Co.: LS 2041, Coryell Co.: LH 6259

Hedypnois cretica (L.) Dum. Cours., Cretan weed. Introduced, annual. Rare on disturbed roadside shoulders. Bell Co.: **LH 5607**, Coryell Co.: **LH 5623**

Helenium amarum (Raf.) H. Rock var. *amarum*, yellow bitterweed. Native, annual. Common on sandy Pleistocene terrace deposits. Bell Co.: LH 5386, Coryell Co.: LS 2757

Helenium autumnale L., fall sneezeweed. Native, perennial. Common on damp soil along banks of creeks. Bell Co.: LS 2048, Coryell Co.: **LH 5470**

Helenium elegans DC. var. *elegans*, elegant sneezeweed. Native, annual. Common along banks of creeks and other damp areas. Bell Co.: **LS 2723**, Coryell Co.: **LS 2831**

Helenium microcephalum DC. var. *microcephalum*, small-head sneezeweed. Native, annual. Common along banks of creeks and other damp areas. Bell Co.: LS 2797, Coryell Co.: LS 3395

Helianthus annuus L., common sunflower. Native, annual. Common in disturbed grasslands and along roadsides. Bell Co.: LH 5047, Coryell Co.: **LS 2875**

Helianthus maximiliani Schrad., Maximilian sunflower. Native, perennial. Common along banks of creeks and other damp areas. Bell Co.: LS 2994, Coryell Co.: LH 5377

Heterotheca canescens (DC.) Shinners, gray gold-aster. Native, perennial. Common in grasslands on dry rocky limestone. Bell Co.: LS 3577, Coryell Co.: LS 4426

Heterotheca subaxillaris (Lam.) Britton & Rusby, camphorweed.

Native, annual or biennial. Common in open woodlands, roadsides, and disturbed areas. Bell Co.: LH 5462, Coryell Co.: **LS 4510**

Hymenopappus scabiosaeus L'Her. var. *corymbosus* (Torr. & A. Gray) B.L. Turner, Carolina woolly-white. Native, biennial. Common in grasslands and open woodlands. Bell Co.: LS 1707, Coryell Co.: LS 2432

Hymenopappus tenuifolius Pursh, chalkhill. Native, biennial. Common on dry rocky limestone. Bell Co.: LH 5043, Coryell Co.: LS 2523

Hypochaeris brasiliensis (Less.) Benth. & Hook. ex Griseb., Brazilian cat's ear. Introduced, biennial. Rare in disturbed areas. Coryell Co.: **LS 2451**

Iva angustifolia Nutt. ex DC., narrow-leaf sumpweed. Native, annual. Common in disturbed grasslands and in moist soil along banks of creeks. Bell Co.: **LS 2952**, Coryell Co.: **LS 3444**

Iva annua L., annual marsh-elder. Native, annual. Common along banks of creeks and other damp areas. Bell Co.: LS 2988, Coryell Co.: **LS 4503**

Krigia caespitosa (Raf.) Chambers, dwarf dandelion. Native, annual. Frequent in damp soil of disturbed areas. Bell Co.: LH 5642, Coryell Co.: LH 6375

Krigia wrightii (A. Gray) K.L. Chambers ex K.J. Kim, Wright's dwarf dandelion. Native, annual. Rare on sandy Pleistocene terrace deposits. Coryell Co.: **LH 5598**

Lactuca floridana (L.) Gaertn., woodland lettuce. Native, annual. Frequent along riparian corridors. Bell Co.: LS 1983, Coryell Co.: **LH 5191**

Lactuca ludoviciana (Nutt.) Riddell, western wild lettuce. Native, biennial. Common in woodlands and along riparian corridors. Bell Co.: LS 3264, Coryell Co.: LS 2744

Lactuca serriola L., prickly lettuce. Introduced, annual. Common in disturbed areas. Bell Co.: **LH 4993**, Coryell Co.: LS 4507

Laennecia coulteri (A. Gray) G.L. Nesom, Coulter's horseweed. Native, annual. Rare in disturbed alluvial floodplain. Bell Co.: **LH 6246**

Liatris aestivalis G.L. Nesom & R. O'Kennon, summer gayfeather. Native, perennial. Frequent in grasslands on dry rocky limestone. Bell Co.: **LH 5373**, Coryell Co.: LS 2003

Liatris mucronata DC., narrow-leaf gayfeather. Native, perennial. Common in grasslands on rocky limestone. Bell Co.: LS 2054, Coryell Co.: LS 4493

Lindheimera texana A. Gray & Engelm., Texas-star. Native, annual. Common in grasslands. Bell Co.: LS 1881, Coryell Co.: LS 2453

Lygodesmia texana (Torr. & A. Gray) Greene, Texas skeletonplant. Native, perennial. Common in grasslands. Bell Co.: LS 2693, Coryell Co.: LS 2673

Marshallia caespitosa Nutt. ex DC. var. *signata* Beadle & F.E. Boynt., Barbara's buttons. Native, perennial. Common in grasslands on rocky limestone, especially in seepy areas. Bell Co.: LS 1777, Coryell Co.: LS 2428

Melampodium leucanthum Torr. & A. Gray, rock daisy. Native, perennial. Common in grasslands on dry rocky limestone. Bell Co.: LS 1852, Coryell Co.: LS 2286

Onopordum acanthium L., cotton-thistle. Introduced, biennial. Rare on roadside shoulder. Bell Co.: **LS 3562**

Packera obovata (Muhl. ex Willd.) W.A. Weber & A. Love, round-leaf groundsel. Native, perennial. Frequent in mesic woodlands and canyons. Bell Co.: **LH 5588**, Coryell Co.: **KSNH 731**

Packera tampicana (DC.) C. Jeffrey, Great Plains ragwort. Native, annual. Frequent in damp open areas and roadside ditches. Bell Co.: **LH 5688**, Coryell Co.: LH 5853

Palafoxia callosa (Nutt.) Torr. & A. Gray, small palafoxia. Native, annual. Common in disturbed grasslands. Bell Co.: LS 2046, Coryell Co.: LS 4430

Parthenium hysterophorus L., false ragweed. Native, annual. Common in disturbed grasslands. Bell Co.: LH 5056, Coryell Co.: **LS 4476**

***Pectis angustifolia* Torr. var. *fastigiata* (A. Gray) Keil**, lemonscent. Native, annual. Occasional in shallow pockets of soil on limestone outcrops and mesatops. Bell Co.: LH 5326, Coryell Co.: LH 5064

Pinaropappus roseus (Less.) Less., white rock lettuce. Native, perennial. Rare on rocky limestone. Bell Co.: LH 6418, Coryell Co.: **LH 5871**

Pluchea camphorata (L.) DC., camphorweed. Native, annual or perennial. Common along banks of creeks and other damp areas. Bell Co.: LH 5267, Coryell Co.: **LH 5306**

Pluchea odorata (L.) Cass., sweetscent. Native, annual. Common along banks of creeks and other damp areas. Bell Co.: LS 2989, Coryell Co.: LS 4437

Pseudognaphalium obtusifolium (L.) Hilliard & B.L. Burtt, fragrant cud-weed. Native, annual. Frequent in woodlands of limestone slopes and adjacent mesatops. Bell Co.: **LH 5399**, Coryell Co.: **LH 5258**

Pyrrhopappus grandiflorus (Nutt.) Nutt., tuber false dandelion. Native, perennial. Occasional on sandy Pleistocene terrace deposits. Coryell Co.: **LH 5673**

Pyrrhopappus pauciflorus (D. Don) DC., Texas dandelion. Native, annual. Common in grasslands and mesic woodlands. Bell Co.: LS 2215, Coryell Co.: LS 2251

Ratibida columnifera (Nutt.) Woot. & Standl., Mexican hat. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 2496, Coryell Co.: LS 2424

Rudbeckia hirta L. var. *pulcherrima* Farw., black-eyed Susan. Native, annual or perennial. Common in grasslands and open woodlands. Bell Co.: LS 2577, Coryell Co.: LS 3373

***Silphium albiflorum* A. Gray,** white rosinweed. Native, perennial. Common on dry rocky limestone. Bell Co.: LS 3573, Coryell Co.: LS 4424

Silphium laciniatum L., compassplant. Native, perennial. Rare on dry rocky limestone. Coryell Co.: **LS 1951**

Silphium radula Nutt., rough-stem rosinweed. Native, perennial. Common along riparian corridors. Bell Co.: LH 5045, Coryell Co.: LS 3977

Silybum marianum (L.) Gaertn., blessed milk-thistle. Introduced, annual or biennial. Occasional in disturbed areas. Bell Co.: LS 2809, Coryell Co.: **LH 6475**

Simsia calva (Engelm. & A. Gray) A. Gray, awnless bush-sunflower. Native, perennial. Common in open woodlands. Bell Co.: LS 1489, Coryell Co.: LS 2407

Smallanthus uvedalius (L.) Mack. ex Small, bear's foot. Native,

perennial. Occasional in shade along riparian corridors. Bell Co.: LH 6097

Solidago altissima L., late goldenrod. Native, perennial. Common in damp soil along banks of creeks and in post oak woodlands. Bell Co.: LS 2995, Coryell Co.: LH 5468

Solidago gigantea Aiton, giant goldenrod. Native, perennial. Common in moist soil along banks of creeks and rivers. Bell Co.: LS 2059, Coryell Co.: **LS 4504**

Solidago nemoralis Aiton var. *longipetiolata* (Mack. & Bush) Palmer & Steyerm., gray goldenrod. Native, perennial. Common in grasslands on dry rocky limestone. Bell Co.: LS 2050, Coryell Co.: LS 2094

Solidago radula Nutt., western rough goldenrod. Native, perennial. Common on dry rocky limestone. Bell Co.: LS 2049, Coryell Co.: LS 2008

Sonchus asper (L.) Hill, spiny sow-thistle. Introduced, annual. Frequent in disturbed areas. Bell Co.: LS 1856, Coryell Co.: **LS 2236**

Sonchus oleraceus L., common sow-thistle. Introduced, annual. Rare in disturbed areas. Bell Co.: LH 6339, Coryell Co.: **LH 5001**

Symphyotrichum divaricatum (Nutt.) G.L. Nesom, wireweed. Native, annual. Common along banks of creeks, ponds, and other damp areas. Bell Co.: LS 4587, Coryell Co.: **LS 4506**

Symphyotrichum drummondii (Lindl.) G.L. Nesom var. *texanum* (Burgess) G.L. Nesom, Texas aster. Native, perennial. Common in shade along riparian corridors and mesic canyons. Bell Co.: LS 2516, Coryell Co.: LH 5476

Symphyotrichum ericoides (L.) G.L. Nesom var. *ericoides*, white heath aster. Native, perennial. Common in grasslands. Bell Co.: LS 4589, Coryell Co.: LH 5469

Symphyotrichum oblongifolium (Nutt.) G.L. Nesom, aromatic aster. Native, perennial. Rare in sandy soil. Coryell Co.: LS 2084

Symphyotrichum praealtum (Poir.) G.L. Nesom, willow-leaf aster. Native, perennial. Frequent in moist soils and along unshaded creek banks. Bell Co.: **LS 4588**, Coryell Co.: LH 6305

Symphyotrichum sericeum (Vent.) G.L. Nesom, silky aster. Native, perennial. Common in grasslands on dry rocky limestone. Bell Co.: **LS 4593**, Coryell Co.: LS 3634

Taraxacum officinale F.H. Wigg., common dandelion. Introduced, biennial or perennial. Common in disturbed areas and lawns. Bell Co.: LS 1695, Coryell Co.: **LS 4599**

Tetraneuris linearifolia (Hook.) Greene, slender-leaf bitterweed. Native, annual. Common in grasslands and on limestone mesatops. Bell Co.: LH 6414, Coryell Co.: LS 2903

Tetraneuris scaposa (DC.) Greene var. *scaposa,* slender-stem bitterweed. Native, perennial. Common in grasslands on dry rocky limestone. Bell Co.: LS 2129, Coryell Co.: LS 2252

Thelesperma filifolium (Hook.) A. Gray var. *filifolium*, stiff greenthread. Native, annual or perennial. Common in grasslands and open woodlands. Bell Co.: LS 3250, Coryell Co.: LS 2413

Thelesperma simplicifolium A. Gray, slender greenthread. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 2498, Coryell Co.: 2498

Thymophylla pentachaeta (DC.) Small, common dogweed. Native, perennial. Frequent in grasslands on rocky limestone and disturbed areas. Bell Co.: **LS 1672**, Coryell Co.: **LH 5559**

Townsendia exscapa (Richardson) Porter, stemless Townsend daisy. Native, perennial. Rare in grasslands on rocky limestone. Bell Co.: LH 5574, Coryell Co.: LH 5566

Tragopogon dubius Scop., yellow salsify. Introduced, biennial. Rare in disturbed area. Bell Co.: **LH 6635**

Verbesina encelioides (Cav.) Benth. & Hook. f. ex A. Gray, cowpen daisy. Native, annual. Frequent in grasslands and disturbed areas. Bell Co.: **LH 5394**, Coryell Co.: **LS 2023**

***Verbesina lindheimeri* B.L. Rob. & Greenm.,** Lindheimer's crownbeard. Native, perennial. Rare in wooded canyons and slopes. Bell Co.: LH 5161, Coryell Co.: LS s.n.

Verbesina virginica L., frostweed. Native, perennial. Common in shade of woodlands and riparian corridors. Bell Co.: LS 1976, Coryell Co.: **LH 5275**

Vernonia baldwinii Torr. ssp. *interior* (Small) Faust, western ironweed. Native, perennial. Common in moist soil along banks of creeks and rivers. Bell Co.: LS 2947, Coryell Co.: **LS 4495**

Vernonia x *guadalupensis* A. Heller (pro sp.) [*baldwinii* x *lindheimeri*], hybrid ironweed. Native, perennial. Frequent in grasslands and along banks of creeks. Bell Co.: **LH 5144**, Coryell Co.: **LH 5274**

Vernonia lindheimeri A. Gray & Engelm., woolly ironweed. Native, perennial. Common on dry rocky limestone. Bell Co.: LS 3575, Coryell Co.: LH 5482

Viguiera dentata (Cav.) Spreng., golden-eye. Native, perennial. Common at woodland edges on limestone. Bell Co.: LH 5397, Coryell Co.: LH 4997

Wedelia texana (A. Gray) B.L. Turner, hairy wedelia. Native, perennial. Rare in grasslands and open woodlands. Bell Co.: **LH 5942**

Xanthisma texanum DC. ssp. *drummondii* (Torr. & A. Gray) Semple, Texas sleepy daisy. Native, annual. Rare among construction debris, possibly a waif. Bell Co.: **LH 5055**

Xanthium strumarium L. var. *canadense* (Mill.) Torr. & Gray, Canada cocklebur. Native, annual. Common along banks of creeks, ponds, and other damp areas. Bell Co.: LS 2991, Coryell Co.: **LS 2017**

Berberidaceae

Mahonia trifoliolata (Moric.) Fedde, agarita. Native, perennial. Common in grasslands and woodlands on dry rocky limestone. Bell Co.: LS 4629, Coryell Co.: **LS 2635**

Nandina domestica Thunb., sacred bamboo. Introduced, perennial. Occasional near old homesites, cultivated, naturalized. Bell Co.: **LS 2104**, Coryell Co.: **LS 4191**

Bignoniaceae

Campsis radicans (L.) Seem. ex Bureau, common trumpet-creeper. Native, perennial. Occasional near old homesites, cultivated, naturalized. Bell Co.: LS 759, Coryell Co.: **LH 6638**

Catalpa speciosa (Warder) Warder ex Engelm., northern ca-

talpa. Native, perennial. Rare along banks of creek, possibly a waif, persisting. Coryell Co.: **LH 5291**

Chilopsis linearis (Cav.) Sweet, desert willow. Native, perennial. Rare at old homesites, cultivated, persisting. Bell Co.: **LS 2837**

Boraginaceae

Buglossoides arvensis (L.) I.M. Johnston, buglossoides. Introduced, annual. Frequent in disturbed grasslands and along roadsides. Bell Co.: LS 4634, Coryell Co.: **LS 4646**

***Cryptantha texana* (A. DC.) Greene,** pick-me-nots. Native, annual. Rare on sandy Pleistocene terrace deposits of the Leon River. Coryell Co.: **LH 6609**

Heliotropium indicum L., India heliotrope. Introduced, annual. Frequent in disturbed alluvial deposits of creeks and lakes. Bell Co.: LH 5528

Heliotropium procumbens Mill., heliotrope. Native, annual. Frequent in disturbed alluvial deposits of creeks and lakes. Bell Co.: LH 5179

Heliotropium tenellum (Nutt.) Torr., white heliotrope. Native, annual. Common in grasslands on rocky limestone. Bell Co.: LS 3980, Coryell Co.: LS 1952

Lithospermum incisum Lehm., narrow-leaf puccoon. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 2766, Coryell Co.: LS 1817

Myosotis macrosperma Engelm., spring forget-me-not. Native, annual. Common in shade along riparian corridors. Bell Co.: LH 5646, Coryell Co.: LS 2263

Onosmodium bejariense DC. ex A. DC. var. *bejariense,* Bexar marbleseed. Native, perennial. Common along riparian corridors. Bell Co.: LH 5004, Coryell Co.: **LH 5123**

Brassicaceae

***Arabis petiolaris* (A. Gray) A. Gray,** Brazos rockcress. Native, annual. Rare in open woodlands. Bell Co.: **LH 6450**, Coryell Co.: **LH 6449**

Brassica juncea (L.) Czern., India mustard. Introduced, annual. Rare on sandy Pleistocene terrace deposits of the Leon River. Coryell Co.: **LH 5944**

Capsella bursa-pastoris (L.) Medik., shepherd's purse. Introduced, annual. Frequent in disturbed areas and lawns. Bell Co.: LH 6334, Coryell Co.: **LS 2237**

Cardamine parviflora L. var. *arenicola* (Britton) O.E. Schulz, sand bittercress. Native, annual. Frequent on sandy Pleistocene terrace deposits. Bell Co.: **LH 6718**, Coryell Co.: **LH 5591**

Descurainia pinnata (Walter) Britton ssp. *pinnata*, western tansy-mustard. Native, annual. Occasional on sandy Pleistocene terrace deposits of the Leon River. Coryell Co.: **LH 4666**

Draba brachycarpa Nutt. ex Torr. & A. Gray, short-pod draba. Native, annual. Rare on sandy Pleistocene terrace deposits. Coryell Co.: **LH 5595**

Draba cuneifolia Nutt. ex Torr. & A. Gray, wedge-leaf draba. Native, annual. Frequent in disturbed areas. Bell Co.: **LS 2113**, Coryell Co.: **LH 6311**

Draba platycarpa Torr. & A. Gray, broad-pod draba. Native, annual. Frequent along roadsides and in disturbed areas. Bell Co.: LS 2140, Coryell Co.: **LS 1437**

Erysimum capitatum (Douglas ex Hook.) Greene, plains erysimum. Native, biennial or perennial. Rare in post oak woodlands. Bell Co.: **LS 1473**

Erysimum repandum L., spreading erysimum. Introduced, annual. Rare sandy soils and disturbed areas. Coryell Co.: **KSNH 715**

Lepidium austrinum Small, southern pepperweed. Native, annual. Common in grasslands and disturbed areas. Bell Co.: **LS 2219**, Coryell Co.: **LS 2272**

Lepidium virginicum L., Virginia pepper-grass. Native, annual. Common in grasslands, open woodlands, and disturbed areas. Bell Co.: LS 2218, Coryell Co.: **LS 1713**

Lesquerella gordonii (A. Gray) S. Watson, Gordon's bladderpod. Native, annual. Frequent in grasslands and disturbed areas. Coryell Co.: **LS 1734**

Lesquerella gracilis (Hook.) S. Watson ssp. *gracilis*, white bladderpod. Native, annual. Common in grasslands, open woodlands, and disturbed areas. Bell Co.: LS 2381, Coryell Co.: LH 6377

***Lesquerella recurvata* (Engelm. ex A. Gray) S. Watson,** slender bladderpod. Native, annual. Common in grasslands, woodlands, and disturbed areas. Bell Co.: LH 6682, Coryell Co.: **LS 1889**

Myagrum perfoliatum L., bird's-eye cress. Introduced, annual. Occasional on sandy alluvium. Bell Co.: **LH 6341**

Nasturtium officinale W.T. Aiton, watercress. Introduced, perennial. Common along creek banks and other damp areas. Bell Co.: LH 6481, Coryell Co.: **LS 3394**

Rapistrum rugosum (L.) All., annual bastard-cabbage. Introduced, annual. Occasional in disturbed grasslands and along roadsides. Bell Co.: LH 6340, Coryell Co.: **LH 5545**

Rorippa sessiliflora (Nutt.) Hitchc., stalkless yellowcress. Native, annual. Common on damp sandy Pleistocene terrace deposits. Bell Co.: LH 6162, Coryell Co.: **LH 6344**

Sisymbrium irio L., rocket-mustard. Introduced, annual. Rare in disturbed areas and lawns. Coryell Co.: **LS 4601**

Sisymbrium officinale (L.) Scop., hedge-mustard. Introduced, annual. Rare in sandy soil and disturbed areas. Coryell Co.: **LH 5879**

Buddlejaceae

Polypremum procumbens L., juniper-leaf. Native, perennial. Frequent on sandy Pleistocene terrace deposits. Bell Co.: CLGY 55134 (HABAYC), Coryell Co.: **LS 4403**

Cactaceae

Coryphantha sulcata (Engelm.) Britton & Rose, pineapple cactus. Native, perennial. Occasional in grasslands and open woodlands. Bell Co.: **LS 749**, Coryell Co.: **LH 6571**

Cylindropuntia imbricata (Haw.) F.M. Knuth, tree cholla. Native, perennial. Rare at an old homesite, cultivated, persisting. Bell Co.: **LH 4908**

Cylindropuntia leptocaulis (DC.) F.M. Knuth, desert Christmas cactus. Native, perennial. Frequent near old homesites and disturbed areas. Bell Co.: LH 6203, Coryell Co.: **LS 743**

Echinocactus texensis Hopffer, horse crippler. Native, perennial. Rare on rocky limestone hills and in sandy soil. Bell Co.: **LH 6605**

Echinocereus reichenbachii (Terscheck ex Walp.) Haage ssp. *reichenbachii*, lace cactus. Native, perennial. Common on

rocky limestone slopes and mesatops. Bell Co.: **LH 5935**, Coryell Co.: **LH 5936**

Escobaria missouriensis (Sweet) D.R. Hunt, Missouri foxtail cactus. Native, perennial. Occasional in grasslands and open woodlands. Bell Co.: **LS 2689**, Coryell Co.: **LH 6378**

Opuntia engelmannii Salm-Dyck ex Engelm. var. *lindheimeri* (Engelm.) Parfitt & Pinkava, Texas prickly-pear. Native, perennial. Common in grasslands, open woodlands, and disturbed areas. Bell Co.: LH 5184, Coryell Co.: LH 5855

Opuntia engelmannii Salm-Dyck ex Engelm. var. *linguiformis* (Griffiths) Parfitt & Pinkava, cow's-tongue prickly-pear. Native, perennial. Rare at old homesites, cultivated, persisting. Bell Co.: **LH 5182**, Coryell Co.: **LS 3270**

Opuntia macrorhiza Engelm., plains prickly-pear. Native, perennial. Common on sandy soils and post oak woodlands. Bell Co.: **LH 5934**, Coryell Co.: **LS 1913**

Opuntia phaeacantha Engelm., brown-spine prickly-pear. Native, perennial. Common in grasslands, open woodlands, and disturbed areas. Bell Co.: **LH 5923**

Callitrichaceae

Callitriche heterophylla Pursh, two-headed water-starwort. Native, annual. Occasional in clear still water, submersed. Bell Co.: LH 5196, Coryell Co.: LH 6678

Campanulaceae

Lobelia cardinalis L., cardinal flower. Native, perennial. Frequent in moist soil along banks of creeks and rivers. Bell Co.: LH 6098, Coryell Co.: **LS 4505**

Triodanis biflora (Ruiz & Pavon) Green, small Venus' looking-glass. Native, annual. Frequent in post oak woodlands. Bell Co.: LH 6477, Coryell Co.: **LS 1505**

Triodanis coloradoensis (Buckley) McVaugh, Colorado River Venus' looking-glass. Native, annual. Frequent on limestone mesatops, slopes, and canyons. Bell Co.: LH 6471, Coryell Co.: **LH 6567**

Triodanis holzingeri McVaugh, Holzinger's Venus' looking-glass. Native, annual. Rare on sandy Pleistocene terrace deposits. Bell Co.: CLGY 54442 (HABAYC) , Coryell Co.: **LH 6796**

Triodanis perfoliata (L.) Nieuwl., clasping Venus' looking-glass. Native, annual. Frequent in open woodlands. Bell Co.: LH 5883, Coryell Co.: **LH 6565**

Capparaceae

Polanisia dodecandra (L.) DC. ssp. *trachysperma* (Torr. & A. Gray) Iltis, sandy-seed clammy-weed. Native, annual. Frequent in sand and gravelly alluvium. Coryell Co.: **LS 4399**

Caprifoliaceae

Abelia x *grandiflora* (Rovelli ex Andre) Rehder [*chinensis* x *uniflora*], glossy abelia. Introduced, perennial. Rare among construction debris, possibly a waif, not persisting. Bell Co.: **LS 803**

Lonicera albiflora Torr. & A. Gray, western white honeysuckle. Native, perennial. Common on limestone canyons and slopes, climbing onto shrubs. Bell Co.: LH 6338, Coryell Co.: **LH 4751**

Lonicera japonica Thunb., Japanese honeysuckle. Introduced, perennial. Common along streams and other damp sites, climbing onto shrubs, cultivated, naturalized. Bell Co.: **LS 2936**, Coryell Co.: LS 3282

Lonicera sempervirens L., coral honeysuckle. Native, perennial. Rare on limestone canyons and slopes, climbing onto shrubs. Coryell Co.: LH 5615

Sambucus nigra L. ssp. *canadensis* (L.) R. Bolli, common elderberry. Native, perennial. Common in woodlands along streams. Bell Co.: LH 5129, Coryell Co.: **LH 6029**

Symphoricarpos orbiculatus Moench, coral-berry. Native, perennial. Common in shade of woodlands and riparian corridors. Bell Co.: JS 4235, Coryell Co.: **LH 5192**

Viburnum rufidulum Raf., rusty blackhaw. Native, perennial. Common in most woodlands. Bell Co.: LS 2204, Coryell Co.: LS 2644

Caryophyllaceae

Arenaria benthamii Fenzl ex Torr. & A. Gray, hilly sandwort. Native, annual. Common on rocky limestone slopes and mesatops, and in disturbed areas. Bell Co.: LH 6473, Coryell Co.: LS 2416

Arenaria serpyllifolia L., thyme-leaved sandwort. Introduced, annual. Frequent in sandy soils, disturbed areas, and in lawns. Bell Co.: **LS 2345**, Coryell Co.: LS 4603

Cerastium brachypodum (Engelm. ex A. Gray) B.L. Rob., short-stalk chickweed. Native, annual. Common in grasslands and open woodlands. Bell Co.: LS 1702, Coryell Co.: **LS 4605**

Cerastium glomeratum Thuill., sticky chickweed. Introduced, annual. Common in grasslands and disturbed areas. Bell Co.: **LS 4650**, Coryell Co.: **LS 2276**

Paronychia virginica Spreng., Park's nailwort. Native, perennial. Frequent in shallow pockets of soil on limestone outcrops and mesatops. Bell Co.: LS 3963, Coryell Co.: **LH 5260**

Polycarpon tetraphyllum (L.) L., four-leaf manyseed. Introduced, annual. Occasional on sandy soils and in post oak woodlands. Coryell Co.: LS 3386

Silene antirrhina L., sleepy catchfly. Native, annual. Frequent in grasslands and open woodlands. Bell Co.: LS 2395, Coryell Co.: **LH 6532**

Stellaria media (L.) Vill. ssp. *media*, common chickweed. Introduced, annual. Common in grasslands, open woodlands, and other damp areas. Bell Co.: LS 4636, Coryell Co.: **LH 5753**

Stellaria media (L.) Vill. ssp. *pallida* (Dumort.) Asch. & Graebn., lesser chickweed. Introduced, annual. Frequent on sandy soils and damp areas. Bell Co.: **CLGY 54024** (HABAYC), Coryell Co.: **LS 2270**

Celastraceae

Euonymus atropurpurea Jacq. var. *atropurpurea*, eastern wahoo. Native, perennial. Rare in mesic woodlands along streams. Coryell Co.: LH 5120

Chenopodiaceae

Chenopodium album L., lamb's quarters. Introduced, annual. Frequent in disturbed areas. Bell Co.: **LS 4242**, Coryell Co.: LH 6253

Chenopodium ambrosioides L., Mexican tea. Introduced, annual. Frequent on sandy Pleistocene terrace deposits. Bell Co.: LH 6064, Coryell Co.: **LS 4438**

Chenopodium berlandieri Moq., pit-seed goosefoot. Native, annual. Rare in sandy soils and disturbed areas. Bell Co.: SJC T43 (TEX), Coryell Co.: **LS s.n.**

Chenopodium leptophyllum (Moq.) Nutt. ex S. Watson, narrow-leaf goosefoot. Native, annual. Occasional in sandy soils and disturbed areas. Bell Co.: **RKGL 477**, Coryell Co.: **LS 4401**

Monolepis nuttalliana (Schutz.) Greene, Nuttall's poverty-weed. Native, annual. Occasional in sandy soils and disturbed areas. Coryell Co.: **LH 6537**

Cistaceae

Helianthemum georgianum Chapm., Georgia rock-rose. Native, perennial. Frequent on sandy Pleistocene terrace deposits and post oak woodlands. Bell Co.: CLGY 55147 (HABAYC), Coryell Co.: **LH 5961**

Helianthemum rosmarinifolium Pursh, rosemary sun-rose. Native, perennial. Frequent on sandy Pleistocene terrace deposits and post oak woodlands. Coryell Co.: **LH 5963**

Lechea mucronata Raf., hairy pinweed. Native, perennial. Frequent on sandy Pleistocene terrace deposits and post oak woodlands. Bell Co.: CLGY 55145 (HABAYC), Coryell Co.: **LH 6156**

***Lechea san-sabeana* (Buckley) Hodgdon,** San Saba pinweed. Native, perennial. Frequent on sandy Pleistocene terrace deposits and post oak woodlands. Coryell Co.: LH 5841

Lechea tenuifolia Michx., narrow-leaf pinweed. Native, perennial. Frequent on sandy Pleistocene terrace deposits and post oak woodlands. Bell Co.: **LH 6050**, Coryell Co.: LH 5959

Convolvulaceae

Convolvulus arvensis L., field bindweed. Introduced, perennial. Rare on roadside shoulders and disturbed areas. Bell Co.: LS 4480, Coryell Co.: LH 6261

Convolvulus equitans Benth., gray bindweed. Native, perennial. Frequent in grasslands and open woodlands, especially in disturbed areas. Bell Co.: LS 3266, Coryell Co.: **LS 2732**

Dichondra carolinensis Michx., Carolina pony-foot. Native, perennial. Common in grasslands and open woodlands, especially in damp soil. Bell Co.: LS 1654, Coryell Co.: **LS 2830**

***Dichondra recurvata* Tharp & M.C. Johnst.,** oakwoods pony-foot. Native, perennial. Occasional on sandy Pleistocene terrace deposits. Coryell Co.: **LH 5875**

Evolvulus nuttallianus Schult., hairy evolvulus. Native, perennial. Common in grasslands on dry rocky limestone. Bell Co.: LH 6417, Coryell Co.: LS 2674

Evolvulus sericeus Sw., white evolvulus. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 1289, Coryell Co.: **LS 3391**

Ipomoea cordatotriloba Dennst. var. *cordatotriloba*, sharp-pod morning-glory. Native, perennial. Common in a variety of habitats, often climbing onto shrubs. Bell Co.: LS 2729, Coryell Co.: **LS 3381**

Ipomoea cordatotriloba Dennst. var. *torreyana* (A. Gray) D. Austin, Torrey's tievine. Native, perennial. Common in a variety of habitats, often climbing onto shrubs. Bell Co.: LH 6109, Coryell Co.: LS 3407

Ipomoea lacunosa L., pitted morning-glory. Native, annual. Common along creek banks and other damp areas, usually in sandy soil. Bell Co.: LH 6102, Coryell Co.: **LS 4489**

Cornaceae

Cornus drummondii C.A. Mey., rough-leaf dogwood. Native, perennial. Common in mesic woodlands along streams and in canyons. Bell Co.: LS 2389, Coryell Co.: **LS 2670**

Crassulaceae

Sedum nuttallianum Raf., yellow stonecrop. Native, annual. Common in seasonally damp pockets of soil on limestone outcrops and mesatops. Bell Co.: LH 4936, Coryell Co.: **LS 2737**

Sedum pulchellum Michx., Texas stonecrop. Native, annual. Frequent in seasonally damp pockets of soil on limestone outcrops and mesatops. Bell Co.: LH 5847, Coryell Co.: LH 5852

Cucurbitaceae

Cucurbita foetidissima Kunth, buffalo gourd. Native, perennial. Common in disturbed grasslands and open woodlands. Bell Co.: LS 2782, Coryell Co.: **LS 2450**

Cucurbita pepo L. var. *texana* (Scheele) D. Decker, Texas gourd. Native, annual. Rare on sandy Pleistocene terrace deposits. Coryell Co.: **LS 4509**

Ibervillea lindheimeri (A. Gray) Greene, balsam gourd. Native, perennial. Frequent in woodlands, climbing onto shrubs. Bell Co.: LH 5848, Coryell Co.: **LS 1884**

Melothria pendula L., meloncito. Native, perennial. Occasional in woodlands, climbing onto shrubs. Bell Co.: CR 66, Coryell Co.: **LH 5542**

Sicyos angulatus L., one-seed bur-cucumber. Native, annual. Occasional in woodlands along streams, climbing onto shrubs and trees. Bell Co.: LS 2791, Coryell Co.: **LH 6025**

Cuscutaceae

Cuscuta cuspidata Engelm., cusp dodder. Native, annual. Frequent in grasslands, parasitizing herbaceous plants. Coryell Co.: **LS 2014**

Cuscuta exaltata Englem., tree dodder. Native, annual. Frequent in woodlands, parasitizing woody plants. Bell Co.: LS 3981, Coryell Co.: LS 3401

Cuscuta indecora Choisy var. *indecora*, showy dodder. Native, annual. Frequent in grasslands and along creek banks, parasitizing herbaceous plants. Bell Co.: LH 6106, Coryell Co.: **LS 2566**

Cuscuta pentagona Engelm., field dodder. Native, annual. Frequent in grasslands and along creek banks, parasitizing herbaceous plants. Bell Co.: LH 5148, Coryell Co.: LH 5074

Ebenaceae

Diospyros kaki L. f., Japanese persimmon. Introduced, perennial. Occasional near old homesites, cultivated, naturalized. Coryell Co.: **LS 2572**

Diospyros texana Scheele, Texas persimmon. Native, perennial. Common in most woodlands. Bell Co.: LS 2222, Coryell Co.: LH 5760

Diospyros virginiana L., common persimmon. Native, peren-

nial. Common along creek banks and other damp areas. Bell Co.: LH 4921, Coryell Co.: LH 6262

Elatinaceae

Bergia texana (Hook.) Seub. ex Walp., Texas bergia. Native, annual. Frequent in mud along margins of creeks and ponds. Bell Co.: **LH 5283**, Coryell Co.: **LS 4434**

Euphorbiaceae

Acalypha monococca (Engelm. ex A. Gray) Lill. W. Mill. & Gandhi, slender one-seeded mercury. Native, annual. Common on sandy Pleistocene terrace deposits. Bell Co.: **LS 765**, Coryell Co.: **LS 2883**

Acalypha ostryifolia Riddell, hop-hornbeam copperleaf. Native, annual. Occasional in disturbed areas. Coryell Co.: **LH 5190**

Acalypha phleoides Cav., Lindheimer's copperleaf. Native, perennial. Common on rocky limestone slopes and mesatops. Bell Co.: LS 3260, Coryell Co.: LS 1709

Argythamnia humilis (Engelm. & A. Gray) Muell. Arg. var. *humilis*, low wild mercury. Native, perennial. Common in grasslands and disturbed areas. Bell Co.: **LS 2810**, Coryell Co.: **LS 1666**

Argythamnia mercurialina (Nutt.) Muell. Arg. var. *mercurialina*, tall wild mercury. Native, perennial. Occasional in grasslands. Bell Co.: KSRS 963, Coryell Co.: **LH 6795**

***Argythamnia simulans* J.W. Ingram**, Plateau silverbush. Native, perennial. Frequent in shaded woodlands. Bell Co.: LH 5186, Coryell Co.: **LH 5011**

Chamaesyce fendleri (Torr. & A. Gray) Small, creeping spurge. Native, perennial. Common on rocky limestone slopes and mesatops. Bell Co.: LS 2487, Coryell Co.: LS 2073

Chamaesyce glyptosperma (Engelm.) Small, rib-seed sandmat. Native, annual. Rare in a post oak woodland. Coryell Co.: **LH 6242**

Chamaesyce maculata (L.) Small, spotted spurge. Native, annual. Frequent on roadside shoulders and in disturbed areas. Bell Co.: LH 5463, Coryell Co.: **LH 5301**

Chamaesyce missurica (Raf.) Shinners, prairie spurge. Native, annual. Common on dry limestone slopes and mesas. Bell Co.: LH 5288, Coryell Co.: **LS 2010**

Chamaesyce nutans (Lag.) Small, eyebane. Introduced, annual. Common in damp soil, especially in disturbed areas. Bell Co.: LS 2955, Coryell Co.: **LS 3568**

Chamaesyce prostrata (Aiton) Small, prostrate euphorbia. Native, annual. Common in disturbed areas. Bell Co.: LH 5128, Coryell Co.: **LS 3404**

Chamaesyce serpens (Kunth) Small, mat euphorbia. Native, annual. Common on mudflats, roadside shoulders, and disturbed areas. Bell Co.: LH 5104, Coryell Co.: **LS 4397**

Chamaesyce stictospora (Engelm.) Small, slim-seed sandmat. Native, annual. Rare along roadside shoulders and disturbed areas. Coryell Co.: **LH 5300**

Chamaesyce villifera (Scheele) Small, hairy spurge. Native, perennial. Common on dry limestone rimrock and adjacent slopes. Bell Co.: LS 2622, Coryell Co.: **LH 5065**

Cnidoscolus texanus (Muell. Arg.) Small, Texas bullnettle. Native, perennial. Common in disturbed grasslands, especially over sand. Bell Co.: LS 2785, Coryell Co.: LS 2463

***Croton alabamensis* E.A. Sm. ex Chapm. var. *texensis* Ginzbarg,** Texabama croton. Native, perennial. Occasional in mesic wooded canyons and adjacent limestone mesatops. Bell Co.: **LH 6448**, Coryell Co.: LH 5567

Croton capitatus Michx. var. *lindheimeri* (Engelm. & A. Gray) Muell. Arg., woolly croton. Native, annual. Frequent on sandy Pleistocene terrace deposits. Coryell Co.: **LS 2019**

Croton fruticulosus Engelm. ex Torr., encinilla. Native, perennial. Rare in mesic wooded canyons. Bell Co.: JS 4237

Croton glandulosus L. var. *lindheimeri* Muell. Arg., Lindheimer's croton. Native, annual. Occasional on sandy Pleistocene terrace deposits. Coryell Co.: **LH 6155**

Croton lindheimerianus Scheele, three-seed croton. Native, annual. Occasional on sandy Pleistocene terrace deposits. Bell Co.: SJC T33 (TEX)

Croton monanthogynus Michx., prairie-tea. Native, annual. Common in disturbed grasslands. Bell Co.: LS 2045, Coryell Co.: LS 2412

Croton texensis (Klotzsch) Muell. Arg., Texas croton. Native, annual. Common in sandy soil and disturbed areas. Bell Co.: LS 3576, Coryell Co.: LS 2020

Euphorbia bicolor Engelm. & A. Gray, snow-on-the-prairie. Native, annual. Common in disturbed grasslands. Bell Co.: LS 806, Coryell Co.: **LS 1999**

Euphorbia cyathophora Murray, wild poinsettia. Native, annual. Common in gravelly creekbeds and mesic wooded limestone canyons. Bell Co.: LS 1990, Coryell Co.: **LS 2884**

Euphorbia dentata Michx., toothed spurge. Native, annual. Common in disturbed areas. Bell Co.: LS 2042, Coryell Co.: **LS 4402**

Euphorbia longicruris Scheele, wedge-leaf euphorbia. Native, annual. Occasional in seasonally seeping limestone grasslands. Coryell Co.: LS 4378

Euphorbia marginata Pursh, snow-on-the-mountain. Native, annual. Common in disturbed grasslands. Bell Co.: LH 5279, Coryell Co.: LS 2000

Euphorbia spathulata Lam., warty euphorbia. Native, annual. Common in grasslands and open woodlands. Bell Co.: GG 373, Coryell Co.: **LH 4670**

Euphorbia tetrapora Engelm., weak spurge. Native, annual. Rare in open grassland. Coryell Co.: **LH 5667**

Phyllanthus abnormis Baill. var. *abnormis*, Drummond's leaf-flower. Native, annual. Rare on sandy Pleistocene terrace deposits. Coryell Co.: **LS 3378**

Phyllanthus polygonoides Nutt. ex Spreng., knotweed leaf-flower. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 1847, Coryell Co.: LS 2281

Stillingia texana I.M. Johnston, Texas stillingia. Native, perennial. Common in sandy soil and post oak woodlands. Bell Co.: LS 2486, Coryell Co.: LS 2427

Tragia betonicifolia Nutt., betony noseburn. Native, perennial. Frequent in sandy soil and open woodlands. Bell Co.: **LH 4938**, Coryell Co.: **LH 5543**

Tragia brevispica Engelm. & A. Gray, short-spike noseburn. Native, perennial. Common in riparian woodlands. Bell Co.: LS 4379, Coryell Co.: **WRC 17604**

Tragia ramosa Torr., catnip noseburn. Native, perennial. Com-

mon in grasslands and open woodlands. Bell Co.: LS 2220, Coryell Co.: LS 2289

Triadica sebifera (L.) Small, Chinese tallow tree. Introduced, perennial. Frequent along streams and other damp sites, cultivated, naturalized. Bell Co.: LH 6607, Coryell Co.: **LS 2911**

Fabaceae

Acacia angustissima (Mill.) Kuntze var. *hirta* (Nutt.) B.L. Rob., fern acacia. Native, perennial. Frequent in grasslands. Bell Co.: LS 2848, Coryell Co.: LH 6533

Acacia farnesiana (L.) Willd., huisache. Native, perennial. Occasional near old homesites, possibly cultivated, naturalized. Bell Co.: LH 4911, Coryell Co.: **LH 6312**

Albizia julibrissin Durazz., mimosa tree. Introduced, perennial. Occasional at old homesites, cultivated, persisting. Bell Co.: **LS 2521**, Coryell Co.: **LS 2595**

Amorpha fruticosa L., false indigo. Native, perennial. Common along banks of creeks. Bell Co.: LS 1995, Coryell Co.: LS 3973

Astragalus lotiflorus Hook., lotus milk-vetch. Native, perennial. Occasional on dry rocky limestone. Bell Co.: LH 6342, Coryell Co.: **LH 6343**

Astragalus nuttallianus DC. var. *austrinus* (Small) Barneby, small-flowered milk-vetch. Native, annual. Rare in grasslands and disturbed areas. Bell Co.: **LH 6333**

Astragalus nuttallianus DC. var. *nuttallianus*, Nuttall's milk-vetch. Native, annual. Common in grasslands and disturbed areas. Bell Co.: LS 1677, Coryell Co.: LS 2260

Astragalus nuttallianus DC. var. *trichocarpus* Torr. & A. Gray, southwestern milk-vetch. Native, annual. Rare in grasslands and disturbed areas. Coryell Co.: **LH 4667**

***Astragalus reflexus* Torr. & A. Gray,** Texas milk-vetch. Native, annual. Occasional in grasslands, especially near riparian corridors. Bell Co.: LH 6479, Coryell Co.: **LH 5679**

***Astragalus wrightii* A. Gray,** Wright's milk-vetch. Native, annual. Rare in grasslands on dry rocky limestone. Bell Co.: LH 6416, Coryell Co.: **LH 6406**

Caesalpinia gilliesii (Wallich ex Hook.) Wallich ex D. Dietr., bird-of-paradise. Introduced, perennial. Rare at an old homesite, cultivated, not persisting. Bell Co.: **LS 1490**

Centrosema virginianum (L.) Benth., spurred butterfly pea. Native, perennial. Rare on sandy Pleistocene terrace deposits. Bell Co.: CLGY 55301 (HABAYC)

Cercis canadensis L. var. *texensis* (S. Watson) M. Hopkins, Texas redbud. Native, perennial. Common on limestone slopes, canyons, and mesas. Bell Co.: GG 350, Coryell Co.: LS 2126

Chamaecrista fasciculata (Michx.) Greene var. *fasciculata,* partridge-pea. Native, annual. Common in disturbed grasslands. Bell Co.: LS 2996, Coryell Co.: LS 4492

Clitoria mariana L., Atlantic pigeon-wings. Native, perennial. Rare on sandy soils and post oak woodlands. Coryell Co.: **LH 5950**

Dalea aurea Nutt. ex Pursh, golden dalea. Native, perennial. Common in grasslands. Bell Co.: LS 2834, Coryell Co.: LS 2896

Dalea compacta Spreng. var. *pubescens* (A. Gray) Barneby, compact prairie-clover. Native, perennial. Common in grasslands on dry rocky limestone. Bell Co.: LS 2730, Coryell Co.: LH 6544

Dalea enneandra Nutt., big-top dalea. Native, perennial. Rare in grasslands. Bell Co.: JC s.n.

Dalea frutescens A. Gray, black dalea. Native, perennial. Common in open woodlands of rocky limestone slopes and mesatops. Bell Co.: LS 2971, Coryell Co.: LS 3432

***Dalea hallii* A. Gray,** Hall's prairie-clover. Native, perennial. Frequent on dry rocky limestone. Bell Co.: **LS 4249**, Coryell Co.: **LH 5303**

Dalea multiflora (Nutt.) Shinners, round-head dalea. Native, perennial. Common in grasslands over dry rocky limestone. Bell Co.: LH 6060, Coryell Co.: LS 4431

Dalea nana Torr. ex A. Gray var. *nana*, dwarf prairie-clover. Native, perennial. Rare in sandy soil. Coryell Co.: **LH 6535**

***Dalea tenuis* (J.M. Coult.) Shinners**, Stanfield prairie-clover. Native, perennial. Common on rocky limestone slopes and mesatops. Bell Co.: LH 6024, Coryell Co.: LS 2864

Desmanthus acuminatus Benth., sharp-pod bundle-flower. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 3253, Coryell Co.: **LS 2754**

Desmanthus illinoensis (Michx.) MacMill. ex B.L. Rob. & Fernald, Illinois bundle-flower. Native, perennial. Common in grasslands and damp areas. Bell Co.: LS 2918, Coryell Co.: LS 2598

Desmanthus leptolobus Torr. & A. Gray, prairie bundle-flower. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LH 4962, Coryell Co.: LS 2573

Desmanthus velutinus Scheele, velvet bundle-flower. Native, perennial. Common in grasslands on rocky limestone. Bell Co.: LS 2807, Coryell Co.: LS 1887

Desmodium glabellum (Michx.) DC., Dillenius' tick-trefoil. Native, perennial. Rare in mesic canyons. Bell Co.: **LH 6107**, Coryell Co.: **LH 6247**

Desmodium paniculatum (L.) DC., panicled tick-clover. Native, perennial. Common along banks of creeks and in other damp areas. Bell Co.: LS 2057, Coryell Co.: **LH 5324**

Desmodium psilophyllum Schlecht., Wright's tick-clover. Native, perennial. Common in mesic limestone canyons and slopes. Bell Co.: **LS 1838**, Coryell Co.: **LH 5480**

Desmodium tweedyi Britton, Tweedy's tick-clover. Native, perennial. Common along banks of creeks and in other damp areas. Bell Co.: **LH 5187**, Coryell Co.: **LS 3293**

Eysenhardtia texana Scheele, Texas kidneywood. Native, perennial. Frequent in woodlands on dry limestone slopes and mesas. Bell Co.: LS 2022, Coryell Co.: LS 2966

Galactia volubilis (L.) Britton, downy milk-pea. Native, perennial. Frequent in mesic woodlands. Bell Co.: **LH 5046**, Coryell Co.: **LS 3899**

Gleditsia triacanthos L., common honey-locust. Native, perennial. Common in woodlands, especially near old homesites. Bell Co.: **LH 5127**, Coryell Co.: LH 5477

Indigofera miniata Ortega, scarlet-pea. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 1774, Coryell Co.: LS 2666

Lathyrus hirsutus L., rough-pea. Introduced, annual. Occasional in grasslands. Coryell Co.: **LS 2266**

Lathyrus pusillus Elliot, low peavine. Native, annual. Occasional in grasslands and open woodlands. Bell Co.: LH 6409, Coryell Co.: **LS 1664**

Lespedeza procumbens Michx., trailing bush-clover. Native, perennial. Common on wooded limestone slopes and mesatops. Bell Co.: LS 2620, Coryell Co.: **LS 2880**

Lespedeza repens (L.) W. Bart., creeping bush-clover. Native, perennial. Frequent in sandy soils and post oak woodlands. Bell Co.: **LH 5526**, Coryell Co.: **CC 1277**

Lespedeza texana Britton, Texas bush-clover. Native, perennial. Common on wooded limestone slopes and mesatops. Bell Co.: LH 5395, Coryell Co.: **LS 2813**

Lespedeza virginica (L.) Britton, slender bush-clover. Native, perennial. Common in sandy soils and post oak woodlands. Bell Co.: LH 5396, Coryell Co.: **LH 5287**

Lotus unifoliolatus (Hook.) Benth. var. *helleri* (Britton) Kartesz & Gandhi, Pursh's deer-vetch. Native, annual. Common in sandy soils and post oak woodlands. Bell Co.: LS 2575, Coryell Co.: **LS 2564**

Lupinus texensis Hook., Texas bluebonnet. Native, annual. Common in grasslands and disturbed areas. Bell Co.: LH 6411, Coryell Co.: LS 2676

Medicago arabica (L.) Huds., spotted medick. Introduced, annual. Rare in disturbed alluvial floodplain. Coryell Co.: **LH 5593**

Medicago lupulina L., black medick. Introduced, annual. Common in grasslands, disturbed areas, and along roadside shoulders. Bell Co.: LS 1864, Coryell Co.: **LS 2544**

Medicago minima (L.) L., small bur-clover. Introduced, annual. Common in grasslands, disturbed areas, and along roadside shoulders. Bell Co.: LS 1863, Coryell Co.: LS 2229

Medicago orbicularis (L.) Bartal., button clover. Introduced, annual. Frequent in grasslands, disturbed areas, and along roadside shoulders. Bell Co.: LS 3252, Coryell Co.: **LS 2438**

Medicago polymorpha L., California button clover. Introduced, annual. Frequent in grasslands and disturbed areas. Bell Co.: LH 5617, Coryell Co.: LH 5624

Medicago sativa L., alfalfa. Introduced, perennial. Rare on roadside shoulder, seeded area, cultivated, persisting. Bell Co.: LH 4942

Melilotus indicus (L.) All., sour-clover. Introduced, annual. Frequent in grasslands and disturbed areas. Bell Co.: LS 2315, Coryell Co.: **LH 4943**

Melilotus officinalis (L.) Lam., yellow sweet-clover. Introduced, biennial or perennial. Frequent in grasslands, disturbed areas, and along roadside shoulders. Bell Co.: LH 5057, Coryell Co.: LH 5839

Mimosa aculeaticarpa Ortega var. *biuncifera* (Benth.) Barneby, catclaw. Native, perennial. Common in post oak woodlands. Bell Co.: LS 3561, Coryell Co.: LS 1465

Mimosa borealis A. Gray, fragrant mimosa. Native, perennial. Common on dry limestone slopes and mesas. Bell Co.: LH 6412, Coryell Co.: **LS 2290**

Mimosa roemeriana Scheele, Roemer's sensitive-briar. Native, perennial. Common on sandy soils and post oak woodlands. Bell Co.: LS 3263, Coryell Co.: LS 2419

Neptunia lutea (Leavenworth) Benth., yellow-puff. Native, perennial. Common in grasslands and disturbed areas. Bell Co.: LS 1486, Coryell Co.: LS 3565

Parkinsonia aculeata L., retama. Native, perennial. Occasional near old homesites, cultivated, naturalized. Bell Co.: LH 5884, Coryell Co.: LH 6569

Pediomelum cuspidatum (Pursh) Rydb., tall-bread scurf-pea. Native, perennial. Occasional on rocky limestone slopes and mesas. Bell Co.: **LH 6615**, Coryell Co.: LH 5876

***Pediomelum cyphocalyx* (A. Gray) Rydb.**, turnip-root scurf-pea. Native, perennial. Occasional in grasslands on dry rocky limestone. Bell Co.: LH 6616, Coryell Co.: LH 6027

***Pediomelum hypogaeum* (Nutt. ex Torr. & A. Gray) Rydb. var. *scaposum* (A. Gray) Mahler**, stemless scurf-pea. Native, perennial. Rare in grasslands on dry rocky limestone. Bell Co.: LS 2200, Coryell Co.: **LH 6546**

***Pediomelum latestipulatum* (Shiners) Mahler var. *appressum* (D.J. Ockendon) Gandhi & L.E. Brown**, Texas Plains Indian breadroot. Native, perennial. Rare in grasslands on dry rocky limestone. Bell Co.: **LS 2212**

Pediomelum linearifolium (Torr. & A. Gray) J. Grimes, narrow-leaf scurf-pea. Native, perennial. Frequent in grasslands on dry rocky limestone. Bell Co.: LH 6617, Coryell Co.: LH 5889

Pediomelum rhombifolium (Torr. & A. Gray) Rydb., round-leaf scurf-pea. Native, perennial. Occasional in sandy soils and post oak woodlands. Coryell Co.: **LS 1816**

Prosopis glandulosa Torr., honey mesquite. Native, perennial. Common in grasslands and open woodlands, especially in deeper soils. Bell Co.: LS 1792, Coryell Co.: LS 2616

Psoralidium tenuiflorum (Pursh) Rydb., slim-leaf scurf-pea. Native, perennial. Occasional in open woodlands. Bell Co.: LH 5147, Coryell Co.: LS 3900

Pueraria montana (Lour.) Merr. var. *lobata* (Willd.) Maesen & S. Almeida, kudzu. Introduced, perennial. Rare along disturbed roadside, climbing onto shrubs and trees. Bell Co.: **LS 1559**

Rhynchosia senna Gillies ex Hook. var. *texana* (Torr. & A. Gray) M.C. Johnst., snout-bean. Native, perennial. Common in open woodlands and disturbed areas. Bell Co.: LS 3897, Coryell Co.: **LS 1882**

Securigera varia (L.) Lassen, crown-vetch. Introduced, perennial. Rare in disturbed areas. Bell Co.: **LS 3299**

Senna marilandica (L.) Link, wild senna. Native, perennial. Occasional in open woodlands and disturbed areas. Bell Co.: LS 2950, Coryell Co.: **LH 6674**

Senna roemeriana (Scheele) Irwin & Barneby, two-leaf senna. Native, perennial. Common in grasslands on rocky limestone. Bell Co.: LH 6419, Coryell Co.: LS 2443

Sesbania herbacea (Mill.) McVaugh, coffee-bean. Native, annual. Frequent in damp mud along ponds and lakes. Bell Co.: **LH 5479**, Coryell Co.: **LS 4486**

Sesbania vesicaria (Jacq.) Elliot, bladder pod. Native, annual. Common in damp soil of creek banks and roadside ditches. Bell Co.: **LH 5278**, Coryell Co.: **LH 5277**

Sophora secundiflora (Ortega) Lag. ex DC., Texas mountain laurel. Native, perennial. Common on rocky limestone slopes and mesatops. Bell Co.: LS 2135, Coryell Co.: LS 2401

Strophostyles helvola (L.) Elliott, amberique bean. Native, an-

nual. Frequent in sandy soil and post oak woodlands. Bell Co.: LS 2061, Coryell Co.: **LS 3428**

Strophostyles leiosperma (Torr. & A. Gray) Piper, slickseed fuzzy-bean. Native, annual. Rare in sandy soil and post oak woodlands. Bell Co.: CLGY 55137 (HABAYC)

Stylosanthes biflora (L.) Britton, Sterns, & Poggenb., side-beak pencil-flower. Native, perennial. Rare in sandy alluvium. Coryell Co.: **WRC 17591**

Styphnolobium affine (Torr. & A. Gray) Walp., Eve's necklace. Native, perennial. Frequent in most woodlands. Bell Co.: **GG 372**, Coryell Co.: **LS 1890**

Trifolium repens L., white clover. Introduced, perennial. Rare in disturbed areas, along creek banks, and in lawns. Bell Co.: **LH 6073**, Coryell Co.: **LS 3288**

Vicia ludoviciana Nutt., deer pea vetch. Native, annual. Common in grasslands and open woodlands. Bell Co.: LS 2322, Coryell Co.: LS 2249

Vicia sativa L. ssp. *nigra* (L.) Ehrh., common vetch. Introduced, annual. Frequent in disturbed grasslands and roadsides. Bell Co.: **LH 5618**, Coryell Co.: **LH 4661**

Vicia villosa Roth ssp. *varia* (Host) Corb., winter vetch. Introduced, annual. Rare in grasslands and disturbed areas. Coryell Co.: **VM s.n.**

Fagaceae

Quercus buckleyi Nixon & Dorr, Buckley's oak. Native, perennial. Common on dry limestone slopes, canyons, and mesas. Bell Co.: LS 2133, Coryell Co.: LS 2127

Quercus fusiformis Small, Plateau live oak. Native, perennial. Common in most habitats. Bell Co.: LS 2205, Coryell Co.: LS 2636

Quercus macrocarpa Michx., bur oak. Native, perennial. Common along riparian corridors. Bell Co.: LS 1697, Coryell Co.: **LH 4749**

Quercus marilandica Muenchh., blackjack oak. Native, perennial. Common on sandy soils and post oak woodlands. Bell Co.: LS 4630, Coryell Co.: LH 4665

Quercus muehlenbergii Engelm., chinkapin oak. Native, perennial. Common in mesic wooded canyons and slopes. Bell Co.: LS 1994, Coryell Co.: **LS 4635**

Quercus shumardii Buckley, Shumard red oak. Native, perennial. Common along riparian corridors. Bell Co.: LH 5643, Coryell Co.: **LH 6304**

Quercus sinuata Walter var. *breviloba* (Torr.) C.H. Mull., Bigelow's oak. Native, perennial. Common on limestone mesatops and in mesic wooded canyons. Bell Co.: LS 2114, Coryell Co.: **LS 2284**

Quercus stellata Wangenh., post oak. Native, perennial. Common on sandy soils and post oak woodlands. Bell Co.: LS 2321, Coryell Co.: **LS 2274**

Fumariaceae

Corydalis micrantha (Engelm. ex A. Gray) A. Gray ssp. *australis* (Chapm.) G.B. Ownbey, southern corydalis. Native, annual. Occasional on sandy Pleistocene terrace deposits. Bell Co.: CLGY 54023 (TEX), Coryell Co.: **LH 5596**

Corydalis micrantha (Engelm. ex A. Gray) A. Gray ssp. *micrantha*, small-flower corydalis. Native, annual. Occasional on sandy Pleistocene terrace deposits. Bell Co.: **LH 5586**

Garryaceae

Garrya ovata Benth. ssp. *lindheimeri* (Torr.) Dahling, Lindheimer's silktassel. Native, perennial. Rare in a mesic wooded canyon. Bell Co.: **LS 2324**

Gentianaceae

Centaurium beyrichii (Torr. & A. Gray ex Torr.) B.L. Rob., mountain-pink. Native, annual. Common on dry rocky limestone. Bell Co.: LS 4390, Coryell Co.: LH 5051

Centaurium muehlenbergii (Griseb.) W. Wright ex Piper, Muhlenberg's centaury. Introduced, annual. Frequent in seasonally seeping limestone soil. Bell Co.: **LS 3301**, Coryell Co.: **LH 6614**

Centaurium texense (Griseb.) Fernald, Texas centaury. Native, annual. Common in grasslands on dry rocky limestone. Bell Co.: LS 2488, Coryell Co.: LS 2538

Eustoma exaltatum (L.) Salisb. ex G. Don ssp. *russellianum* (Hook.) Kartesz, bluebell gentian. Native, annual or perennial. Common in seasonally seeping limestone soil and along creek banks, especially in sun. Bell Co.: **LS 4590**, Coryell Co.: LS 3567

Sabatia campestris Nutt., prairie rose gentian. Native, annual. Occasional on sandy soils and post oak woodlands. Bell Co.: CLGY 54441 (HABAYC), Coryell Co.: LS 3370

Geraniaceae

Erodium cicutarium (L.) L'Her. ex Aiton, filaree. Introduced, annual. Common in grasslands and disturbed areas. Bell Co.: LS 1701, Coryell Co.: **LS 2225**

Erodium texanum A. Gray, Texas stork's-bill. Native, annual. Common in grasslands and disturbed areas. Bell Co.: GG 347, Coryell Co.: LS 2226

Geranium carolinianum L., crane's-bill. Native, annual. Common in grasslands and disturbed areas. Bell Co.: LS 1703, Coryell Co.: **LS 2231**

Geranium texanum (Trel.) A. Heller, Texas geranium. Native, annual. Common in grasslands and disturbed areas. Bell Co.: LS 1836, Coryell Co.: LS 2643

Haloragaceae

Myriophyllum heterophyllum Michx., two-leaf water-milfoil. Native, perennial. Occasional in ponds and lakes, submersed. Bell Co.: LH 5265, Coryell Co.: LH 5484

Hippocastanaceae

Aesculus glabra Willd. var. *arguta* (Buckley) B.L. Rob., Texas buckeye. Native, perennial. Frequent along riparian corridors and in mesic wooded canyons. Bell Co.: LS 4638, Coryell Co.: **LS 4625**

Hydrophyllaceae

Nama hispidum A. Gray, sandbells. Native, annual. Rare on sandy Pleistocene terrace deposits and post oak woodlands. Bell Co.: CLGY 54438 (HABAYC), Coryell Co.: LH 6541

Nama jamaicense L., Jamaican weed. Native, annual. Occasional on sandy Pleistocene terrace deposits. Bell Co.: LH 5687, Coryell Co.: **LH 5752**

Nemophila phacelioides Nutt., baby blue-eyes. Native, annual. Common in shade along riparian corridors. Bell Co.: LH 5620, Coryell Co.: **LH 5755**

Phacelia congesta Hook., blue-curls. Native, annual. Common

in open woodlands over limestone slopes. Bell Co.: LH 4970, Coryell Co.: **LS 1711**

Juglandaceae

Carya illinoinensis (Wangenh.) K. Koch, pecan. Native, perennial. Common along riparian corridors. Bell Co.: LS 1844, Coryell Co.: LS 3292

Juglans major (Torr.) A. Heller, Arizona walnut. Native, perennial. Common in mesic wooded canyons and riparian corridors. Bell Co.: LS 1843, Coryell Co.: LS 2254

Juglans microcarpa Berl., Texas walnut. Native, perennial. Rare along gravelly creek bed. Coryell Co.: **LS 1717**

Juglans nigra L., black walnut. Native, perennial. Common along riparian corridors. Bell Co.: CC 1462, Coryell Co.: **LS 2832**

Krameriaceae

Krameria lanceolata Torr., trailing ratany. Native, perennial. Common in grasslands on rocky limestone. Bell Co.: LS 1851, Coryell Co.: LS 2423

Lamiaceae

Clinopodium arkansanum (Nutt.) House, limestone calamint. Native, perennial. Rare in seasonally seeping limestone soil. Bell Co.: LH 5924

Hedeoma acinoides Scheele, annual pennyroyal. Native, annual. Common in grasslands and open woodlands. Bell Co.: LH 6410, Coryell Co.: **LS 2283**

Hedeoma drummondii Benth., Drummond's hedeoma. Native, perennial. Common in grasslands and open woodlands. Bell Co.: **LS 2621**, Coryell Co.: **LS 2898**

Hedeoma reverchonii (A. Gray) A. Gray var. *reverchonii*, rock hedeoma. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 2682, Coryell Co.: LS 3978

Hedeoma reverchonii (A. Gray) A. Gray var. *serpyllifolia* (Small) Irving, Reverchon's false pennyroyal. Native, perennial. Common in grasslands on dry rocky limestone. Bell Co.: **LH 4941**, Coryell Co.: **LH 5000**

Lamium amplexicaule L., henbit. Introduced, annual. Occasional in disturbed areas, lawns, and near old homesites. Bell Co.: LS 4637, Coryell Co.: **LS 4600**

Lycopus americanus Muhl. ex W. Bart., American bugleweed. Native, perennial. Frequent along banks of creeks and other damp areas. Bell Co.: LS 2064, Coryell Co.: LH 5109

Marrubium vulgare L., common horehound. Introduced, perennial. Frequent in grasslands and disturbed areas, especially near old homesites. Bell Co.: LS 1791, Coryell Co.: **LS 2657**

Mentha x *piperita* L. (pro sp.) [*aquatica* x *spicata*], peppermint. Introduced, perennial. Rare along banks of creeks and other damp areas. Bell Co.: LS 1972

Mentha spicata L., spearmint. Introduced, perennial. Rare along banks of creeks and other damp areas. Bell Co.: CLGY 54545 (HABAYC)

Monarda citriodora Cerv. ex Lag., lemon beebalm. Native, annual. Common in grasslands and open woodlands. Bell Co.: LS 2808, Coryell Co.: **LS 2439**

***Monarda punctata* L. ssp. *punctata* var. *intermedia* (E.M. McClint. & Epling) Waterf.**, spotted beebalm. Native, annual. Occasional on sandy Pleistocene terrace deposits. Bell Co.: **CLGY 54256** (TEX), Coryell Co.: **LH 5958**

Salvia azurea Michx. ex Lam. var. *grandiflora* Benth., giant blue sage. Native, perennial. Common in grasslands on rocky limestone. Bell Co.: LS 3430, Coryell Co.: **LS 4498**

***Salvia engelmannii* A. Gray,** Engelmann's sage. Native, perennial. Common in grasslands on dry rocky limestone. Bell Co.: LH 5764, Coryell Co.: LH 6348

Salvia farinacea Benth., mealy sage. Native, perennial. Common in grasslands on dry rocky limestone. Bell Co.: LH 4935, Coryell Co.: **LS 2668**

Salvia reflexa Hornem., lance-leaf sage. Native, annual. Rare in grasslands and disturbed areas. Bell Co.: LH 6287

Salvia roemeriana Scheele, cedar sage. Native, perennial. Common in mesic wooded canyons and hillsides. Bell Co.: GG 358, Coryell Co.: **LH 5612**

Salvia texana (Scheele) Torr., Texas sage. Native, perennial. Common in grasslands on rocky limestone. Bell Co.: GG 348, Coryell Co.: **LS 2293**

Scutellaria drummondii Benth. var. *drummondii*, Drummond's skullcap. Native, annual. Common in grasslands and open woodlands. Bell Co.: LS 2342, Coryell Co.: LS 1712

Scutellaria ovata Hill ssp. *bracteata* (Benth.) Elping, egg-leaf skullcap. Native, perennial. Frequent in mesic limestone wooded canyons. Bell Co.: LS 2842, Coryell Co.: **LH 5009**

Scutellaria wrightii A. Gray, Wright's skullcap. Native, perennial. Common on dry rocky limestone. Bell Co.: LH 5765, Coryell Co.: **LS 2300**

Stachys crenata Raf., shade betony. Native, annual or perennial. Frequent in shade along riparian corridors. Bell Co.: LH 5587, Coryell Co.: **LS 2649**

Teucrium canadense L., American germander. Native, perennial. Common in shade of upland woodlands and riparian corridors. Bell Co.: LS 4380, Coryell Co.: LS 4400

Teucrium laciniatum Torr., cut-leaf germander. Native, perennial. Rare in grasslands on rocky limestone. Coryell Co.: LH 5873

Trichostema brachiatum L., flux-weed. Native, annual. Frequent in disturbed areas. Bell Co.: LH 5189, Coryell Co.: LS 1414

Warnockia scutellarioides (Engelm. & A. Gray) M.W. Turner, prairie brazoria. Native, annual. Common in grasslands on rocky limestone. Bell Co.: LS 2722, Coryell Co.: LS 2411

Lauraceae

Lindera benzoin (L.) Blume var. *pubescens* (Palmer & Steyerm.) Rehder, northern spicebush. Native, perennial. Frequent in mesic wooded canyons, especially near springs. Bell Co.: LH 5576, Coryell Co.: **LH 5568**

Lentibulariaceae

Utricularia gibba L., cone-spur bladderwort. Native, perennial. Occasional in ponds and lakes, submersed. Bell Co.: LS 2942

Linaceae

Linum berlandieri Hook. var. *berlandieri,* Berlandier's flax. Native, annual. Common in grasslands. Bell Co.: LS 2333, Coryell Co.: LS 2446

Linum grandiflorum Desf., flowering flax. Introduced, annual.

Rare on roadside shoulders and seeded areas, cultivated, not persisting. Coryell Co.: KSNH 787 (CMML)

Linum hudsonioides Planch., Texas flax. Native, annual. Rare in sandy soil and post oak woodlands. Bell Co.: LH 6801, Coryell Co.: **LH 5671**

Linum rupestre (A. Gray) Engelm. ex A. Gray, rock flax. Native, annual. Common on dry open limestone slopes and mesas. Bell Co.: LS 2660, Coryell Co.: LS 2406

Loasaceae

Mentzelia oligosperma Nutt. ex Sims, stick-leaf. Native, perennial. Frequent on dry limestone slopes and mesas. Bell Co.: LH 5904, Coryell Co.: LS 2745a

Loganiaceae

Mitreola petiolata (J.F. Gmel.) Torr. & A. Gray, lax hornpod. Native, annual. Common along banks of creeks and other damp areas. Bell Co.: LH 5268, Coryell Co.: **LH 5165**

Spigelia hedyotidea A. DC., prairie pinkroot. Native, perennial. Rare in shade of woodlands. Bell Co.: **LH 5903,** Coryell Co.: **LH 6563**

Lythraceae

Ammannia coccinea Rottb., purple ammannia. Native, annual. Common along banks of creeks and other damp areas. Bell Co.: LH 5180, Coryell Co.: **LS 4439**

Lagerstroemia indica L., common crape-myrtle. Introduced, perennial. Rare at old homesites, cultivated, persisting. Bell Co.: **LH 6048**, Coryell Co.: **LS 2914**

Lythrum californicum Torr. & A. Gray, California loosestrife. Native, perennial. Frequent along banks of creeks and other damp areas. Bell Co.: LS 2843, Coryell Co.: LS 2710

Malvaceae

Abutilon fruticosum Guill. & Perr., Indian-mallow. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 2929, Coryell Co.: **LS 2522**

Callirhoe involucrata (Torr. & A. Gray) A. Gray var. *involucrata*, low poppy-mallow. Native, perennial. Frequent on sandy soils and post oak woodlands. Bell Co.: CLGY 55111 (HABAYC), Coryell Co.: LH 6536

Callirhoe pedata (Nutt. ex Hook.) A. Gray, finger poppy-mallow. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 3274, Coryell Co.: LS 2435

Malva neglecta Wallr., common mallow. Introduced, annual or biennial. Occasional in disturbed areas and near old homesites. Bell Co.: **LS 2781**

***Malvastrum aurantiacum* (Scheele) Walp.**, golden false-mallow. Native, perennial. Occasional on sandy Pleistocene terrace deposits of the Leon River. Coryell Co.: **LH 5451**

Malvaviscus arboreus Dill. ex Cav. var. *drummondii* (Torr. & A. Gray) Schery, Drummond wax-mallow. Native, perennial. Occasional in mesic wooded canyons and along riparian corridors. Bell Co.: **LS 2626**, Coryell Co.: **LH 6675**

Modiola caroliniana (L.) G. Don, Carolina modiola. Native, perennial. Occasional in disturbed areas and in lawns. Bell Co.: **LH 5837**, Coryell Co.: **LS 2639**

Rhynchosida physocalyx (A. Gray) Fryxell, spear-leaf sida. Native, perennial. Common in open woodlands, especially in partial shade. Bell Co.: **LS 2933**, Coryell Co.: LH 6539

Sida abutifolia Mill., spreading sida. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LH 4959, Coryell Co.: **LS 2702**

Sida spinosa L., prickly fanpetals. Native, annual. Occasional in damp soil, disturbed areas. Bell Co.: LH 6105

Meliaceae

Melia azedarach L., China-berry. Introduced, perennial. Common in most habitats, cultivated, naturalized. Bell Co.: LS 2680, Coryell Co.: **LS 2267**

Menispermaceae

Cocculus carolinus (L.) DC., Carolina snailseed. Native, perennial. Common in most woodlands, climbing onto shrubs. Bell Co.: LS 2861, Coryell Co.: **LS 3414**

Molluginaceae

Mollugo verticillata L., green carpetweed. Native, annual. Rare on sandy Pleistocene terrace deposits. Bell Co.: CLGY 55142 (HABAYC), Coryell Co.: **LH 6157**

Moraceae

Ficus carica L., common fig. Introduced, perennial. Occasional at old homesites, cultivated, persisting. Bell Co.: **LS 1964**, Coryell Co.: **LH 6639**

Maclura pomifera (Raf.) C.K. Schneid., Osage orange. Native, perennial. Common along riparian corridors and fencerows. Bell Co.: LS 2679, Coryell Co.: LS 1907

Morus alba L., white mulberry. Introduced, perennial. Rare at old homesites, cultivated, persisting. Bell Co.: LS 1699, Coryell Co.: **LH 5296**

Morus microphylla Buckley, Texas mulberry. Native, perennial. Common in mesic wooded canyons. Bell Co.: JS 4225, Coryell Co.: **LH 4907**

Morus rubra L., red mulberry. Native, perennial. Common along riparian corridors and in mesic wooded canyons. Bell Co.: LS 1696, Coryell Co.: LS 2758

Nyctaginaceae

Boerhavia diffusa L., scarlet spiderling. Native, perennial. Occasional in sandy soil and disturbed areas. Bell Co.: LH 6670, Coryell Co.: **LH 5455**

Mirabilis albida (Walter) Heimerl, white four-o'clock. Native, perennial. Common in open woodlands. Bell Co.: LH 5175, Coryell Co.: **LH 5472**

Mirabilis jalapa L., marvel of Peru. Introduced, perennial. Occasional at old homesites, cultivated, naturalized. Coryell Co.: **LH 6061**

Mirabilis latifolia (A. Gray) Diggs, Lipscomb, & O'Kennon, broad-leaved four-o'clock. Native, perennial. Common in open woodlands. Bell Co.: **LS 2983**, Coryell Co.: **LH 5600**

Mirabilis linearis (Pursh) Heimerl, linear-leaf four-o'clock. Native, perennial. Occasional in grasslands and open woodlands. Bell Co.: **LH 5039**, Coryell Co.: **LH 4912**

Mirabilis nyctaginea (Michx.) MacMill., wild four-o'clock. Native, perennial. Occasional in open woodlands and mesatops. Bell Co.: **LH 5048**, Coryell Co.: **LS 4243**

Oleaceae

Forestiera pubescens Nutt. var. *glabrifolia* Shinners, smooth-leaf forestiera. Native, perennial. Common in most woodlands. Bell Co.: LS 2320, Coryell Co.: **LS 2285**

Forestiera pubescens Nutt. var. *pubescens*, elbow-bush. Native, perennial. Common in most woodlands. Bell Co.: LS 2130, Coryell Co.: **LS 2121**

Fraxinus americana L., white ash. Native, perennial. Common along riparian corridors. Bell Co.: **LH 5053**, Coryell Co.: **LS 2549**

Fraxinus pennsylvanica Marsh., green ash. Native, perennial. Common along riparian corridors. Coryell Co.: **LH 5075**

Fraxinus texensis (A. Gray) Sarg., Texas white ash. Native, perennial. Common in woodlands. Bell Co.: GG 354, Coryell Co.: LS 4614

Fraxinus velutina Torr., velvet ash. Native, perennial. Frequent along streams and other damp sites, cultivated, naturalized. Bell Co.: **LH 5380**, Coryell Co.: **LH 5378**

Jasminum nudiflorum Lindl., winter jasmine. Introduced, perennial. Rare at one old homesite, cultivated, persisting. Coryell Co.: **LH 6306**

Ligustrum lucidum W.T. Aiton, glossy privet. Introduced, perennial. Common along streams and other damp sites, cultivated, naturalized. Bell Co.: **LS 4596**, Coryell Co.: **LS 2596**

Ligustrum sinense Lour., Chinese privet. Introduced, perennial. Frequent along streams and other damp sites, cultivated, naturalized. Bell Co.: **LH 6800**, Coryell Co.: **LH 5874**

Syringa x *persica* L. [*afghanica* x *laciniata*], Persian lilac. Introduced, perennial. Rare at one old homesite, cultivated, persisting. Bell Co.: **LS 4632**

Onagraceae

Calylophus berlandieri Spach ssp. *berlandieri*, half-shrub sundrops. Native, perennial. Common in grasslands and open woodlands. Bell Co.: **LS 2694**, Coryell Co.: **LS 2708**

Calylophus berlandieri Spach ssp. *pinifolius* (Engelm. & A. Gray) Towner, Berlandier's evening-primrose. Native, perennial. Common in grasslands and open woodlands. Bell Co.: **GG 346**, Coryell Co.: LS 2899

Gaura brachycarpa Small, plains gaura. Native, annual. Frequent in grasslands and open woodlands. Bell Co.: LS 2341, Coryell Co.: **LS 2568**

Gaura coccinea Nutt. ex Pursh, scarlet gaura. Native, perennial. Common in open woodlands. Bell Co.: LS 1674, Coryell Co.: **LS 1719**

Gaura drummondii (Spach) Torr. & A. Gray, sweet gaura. Native, perennial. Frequent in post woodlands and sandy soils. Bell Co.: LH 5859, Coryell Co.: **LS 2404**

Gaura longiflora Spach, tall gaura. Native, annual or biennial. Rare in grasslands and open woodlands. Coryell Co.: **CC 1488**

Gaura mollis James, lizard-tail gaura. Native, annual. Common in grasslands and disturbed areas. Bell Co.: LS 3258, Coryell Co.: **LS 3975**

Gaura sinuata Nutt. ex Ser., wavy-leaf gaura. Native, perennial. Common in grasslands and disturbed areas. Bell Co.: LS 2495, Coryell Co.: LS 2526

Gaura suffulta Engelm. ex A. Gray ssp. *suffulta,* roadside gaura. Native, annual. Common in grasslands and open woodlands. Bell Co.: LS 2379, Coryell Co.: LS 2527

Ludwigia octovalvis (Jacq.) P.H. Raven, shrubby water-primrose. Native, perennial. Common along banks of creeks and other damp areas. Bell Co.: LH 5193, Coryell Co.: **LH 5308**

Ludwigia palustris (L.) Elliot, marsh-purslane. Native, perennial. Common along banks of creeks and other damp areas. Bell Co.: LS 2502, Coryell Co.: LS 3966

Ludwigia peploides (Kunth) P.H. Raven, floating primrose-willow. Native, perennial. Occasional along banks of creeks and other damp areas. Bell Co.: LH 6669

Ludwigia repens J.R. Forst., creeping water-primrose. Native, perennial. Common along banks of creeks and other damp areas. Bell Co.: LS 4287, Coryell Co.: **LH 5305**

Oenothera jamesii Torr. & A. Gray, river primrose. Native, biennial. Frequent along banks of creeks and other damp areas. Bell Co.: LS 3961, Coryell Co.: LH 5392

Oenothera laciniata Hill, cut-leaf evening-primrose. Native, annual or perennial. Frequent on sandy Pleistocene terrace deposits. Bell Co.: LH 5684, Coryell Co.: **LH 4672**

Oenothera macrocarpa Nutt. ssp. *macrocarpa*, flutter-mill. Native, perennial. Common on dry rocky limestone. Bell Co.: LS 2485, Coryell Co.: LS 2528

Oenothera rhombipetala Nutt. ex Torr. & A. Gray, four-point evening-primrose. Native, biennial. Rare on sandy Pleistocene terrace deposits. Coryell Co.: LH 6612

Oenothera speciosa Nutt., showy primrose. Native, perennial. Common in grasslands, open woodlands, and disturbed areas. Bell Co.: LS 2386, Coryell Co.: LS 2255

Oenothera triloba Nutt., stemless evening-primrose. Native, annual. Frequent on limestone mesatops and dry grasslands. Bell Co.: LS 4649, Coryell Co.: **LS 1444**

Stenosiphon linifolius (Nutt. ex E. James) Heynh., false gaura. Native, perennial. Common in grasslands on dry rocky limestone. Bell Co.: LS 2629, Coryell Co.: LS 4429

Oxalidaceae

Oxalis corniculata L., creeping ladies'-sorrel. Introduced, perennial. Frequent in most habitats. Bell Co.: LH 5645, Coryell Co.: LH 5640

Oxalis dillenii Jacq., slender yellow wood-sorrel. Native, perennial. Frequent in most habitats. Bell Co.: LH 5857, Coryell Co.: LH 5960

Oxalis drummondii A. Gray, purple wood-sorrel. Native, perennial. Occasional in grasslands and open woodlands. Bell Co.: LH 5536, Coryell Co.: LH 6252

Papaveraceae

Argemone albiflora Hornem. ssp. *texana* G.B. Ownbey, white prickly-poppy. Native, annual or biennial. Common in disturbed grasslands. Bell Co.: **LS 2840**, Coryell Co.: **LS 3286**

***Argemone aurantiaca* G.B. Ownbey,** Texas prickly-poppy. Native, annual or biennial. Rare in disturbed grasslands. Bell Co.: LH 6632, Coryell Co.: **LH 6814**

Passifloraceae

***Passiflora affinis* Engelm.,** bracted passion-flower. Native, perennial. Common in mesic woodlands, climbing onto shrubs and trees. Bell Co.: LH 5114, Coryell Co.: **LH 5257**

Passiflora lutea L., yellow passion-flower. Native, perennial. Common in mesic woodlands, climbing onto shrubs and trees. Bell Co.: LH 5003, Coryell Co.: **LH 5050**

Passiflora tenuiloba Engelm., bird-wing passion-flower. Native, perennial. Rare on limestone cliffs of mesic wooded canyons. Bell Co.: **LH 5539**

Pedaliaceae

Proboscidea louisianica (Mill.) Thell., common devil's claw. Native, annual. Common in disturbed areas. Bell Co.: LS 2855, Coryell Co.: **LS 2614**

Phytolaccaceae

Phytolacca americana L., American pokeweed. Native, annual. Common in open woodlands and disturbed areas. Bell Co.: LS 2625, Coryell Co.: LS 3310

Rivina humilis L., pigeon-berry. Native, perennial. Frequent in shade of woodlands. Bell Co.: LS 2934, Coryell Co.: LS 3419

Plantaginaceae

Plantago helleri Small, cedar plantain. Native, annual. Common in grasslands and open woodlands. Bell Co.: LS 2388, Coryell Co.: LS 2248

Plantago lanceolata L., English plantain. Introduced, biennial or perennial. Rare on disturbed roadside shoulder. Bell Co.: **LH 5068**

Plantago patagonica Jacq., bristle-bract plantain. Native, annual. Frequent in sandy soils, post oak woodlands, and disturbed areas. Bell Co.: **LS 2763**, Coryell Co.: **LS 3375**

Plantago rhodosperma Decne., red-seed plantain. Native, annual. Common in grasslands and disturbed areas. Bell Co.: LS 3276, Coryell Co.: LS 2701

Plantago virginica L., pale-seed plantain. Native, annual. Frequent in alluvial soil along creek and river banks. Bell Co.: LS 2731, Coryell Co.: LH 5757

Plantago wrightiana Decne., Wright's plantain. Native, annual. Frequent in grasslands and disturbed areas. Bell Co.: LS 3267, Coryell Co.: LS 2823

Platanaceae

Platanus occidentalis L., American sycamore. Native, perennial. Common along gravelly creek beds and at springs in mesic canyons. Bell Co.: LH 5054, Coryell Co.: LS 3295

Polemoniaceae

Giliastrum incisum (Benth.) J.M. Porter, split-leaf gilia. Native, annual. Occasional on dry limestone slopes and mesas. Bell Co.: GG 360, Coryell Co.: **LH 5850**

Ipomopsis rubra (L.) Wherry, standing cypress. Native, annual or biennial. Common in grasslands and disturbed areas. Bell Co.: LS 2592, Coryell Co.: **LS 2827**

Phlox drummondii Hook. ssp. *mcallisteri* (Whitehouse) Wherry, McAllister's phlox. Native, annual. Occasional on sandy soils and post oak woodlands. Bell Co.: **CC 1697**, Coryell Co.: **LH 5878**

***Phlox roemeriana* Scheele,** gold-eye phlox. Native, annual. Occasional in grasslands and open woodlands. Bell Co.: LS 4648, Coryell Co.: LH 6379

Phlox villosissima (A. Gray) Small, downy phlox. Native, perennial. Occasional in gravelly alluvium of creeks and adjacent slopes. Bell Co.: CLGY 55048 (HABAYC), Coryell Co.: **LH 4747**

Polygalaceae

Polygala alba Nutt., white milkwort. Native, perennial. Common in grasslands on rocky limestone. Bell Co.: LS 1850, Coryell Co.: LS 2296

Polygala incarnata L., pink milkwort. Native, annual. Rare on sandy Pleistocene terrace deposits. Coryell Co.: **WRC 17580**

Polygala lindheimeri A. Gray var. *parvifolia* Wheelock, shrubby milkwort. Native, perennial. Frequent in grasslands on dry rocky limestone. Bell Co.: **LS 3579**, Coryell Co.: LH 6069

Polygala verticillata L., whorled milkwort. Native, annual. Frequent in grasslands over limestone or sand. Bell Co.: **LH 4951**, Coryell Co.: **LS 1466**

Polygonaceae

Eriogonum annuum Nutt., annual wild buckwheat. Native, annual or biennial. Occasional in grasslands and disturbed areas. Coryell Co.: LS 1472

Eriogonum longifolium Nutt. var. *longifolium*, long-leaf wild buckwheat. Native, perennial. Frequent in sandy soils and post oak woodlands. Bell Co.: LS 2039, Coryell Co.: LS 2916

Polygonum aviculare L., prostrate knotweed. Introduced, annual or perennial. Frequent in disturbed areas. Bell Co.: LH 5910, Coryell Co.: **LS 2603**

Polygonum lapathifolium L., willow smartweed. Native, annual. Frequent in damp mud along creeks and ponds. Bell Co.: LH 6104, Coryell Co.: **LS 4499**

Polygonum pensylvanicum L., pink smartweed. Native, annual. Frequent along creeks and ponds. Bell Co.: **LH 6068**, Coryell Co.: LS 4500

Polygonum punctatum Elliot, water smartweed. Native, annual or perennial. Common in damp mud along creeks and ponds. Bell Co.: LH 5533, Coryell Co.: **LS 4469**

Polygonum ramosissimum Michx., bushy knotweed. Native, annual. Frequent in damp soil and disturbed areas. Bell Co.: **LH 6103**, Coryell Co.: **LS 2888**

Rumex altissimus Alph. Wood, pale dock. Native, biennial or perennial. Rare in damp mud along creeks, ponds, and roadside ditches. Bell Co.: CLGY 54229 (HABAYC), Coryell Co.: **LH 6314**

Rumex chrysocarpus Moris, amamastla. Native, perennial. Rare in damp mud along creeks, ponds, and roadside ditches. Bell Co.: LH 6373, Coryell Co.: **LH 6815**

Rumex crispus L., curly dock. Introduced, perennial. Common in damp mud along creeks, ponds, and roadside ditches. Bell Co.: LH 4920, Coryell Co.: **LH 6543**

Rumex hastatulus Baldw., heart-wing sorrel. Native, perennial. Frequent on sandy soils and post oak woodlands. Bell Co.: CLGY 54245 (HABAYC), Coryell Co.: LH 5668

Rumex pulcher L., fiddle dock. Introduced, perennial. Common in damp mud along creeks, ponds, and roadside ditches. Bell Co.: LH 6374, Coryell Co.: **LS 2462**

Portulacaceae

Claytonia virginica L., Virginia spring-beauty. Native, perennial. Rare in open woodlands. Bell Co.: LH 6677

Portulaca oleracea L., common purslane. Introduced, annual. Frequent on limestone mesatops and disturbed areas. Bell Co.: LH 5174, Coryell Co.: **LS 2891**

Portulaca pilosa L., chisme. Native, annual. Frequent on limestone mesatops and dry grasslands. Bell Co.: LS 2967, Coryell Co.: **LS 2890**

Primulaceae

Anagallis arvensis L., scarlet pimpernel. Introduced, annual. Occasional in disturbed grasslands. Bell Co.: **LS 4384**, Coryell Co.: **LH 6613**

Samolus ebracteatus Kunth ssp. *cuneatus* (Small) R. Knuth, limerock brookweed. Native, perennial. Occasional on seeping limestone in riparian areas and mesic wooded canyons. Bell Co.: RKGL 501

Samolus valerandi L. ssp. *parviflorus* (Raf.) Hulten, thin-leaf brookweed. Native, perennial. Common on seeping limestone in riparian areas and mesic wooded canyons. Bell Co.: LH 5473, Coryell Co.: **LS 3965**

Punicaceae

Punica granatum L., pomegranate. Introduced, perennial. Occasional at old homesites, cultivated, persisting. Bell Co.: **LH 6047**, Coryell Co.: **LS 2774**

Rafflesiaceae

Pilostyles thurberi A. Gray, Thurber's pilostyles. Native, perennial. Rare in woodlands, parasitizing *Dalea frutescens*. Bell Co.: JJ s.n., Coryell Co.: **LH 5466**

Ranunculaceae

Anemone berlandieri Pritz., wind-flower. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 2116, Coryell Co.: LS 2123

Aquilegia canadensis L., common columbine. Native, perennial. Frequent on limestone in mesic wooded canyons. Bell Co.: LH 5582, Coryell Co.: **LH 5611**

Clematis drummondii Torr. & A. Gray, Drummond's clematis. Native, perennial. Frequent in open woodlands, climbing onto shrubs. Bell Co.: **LS 1959**, Coryell Co.: **LS 2100**

Clematis pitcheri Torr. & A. Gray var. *pitcheri*, purple leatherflower. Native, perennial. Common along banks of creeks and ponds, climbing onto shrubs. Bell Co.: LS 3304, Coryell Co.: **LS 3887**

***Clematis texensis* Buckley,** scarlet clematis. Native, perennial. Frequent in mesic wooded canyons and on limestone mesatops, climbing onto shrubs. Bell Co.: LH 6023, Coryell Co.: LH 6022

Delphinium carolinianum Walter ssp. *virescens* (Nutt.) R.E. Brooks, prairie larkspur. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 2724, Coryell Co.: **LS 2554**

Ranunculus fascicularis Muhl. ex Bigelow, early buttercup. Native, perennial. Rare on sandy Pleistocene terrace deposits of the Leon River. Coryell Co.: **LH 6739**

Ranunculus macranthus Scheele, showy buttercup. Native, perennial. Frequent along banks of creeks and other damp areas. Bell Co.: CLGY 54149 (HABAYC), Coryell Co.: LS 2646

Ranunculus sceleratus L., blister buttercup. Native, annual. Common along banks of creeks and other damp areas. Bell Co.: LH 5530, Coryell Co.: **LS 4440**

Rhamnaceae

Berchemia scandens (Hill) K. Koch, supple-jack. Native, perennial. Common along riparian corridors and in mesic canyons, climbing onto shrubs and trees. Bell Co.: LS 2683, Coryell Co.: **LH 4745**

Ceanothus herbaceus Raf., redroot. Native, perennial. Common on dry rocky limestone slopes. Bell Co.: LS 4642, Coryell Co.: LH 6547

Frangula caroliniana (Walter) A. Gray, Carolina buckthorn. Native, perennial. Common in most woodlands, especially mesic woodlands. Bell Co.: LS 2506, Coryell Co.: **LS 2665**

Ziziphus zizyphus (L.) Karst., common jujube. Introduced, perennial. Frequent near old homesites, cultivated, naturalized. Bell Co.: LS 2784, Coryell Co.: LS 3312

Rosaceae

Crataegus crus-galli L., cockspur hawthorn. Native, perennial. Rare in open woodland. Coryell Co.: **LH 5758**

Geum canadense Jacq. var. *canadense*, plains white avens. Native, perennial. Common in shade along riparian corridors. Bell Co.: LS 3269, Coryell Co.: **LS 3291**

Photinia serratifolia (Desf.) Kalkm., Chinese photinia. Introduced, perennial. Occasional at old homesites, cultivated, persisting. Bell Co.: **LH 6601**, Coryell Co.: **LH 5614**

Prunus mexicana S. Watson, Mexican plum. Native, perennial. Common in most woodlands. Bell Co.: JS 4234, Coryell Co.: **LS 4616**

Prunus munsoniana W. Wight & Hedrick, wildgoose plum. Native, perennial. Frequent along banks of creeks and in other damp areas. Bell Co.: **LS 4659**, Coryell Co.: **LS 4623**

Prunus persica (L.) Batsch, peach. Introduced, perennial. Occasional at old homesites, cultivated, persisting. Bell Co.: **LS 4622**, Coryell Co.: **LS 1708**

Prunus rivularis Scheele, creek plum. Native, perennial. Common along banks of creeks and other damp areas. Bell Co.: **LS 4628**, Coryell Co.: LS 2645

***Prunus serotina* Ehrh. var. *eximia* (Small) Little,** Escarpment black cherry. Native, perennial. Rare in mesic wooded limestone canyons. Bell Co.: **LH 5002**, Coryell Co.: **BH s.n.**

Prunus umbellata Elliot, flatwood plum. Native, perennial. Occasional in open woodlands. Bell Co.: **LS 734**

Pyracantha coccinea M. Roem., scarlet fire-thorn. Introduced, perennial. Rare at old homesites and wildlife foodplots, cultivated, persisting. Coryell Co.: **LS 3627**

Pyracantha koidzumii (Hayata) Rehder, Formosa fire-thorn. Introduced, perennial. Rare at old homesites and wildlife foodplots, cultivated, persisting. Bell Co.: LS 4594, Coryell Co.: LH 5376

Pyrus calleryana Decne., Bradford pear. Introduced, perennial. Rare at old homesites, cultivated, persisting. Bell Co.: **LS 4621**, Coryell Co.: **LH 6676**

Pyrus communis L., common pear. Introduced, perennial. Rare at old homesites, cultivated, persisting. Bell Co.: **LH 5585**, Coryell Co.: **LS 2120**

Rosa eglanteria L., sweet briar rose. Introduced, perennial. Rare at old homesites, cultivated, persisting. Bell Co.: LH 5941

Rosa multiflora Thunb., Japanese rose. Introduced, perennial. Rare at old homesites, cultivated, persisting. Coryell Co.: RTBS 213

Rosa sp., antique rose. Introduced, perennial. Rare at old homesites, cultivated, persisting. Bell Co.: LH 5938, Coryell Co.: LS 2705

Rubus aboriginum Rydb., aboriginal dewberry. Native, perennial. Common in open woodlands. Bell Co.: **LS 2515**, Coryell Co.: **LS 1434**

Rubus bifrons Vest ex Tratt., two-leafed blackberry. Introduced, perennial. Occasional near old homesites, cultivated, naturalized. Bell Co.: LH 4939, Coryell Co.: LS 2400

Rubus trivialis Michx., southern dewberry. Native, perennial. Common in most habitats. Bell Co.: LS 1794, Coryell Co.: LH 4662

Sanguisorba annua (Nutt. ex Hook.) Nutt. ex Torr. & A. Gray, prairie burnet. Native, annual. Rare on sandy soils and post oak woodlands. Bell Co.: **LH 6737**, Coryell Co.: **LH 4919**

Rubiaceae

Cephalanthus occidentalis L., common buttonbush. Native, perennial. Common along banks of creeks and other damp areas. Bell Co.: LS 2591, Coryell Co.: LS 3566

Diodia teres Walter var. *teres*, poor-Joe. Native, annual. Frequent on sandy Pleistocene terrace deposits of the Leon River. Bell Co.: CLGY 55102 (HABAYC), Coryell Co.: **LS 3417**

Diodia virginiana L., Virginia buttonweed. Native, perennial. Occasional along streams and other damp sites. Bell Co.: **LH 5168**, Coryell Co.: **LH 5485**

Galium aparine L., catchweed bedstraw. Introduced, annual. Frequent in mesic woodlands and disturbed areas. Bell Co.: LS 2316, Coryell Co.: **LS 2262**

Galium circaezans Michx., woods bedstraw. Native, perennial. Frequent in shade of mesic limestone canyons. Bell Co.: LS 1993, Coryell Co.: LS 2748

Galium texense A. Gray, Texas bedstraw. Native, annual or perennial. Frequent in shade of mesic limestone canyons. Bell Co.: LS 1870, Coryell Co.: **LS 2651**

Galium virgatum Nutt., southwest bedstraw. Native, annual. Common in grasslands and open woodlands. Bell Co.: LS 2197, Coryell Co.: LS 2652

Houstonia pusilla Schoepf, tiny bluet. Native, annual. Rare on sandy Pleistocene terrace deposits of the Leon River. Coryell Co.: **LH 5597**

Sherardia arvensis L., spurwort. Introduced, annual. Occasional in disturbed areas, along creek banks, and in lawns. Bell Co.: LH 5606, Coryell Co.: **LH 5605**

Stenaria nigricans (Lam.) Terrell var. *nigricans*, prairie bluets. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 2479, Coryell Co.: LS 2430

Rutaceae

Ptelea trifoliata L. ssp. *angustifolia* (Benth.) V. Bailey var. *persicifolia* (Greene) V. Bailey, narrow-leaf hoptree. Native, perennial. Common in most woodlands, especially mesic woodlands. Bell Co.: **LH 5145**, Coryell Co.: **LH 5049**

Ptelea trifoliata L. ssp. *trifoliata* var. *mollis* Torr. & A. Gray, woolly hoptree. Native, perennial. Common in most woodlands, especially mesic woodlands. Bell Co.: LS 2765, Coryell Co.: LS 1945

Thamnosma texanum (A. Gray) Torr., rue of the mountains. Native, perennial. Rare in grasslands on dry rocky limestone. Coryell Co.: BT 3810 (TEX)

Zanthoxylum clava-herculis L., Hercules' club. Native, perennial. Rare on sandy soils and post oak woodlands. Bell Co.: GG 359, Coryell Co.: **LS 3387**

Zanthoxylum hirsutum Buckley, prickly-ash. Native, perennial. Common in open woodlands. Bell Co.: **LS 1782**, Coryell Co.: LS 2617

Salicaceae

Populus deltoides Bartram ex Marsh. ssp. *deltoides*, eastern cottonwood. Native, perennial. Common along riparian corridors. Bell Co.: LH 4929, Coryell Co.: LS 4643

Salix nigra Marsh., black willow. Native, perennial. Common along banks of creeks and other damp areas. Bell Co.: GG 362, Coryell Co.: LH 4660

Sapindaceae

Cardiospermum halicacabum L., common balloonvine. Introduced, annual. Common along banks of creeks and other damp areas. Bell Co.: LH 5527, Coryell Co.: LS 1933

Sapindus saponaria L. var. *drummondii* (Hook. & Arn.) L.D. Benson, western soapberry. Native, perennial. Common along riparian corridors and in open woodlands. Bell Co.: LS 2594, Coryell Co.: LS 2548

Ungnadia speciosa Endl., Mexican buckeye. Native, perennial. Common on limestone slopes, canyons, and mesas. Bell Co.: GG 356, Coryell Co.: LS 2638

Sapotaceae

Sideroxylon lanuginosum Michx. ssp. *albicans* (Sarg.) Kartesz & Gandhi, chittamwood. Native, perennial. Common in most woodlands. Bell Co.: LS 4393, Coryell Co.: LH 5014

Scrophulariaceae

Agalinis densiflora (Benth.) Blake, fine-leaf gerardia. Native, annual. Frequent in grasslands on dry rocky limestone. Bell Co.: LH 5162, Coryell Co.: LH 6166

Agalinis heterophylla (Nutt.) Small ex Britton, prairie agalinis. Native, annual. Common in grasslands on rocky limestone. Bell Co.: LS 2954, Coryell Co.: LS 4497

Bacopa monnieri (L.) Pennell, coastal water-hyssop. Native, perennial. Occasional in mud of ponds and lakes. Bell Co.: LH 5461, Coryell Co.: **LS 4487**

Bacopa rotundifolia (Michx.) Wettst., disc water-hyssop. Native, perennial. Rare in mud of a pond. Bell Co.: **LH 4965**

Buchnera floridana Gand., bluehearts. Native, perennial. Common in seasonally seeping limestone grasslands and along unshaded creek banks. Bell Co.: **LH 5155**, Coryell Co.: **LH 5164**

Castilleja indivisa Engelm., Texas paintbrush. Native, annual. Common in grasslands. Bell Co.: LH 5905, Coryell Co.: LS 2279

***Castilleja purpurea* (Nutt.) G. Don var. *lindheimeri* (A. Gray) Shinners**, prairie paintbrush. Native, perennial. Common

in grasslands on dry rocky limestone. Bell Co.: LH 5761, Coryell Co.: **LH 5763**

Castilleja purpurea (Nutt.) G. Don var. *purpurea,* downy Indian paintbrush. Native, perennial. Occasional in grasslands on rocky limestone. Coryell Co.: LH 6346

Dasistoma macrophylla (Nutt.) Raf., mullein seymeria. Native, perennial. Rare in mesic wooded canyons. Bell Co.: **LH 6631**, Coryell Co.: **LH 5125**

Leucospora multifida (Michx.) Nutt., narrow-leaf conobea. Native, annual. Common along banks of creeks and other damp areas. Bell Co.: LH 5153, Coryell Co.: **LS 2030**

Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm., snapdragon vine. Native, perennial. Occasional along limestone cliffs above Belton Lake, climbing onto shrubs. Bell Co.: **LS 4383**, Coryell Co.: **LH 6667**

Mecardonia procumbens (Mill.) Small, prostrate water-hyssop. Native, perennial. Common along banks of creeks and other damp areas. Bell Co.: LS 3626, Coryell Co.: **LS 4395**

Nuttallanthus texanus (Scheele) D.A. Sutton, Texas toad-flax. Native, annual. Occasional on sandy soils and post oak woodlands. Bell Co.: LH 6717, Coryell Co.: **LH 4668**

Penstemon cobaea Nutt., wild foxglove. Native, perennial. Common in grasslands on rocky limestone. Bell Co.: GG 364, Coryell Co.: LH 6349

Penstemon laxiflorus Pennell, loose-flowered penstemon. Native, perennial. Rare on sandy soils and post oak woodlands. Coryell Co.: **LS 1462**

Verbascum thapsus L., common mullein. Introduced, biennial. Frequent in disturbed areas. Bell Co.: LS 4386, Coryell Co.: **LS 3582**

Veronica anagallis-aquatica L., water speedwell. Introduced, perennial. Frequent along banks of creeks and rivers. Bell Co.: **LH 5621**, Coryell Co.: **LH 5756**

Veronica arvensis L., common speedwell. Introduced, annual. Frequent in damp soil and disturbed areas. Bell Co.: **LS 1658**, Coryell Co.: **LS 2269**

Veronica peregrina L. ssp. *xalapensis* (Kunth) Pennell, Jalapa speedwell. Native, annual. Frequent in damp soil and disturbed areas. Bell Co.: LH 6336, Coryell Co.: **LS 2455**

Veronica polita Fries, gray field speedwell. Introduced, annual. Rare in disturbed areas and lawns. Bell Co.: **LH 6680**, Coryell Co.: **LS 4602**

Simaroubaceae

Ailanthus altissima (Mill.) Swingle, tree-of-heaven. Introduced, perennial. Occasional near old homesites, cultivated, naturalized. Bell Co.: **LH 6415**, Coryell Co.: **LH 6633**

Solanaceae

Bouchetia erecta DC., erect bouchetia. Native, perennial. Rare in grasslands on dry rocky limestone. Bell Co.: LH 4909

Calibrachoa parviflora (Juss.) D'Arcy, seaside petunia. Native, annual. Rare in mud of ponds and lakes. Bell Co.: SJC T1 (TEX)

Chamaesaracha coniodes (Moric. ex Dunal) Britton, gray five eyes. Native, perennial. Frequent in grasslands and disturbed areas. Bell Co.: **LH 5888**, Coryell Co.: **LS 4644**

Chamaesaracha edwardsiana Averett, Plateau false nightshade. Native, perennial. Frequent in grasslands and disturbed areas. Bell Co.: **LH 5856**, Coryell Co.: **LS 2667**

Chamaesaracha sordida (Dunal) A. Gray, hairy false nightshade. Native, perennial. Frequent in grasslands and disturbed areas. Bell Co.: LH 5766

Datura inoxia Mill., Indian-apple. Introduced, perennial. Frequent in sandy alluvium along streams and in disturbed areas. Bell Co.: **LH 6248**, Coryell Co.: **LS 3431**

Datura stramonium L., Jimson-weed. Introduced, annual. Rare in disturbed areas. Bell Co.: CLGY 55B1 (HABAYC)

Datura wrightii Regel, sacred thorn-apple. Native, perennial. Frequent in sandy alluvium along streams and in disturbed areas. Bell Co.: LH 6063, Coryell Co.: LH 6160

Physalis angulata L., cut-leaf ground-cherry. Native, annual. Frequent in sandy and gravelly alluvium along streams. Bell Co.: LS 2860, Coryell Co.: **LS 4490**

Physalis cinerascens (Dunal) Hitchc. var. *cinerascens,* yellow ground-cherry. Native, perennial. Common in open woodlands and disturbed areas. Bell Co.: LS 2777, Coryell Co.: **LS 2525**

Physalis heterophylla Nees, clammy ground-cherry. Native, perennial. Common in open woodlands and disturbed areas. Bell Co.: LS 1705, Coryell Co.: **LS 2741**

Physalis mollis Nutt. var. *mollis*, field ground-cherry. Native, perennial. Common on sandy soils and post oak woodlands. Bell Co.: **LS 1775**, Coryell Co.: **LS 2825**

Solanum dimidiatum Raf., western horse-nettle. Native, perennial. Common in disturbed grasslands. Bell Co.: LS 2935, Coryell Co.: **LS 1898**

Solanum elaeagnifolium Cav., silver-leaf nightshade. Native, perennial. Common in disturbed grasslands. Bell Co.: **LS 3262**, Coryell Co.: **LS 2447**

Solanum ptycanthum Dunal, American nightshade. Introduced, annual. Frequent in mesic woodlands. Bell Co.: LS 2805, Coryell Co.: **LS 2849**

Solanum rostratum Dunal, buffalo-bur. Native, annual. Common in disturbed grasslands. Bell Co.: **LS 1956**, Coryell Co.: **LS 2541**

Solanum triquetrum Cav., Texas nightshade. Native, perennial. Occasional in mesic woodlands. Bell Co.: LH 4972, Coryell Co.: LS 1710

Sterculiaceae

Melochia pyramidata L., pyramid-flower. Native, perennial. Occasional in disturbed areas and in recent landscape plantings. Bell Co.: **LH 6668**

Styracaceae

***Styrax platanifolius* Engelm. ssp. *platanifolius*,** sycamore-leaf snowbell. Native, perennial. Frequent in mesic wooded limestone canyons. Bell Co.: WRC 17396, Coryell Co.: LH 5759

Tamaricaceae

Tamarix ramosissima Ledeb., salt-cedar. Introduced, perennial. Rare at old homesites, cultivated, persisting. Bell Co.: **LH 6067**, Coryell Co.: **LH 6637**

Ulmaceae

Celtis laevigata Willd. var. *laevigata*, Texas sugarberry. Native,

perennial. Common along riparian corridors. Bell Co.: LH 5900, Coryell Co.: LH 4669

Celtis laevigata Willd. var. *reticulata* (Torr.) L.D. Benson, net-leaf hackberry. Native, perennial. Common on dry limestone slopes and mesas. Bell Co.: LS 2970, Coryell Co.: LS 2704

Celtis laevigata Willd. var. *texana* Sarg., Texas hackberry. Native, perennial. Common in mesic woodlands. Bell Co.: LS 4633, Coryell Co.: LS 3684

Ulmus americana L., American elm. Native, perennial. Common along riparian corridors. Bell Co.: WRC 17586, Coryell Co.: **LS 3659**

Ulmus crassifolia Nutt., cedar elm. Native, perennial. Common in most woodlands. Bell Co.: LH 5285, Coryell Co.: LH 5272

Ulmus rubra Muhl., slippery elm. Native, perennial. Occasional along riparian corridors. Coryell Co.: **JW 277**

Urticaceae

Boehmeria cylindrica (L.) Sw., bog-hemp. Native, perennial. Rare along banks of creeks and rivers. Bell Co.: LH 6100

Parietaria pensylvanica Muhl. ex Willd., Pennsylvania pellitory. Native, annual. Common in shade of woodlands and disturbed areas. Bell Co.: LS 1685, Coryell Co.: LS 2650

Urtica chamaedryoides Pursh, stinging nettle. Native, annual. Frequent in shade of mesic limestone canyons and along riparian corridors. Bell Co.: LS 2137, Coryell Co.: **LS 2631**

Valerianaceae

Valerianella amarella (Lindh. ex Engelm.) Krok, hairy cornsalad. Native, annual. Common in grasslands on rocky limestone. Bell Co.: LH 4826, Coryell Co.: **LH 5676**

Valerianella radiata (L.) Dufr., beaked cornsalad. Native, annual. Common in grasslands on rocky limestone. Bell Co.: LS 2335, Coryell Co.: **LH 6550**

Verbenaceae

Callicarpa americana L., American beauty-berry. Native, perennial. Common in mesic wooded canyons and along riparian corridors. Bell Co.: LS 1968, Coryell Co.: LS 3972

Glandularia bipinnatifida (Nutt.) Nutt. var. *bipinnatifida*, Dakota vervain. Native, perennial. Common in grasslands on rocky limestone and disturbed areas. Bell Co.: LS 2213, Coryell Co.: LS 4645

Glandularia pumila (Rydb.) Umber, pink vervain. Native, annual. Common in grasslands and on limestone mesatops. Bell Co.: LS 2115, Coryell Co.: **LS 1438**

Lantana camara L., West Indian lantana. Introduced, perennial. Frequent near old homesites, cultivated, naturalized. Bell Co.: LS 1508, Coryell Co.: **LH 6570**

Lantana urticoides Hayek, Texas lantana. Native, perennial. Common in woodlands and open areas. Bell Co.: LS 1784, Coryell Co.: LS 2742

Phryma leptostachya L., American lopseed. Native, perennial. Frequent in mesic wooded canyons. Bell Co.: LS 4392, Coryell Co.: **LH 5126**

Phyla nodiflora (L.) Greene, Texas frog-fruit. Native, perennial. Common along banks of creeks and in disturbed grasslands. Bell Co.: LS 2500, Coryell Co.: **LS 2420**

Verbena brasiliensis Vell., Brazilian vervain. Introduced, perennial. Frequent along banks of creeks and rivers. Bell Co.: LH 4934, Coryell Co.: LS 4394

Verbena canescens Kunth, gray vervain. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 4653, Coryell Co.: LS 3498

Verbena halei Small, Texas vervain. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 2390, Coryell Co.: **LS 2434**

Verbena scabra Vahl, harsh vervain. Native, perennial. Occasional along banks of creeks and rivers. Bell Co.: LH 6096, Coryell Co.: WRC 17734

Verbena xutha Lehm., coarse vervain. Native, perennial. Occasional in grasslands and disturbed areas. Bell Co.: LS 4387, Coryell Co.: **LS 1471**

Vitex agnus-castus L. var. *agnus-castus*, common chaste-tree. Introduced, perennial. Common near old homesites, cultivated, naturalized. Bell Co.: LS 4385, Coryell Co.: **LS 3893**

Violaceae

Hybanthus verticillatus (Ortega) Baill., nodding green-violet. Native, perennial. Frequent in grasslands and open woodlands. Bell Co.: LH 6062, Coryell Co.: LH 6540

Viola bicolor Pursh, field pansy. Native, annual. Rare on sandy Pleistocene terrace deposits of the Leon River. Coryell Co.: **LH 5594**

Viola missouriensis Greene, Missouri violet. Native, perennial. Common in shade of riparian corridors and mesic wooded canyons. Bell Co.: LS 2109, Coryell Co.: **LS 2632**

Viola sororia Willd., sister violet. Native, perennial. Common in shade of riparian corridors and mesic wooded canyons. Bell Co.: LH 5577, Coryell Co.: **LH 5581**

Viscaceae

Phoradendron tomentosum (DC.) Engelm. ex A. Gray, Christmas mistletoe. Native, perennial. Common in woodlands, hemiparasite of trees. Bell Co.: LS 2134, Coryell Co.: **LS 2125**

Vitaceae

Ampelopsis arborea (L.) Koehne, pepper-vine. Native, perennial. Common in sun along creeks and streams, especially at margins of riparian corridors. Bell Co.: LS 1985, Coryell Co.: **LS 2817**

Ampelopsis cordata Michx., heart-leaf ampelopsis. Native, perennial. Common along wooded riparian corridors, climbing onto shrubs and trees. Bell Co.: **LH 4902**, Coryell Co.: LS 2816

Cissus trifoliata (L.) L., sorrelvine. Native, perennial. Frequent in woodlands, climbing onto shrubs. Bell Co.: LH 4971, Coryell Co.: **LS 2906**

***Parthenocissus heptaphylla* (Buckley) Britton ex Small,** seven-leaf creeper. Native, perennial. Common on limestone slopes and mesas, climbing onto shrubs. Bell Co.: LH 5967, Coryell Co.: **LH 5962**

Parthenocissus quinquefolia (L.) Planch., Virginia creeper. Native, perennial. Common along wooded riparian corridors, climbing onto shrubs and trees. Bell Co.: LS 1977, Coryell Co.: **LH 6611**

Vitis cinerea (Engelm.) Engelm. ex Millard var. *helleri* (L.H. Bailey) M.O. Moore, winter grape. Native, perennial. Common in

most woodlands, climbing onto shrubs and trees. Bell Co.: LS 2319, Coryell Co.: LS 2677

***Vitis monticola* Buckley,** sweet mountain grape. Native, perennial. Common on dry limestone slopes and mesas, climbing onto shrubs. Bell Co.: LH 5849, Coryell Co.: LH 5846

Vitis mustangensis Buckley, mustang grape. Native, perennial. Common in most woodlands, especially in sandy soil and along riparian corridors, climbing onto shrubs and trees. Bell Co.: LS 2318, Coryell Co.: **LS 1821**

Vitis vulpina L., fox grape. Native, perennial. Common along riparian corridors, climbing onto shrubs and trees. Bell Co.: LS 1869, Coryell Co.: **LH 4903**

Zygophyllaceae

Kallstroemia parviflora J.B.S. Norton, warty caltrop. Native, annual. Occasional in sandy soil and disturbed areas. Bell Co.: LH 6673, Coryell Co.: **LS 4484**

MAGNOLIOPHYTA: Monocotyledonae

Agavaceae

Agave americana L., American century plant. Native, perennial. Rare at old homesites and illegal dump sites, cultivated, persisting. Bell Co.: **LH 6572**, Coryell Co.: **LH 6534**

Hesperaloe parviflora (Torr.) J.M. Coult., red-flower false yucca. Native, perennial. Rare among construction debris, possibly a waif, persisting. Coryell Co.: **LH 6679**

***Nolina lindheimeriana* (Scheele) S. Watson,** devil's shoestring. Native, perennial. Common on dry rocky limestone slopes. Bell Co.: **LH 6021**, Coryell Co.: **LH 5007**

Nolina texana S. Watson, Texas sacahuista. Native, perennial. Common on shaded limestone slopes and in grasslands on dry rocky limestone. Bell Co.: **LS 2681**, Coryell Co.: **LS 2295**

Yucca arkansana Trel., Arkansas yucca. Native, perennial. Frequent in grasslands and open woodlands. Bell Co.: LH 5887, Coryell Co.: LS 1894

Yucca constricta Buckley, Buckley's yucca. Native, perennial. Frequent in grasslands and open woodlands. Bell Co.: **LS 1487**

Yucca constricta Buckley x *Y. louisianensis* Trel., hybrid yucca. Native, perennial. Rare on sandy Pleistocene terrace deposits of the Leon River. Coryell Co.: WRC 17587

***Yucca pallida* McKelvey,** pale yucca. Native, perennial. Common on rocky limestone grasslands, slopes, and mesas. Bell Co.: LH 4931, Coryell Co.: LH 5101

***Yucca rupicola* Scheele**, Texas yucca. Native, perennial. Frequent in grasslands and open woodlands. Bell Co.: LH 5185, Coryell Co.: **LH 6548**

Yucca treculeana Carr., Spanish-dagger. Native, perennial. Rare at old homesites, cultivated, persisting. Bell Co.: **LS 4652**, Coryell Co.: **LH 6719**

Alismataceae

Echinodorus berteroi (Spreng.) Fassett, burhead. Native, perennial. Common along banks of creeks and other damp areas. Bell Co.: LH 5284, Coryell Co.: LS 1934

Sagittaria calycina Engelm. var. *calycina,* giant arrowhead. Native, perennial. Frequent in shallow water or mud near banks of creeks and ponds. Bell Co.: **LH 5263**

Sagittaria platyphylla (Engelm.) J.G. Sm., delta arrowhead. Native, perennial. Common in shallow water or mud near banks of creeks and ponds. Bell Co.: LH 5264, Coryell Co.: **LH 5390**

Araceae

Arisaema dracontium (L.) Schott, green-dragon. Native, perennial. Frequent in mesic wooded canyons and along riparian corridors. Bell Co.: LH 4917, Coryell Co.: LH 4899

Xanthosoma sagittifolium (L.) Schott, arrow-leaf elephant's ear. Introduced, perennial. Rare at damp areas near old homesites, cultivated, persisting. Bell Co.: **LS 761**

Bromeliaceae

Tillandsia recurvata (L.) L., small ball-moss. Native, perennial. Occasional in mesic woodlands, epiphyte on trees. Bell Co.: LH 5146, Coryell Co.: **LH 5616**

Commelinaceae

Commelina diffusa Burm. f., climbing dayflower. Native, annual. Rare on sandy Pleistocene terrace deposits. Bell Co.: **LH 6163**

Commelina erecta L. var. *angustifolia* (Michx.) Fernald, whitemouth dayflower. Native, perennial. Occasional on sandy soil and post oak woodlands. Bell Co.: **LH 6802**, Coryell Co.: **LH 5456**

Commelina erecta L. var. *erecta*, erect dayflower. Native, perennial. Common along riparian corridors and woodland edges. Bell Co.: LS 2587, Coryell Co.: **LS 2882**

Tinantia anomala (Torr.) C.B. Clarke, false dayflower. Native, annual. Frequent in mesic woodlands and along riparian corridors. Bell Co.: LH 5622, Coryell Co.: LH 5010

***Tradescantia edwardsiana* Tharp,** Plateau spiderwort. Native, perennial. Frequent in mesic wooded canyons. Bell Co.: JS 4229, Coryell Co.: LH 5639

Tradescantia gigantea Rose, giant spiderwort. Native, perennial. Frequent in mesic woodlands and along riparian corridors. Coryell Co.: LS 1730

***Tradescantia humilis* Rose,** Texas spiderwort. Native, perennial. Frequent along riparian corridors and woodland edges. Bell Co.: LH 6407, Coryell Co.: **LH 5650**

Tradescantia occidentalis (Britton) Smyth, prairie spiderwort. Native, perennial. Frequent in open woodlands and grasslands. Bell Co.: LH 6742, Coryell Co.: LS 2273

Cyperaceae

Carex austrina (Small) Mack., southern caric sedge. Native, perennial. Rare in grasslands. Bell Co.: LS 1796, Coryell Co.: **LH 5845**

Carex blanda Dewey, charming caric sedge. Native, perennial. Frequent along wooded riparian corridors. Bell Co.: LH 5683, Coryell Co.: **LH 5604**

Carex bulbostylis Mack., globose caric sedge. Native, perennial. Frequent along wooded riparian corridors. Bell Co.: LS 1479, Coryell Co.: **LH 4663**

Carex corrugata Fernald, wrinkle-fruit caric sedge. Native, perennial. Occasional on sandy alluvium. Coryell Co.: **LS 1909**

***Carex edwardsiana* Bridges & Orzell,** Edwards Plateau caric sedge. Native, perennial. Common in mesic wooded canyons. Bell Co.: LH 5583, Coryell Co.: LH 5613

Carex emoryi Dewey, Emory's sedge. Native, perennial. Rare along banks of creeks. Coryell Co.: **LH 6816**

Carex frankii Kunth, Joseph Frank's caric sedge. Native, perennial. Rare along banks of creeks. Bell Co.: LS 2719

Carex lurida Wahlenb., sallow sedge. Native, perennial. Rare along banks of creeks and in other damp areas. Bell Co.: **LH 5926**, Coryell Co.: **LH 5948**

Carex microdonta Torr. & Hook., small-tooth caric sedge. Native, perennial. Common along banks of creeks and ponds and in other damp areas. Bell Co.: LH 5890, Coryell Co.: LH 5898

Carex muehlenbergii Schkuhr ex Willd. var. *enervis* Boott, Muhlenberg's veinless caric sedge. Native, perennial. Common in post oak woodlands and on sandy alluvium. Bell Co.: LH 5682, Coryell Co.: **LS 2755**

Carex perdentata S.D. Jones, conspicuously-toothed caric sedge. Native, perennial. Frequent along wooded riparian corridors. Bell Co.: LS 2768, Coryell Co.: **LS 3287**

Carex planostachys Kunze, cedar sedge. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 2132, Coryell Co.: LS 2124

Carex tetrastachya Scheele, four-angle caric sedge. Native, perennial. Common along banks of creeks and other damp areas. Bell Co.: LH 5769, Coryell Co.: LH 5881

Cladium mariscus (L.) Pohl ssp. *jamaicense* (Crantz) Kuk., sawgrass. Native, perennial. Rare on limestone ledges along banks of creeks and other damp areas. Bell Co.: **LS 2393**

Cyperus acuminatus Torr. & Hook. ex Torr., taper-leaf flat sedge. Native, perennial. Common along banks of creeks and other damp areas. Bell Co.: LH 5117, Coryell Co.: LH 5062

Cyperus eragrostis Lam., tall flat sedge. Native, perennial. Rare along banks of creeks. Coryell Co.: **SMKL 94**

Cyperus erythrorhizos Muhl., red-root flat sedge. Native, annual. Occasional along banks of creeks. Bell Co.: **LH 5262**

Cyperus esculentus L., yellow nut-sedge. Native, perennial. Occasional along banks of creeks and other damp areas. Coryell Co.: **LH 4999**

Cyperus lupulinus (Spreng.) Marcks ssp. *lupulinus,* slender flat sedge. Native, perennial. Frequent in open woodlands. Bell Co.: JW 196, Coryell Co.: **LS 3311**

Cyperus odoratus L., fragrant flat sedge. Native, annual or perennial. Frequent along banks of creeks and other damp areas. Bell Co.: LH 6101, Coryell Co.: JW 283

Cyperus pseudothyrsiflorus (Kuk.) J. Rich. Carter & S.D. Jones, flat sedge. Native, perennial. Rare in damp soil. Bell Co.: **LH 6049**

Cyperus pseudovegetus Steud., marsh flat sedge. Native, perennial. Frequent along banks of creeks and other damp areas. Coryell Co.: **LS 2700**

Cyperus retroflexus Buckley, one-flower flat sedge. Native, perennial. Frequent in open woodlands. Bell Co.: LS s.n., Coryell Co.: LS 2075

Cyperus setigerus Torr. & Hook., flat sedge. Native, perennial. Rare in damp soil of roadside ditch. Bell Co.: SEW 2975 (TEX)

Cyperus squarrosus L., bearded flat sedge. Native, annual. Occasional along banks of creeks and other damp areas. Coryell Co.: **LH 5102**

Cyperus strigosus L., false nut-grass. Native, perennial. Frequent along banks of creeks and other damp areas. Bell Co.: **LH 5116**, Coryell Co.: **LH 5103**

Eleocharis geniculata (L.) Roem. & Schult., Canada spike-rush. Native, annual. Frequent along banks of creeks and other damp areas. Bell Co.: LH 5271, Coryell Co.: **LH 5540**

Eleocharis montevidensis Kunth, sand spike-rush. Native, perennial. Frequent along banks of creeks and other damp areas. Bell Co.: **LS 2513**, Coryell Co.: **LS 2456**

Eleocharis occulta S.G. Sm., limestone spike-rush. Native, perennial. Frequent along banks of creeks and other damp areas. Bell Co.: **LH 5891**

Eleocharis palustris (L.) Roem. & Schult. var. *palustris,* large-spike spike-rush. Native, perennial. Frequent along banks of creeks and ponds. Bell Co.: **LH 4933**, Coryell Co.: **LH 4946**

Eleocharis parvula (Roem. & Schult.) Link ex Bluff, Nees & Schauer, dwarf spike-rush. Native, perennial. Rare along banks of creeks and other damp areas. Bell Co.: **WRC 17738**, Coryell Co.: **LH 6194**

Eleocharis quadrangulata (Michx.) Roem. & Schult., square-stem spike-rush. Native, perennial. Frequent along banks of creeks and ponds. Bell Co.: LH 5899, Coryell Co.: LH 4945

Fimbristylis puberula (Michx.) Vahl var. *puberula*, hairy fimbry. Native, perennial. Rare in seasonally seeping limestone soil. Coryell Co.: LH 5304

Fimbristylis vahlii (Lam.) Link, Vahl's fimbristylis. Native, annual. Occasional along muddy banks of ponds. Bell Co.: LH 5281

Fuirena simplex Vahl var. *simplex*, umbrella sedge. Native, perennial. Common along banks of creeks and other damp areas. Bell Co.: LH 5151, Coryell Co.: **LH 5108**

Rhynchospora nivea Boeck., snowy white-top sedge. Native, perennial. Rare on limestone ledge along banks of creek. Bell Co.: LH 5152

Schoenoplectus californicus (C.A. Mey.) Palla, California bulrush. Native, perennial. Occasional along muddy banks of ponds. Bell Co.: LH 4994, Coryell Co.: **LH 4947**

Schoenoplectus pungens (Vahl) Palla, common three-square. Native, perennial. Rare along muddy banks of ponds. Bell Co.: **LH 5143**

Schoenoplectus saximontanus (Fernald) Raynal, Rocky Mountain bulrush. Native, annual or perennial. Occasional along muddy banks of ponds. Bell Co.: **LH 6207**, Coryell Co.: LH 6193

Scirpus pendulus Muhl., rufous bulrush. Native, perennial. Occasional along banks of creeks. Bell Co.: **LH 5908**

Scleria ciliata Michx., fringed nut-rush. Native, perennial. Rare on sandy Pleistocene terrace deposits of the Leon River. Coryell Co.: **WRC 17583**

Scleria oligantha Michx., little-head nut-rush. Native, perennial. Frequent in sandy soils and post oak woodlands. Bell Co.: LH 5930, Coryell Co.: **LH 5951**

Iridaceae

Iris germanica L., German iris. Introduced, perennial. Occasional at old homesites, cultivated, persisting. Bell Co.: **LH 6337**, Coryell Co.: **LH 6345**

Iris pseudacorus L., pale yellow iris. Introduced, perennial. Rare along banks of a fishing pond, possibly a waif. Coryell Co.: **LH 6735**

Nemastylis geminiflora Nutt., prairie celestial. Native, perennial. Frequent in open areas of woodlands. Bell Co.: LH 5644, Coryell Co.: **LS 2193**

Sisyrinchium chilense Hook., sword-leaf blue-eyed grass. Native, perennial. Common in open woodlands, grasslands, and riparian areas. Bell Co.: **LH 4754**, Coryell Co.: LS 2297

Sisyrinchium minus Engelm. & A. Gray, dwarf blue-eyed grass. Native, annual. Frequent in sandy soil and post oak woodlands. Bell Co.: LH 6727, Coryell Co.: **LH 6734**

Sisyrinchium pruinosum Bickn., dotted blue-eyed grass. Native, perennial. Common in open woodlands and grasslands. Bell Co.: LH 5592, Coryell Co.: **LS 1905**

Juncaceae

Juncus brachycarpus Engelm., whiteroot rush. Native, perennial. Occasional in sandy soil. Coryell Co.: **LH 5672**

Juncus bufonius L., toad rush. Native, annual. Occasional in damp, sandy soil. Bell Co.: LH 5858

Juncus dichotomus Elliot, forked rush. Native, perennial. Common along banks of creeks and ponds, and other damp areas. Bell Co.: LH 5892, Coryell Co.: **LH 5854**

Juncus dudleyi Wiegand, Dudley's rush. Native, perennial. Occasional in damp soil. Bell Co.: **KSRS 869**, Coryell Co.: **LH 4958**

Juncus effusus L. var. *solutus* Fernald & Wiegand, common rush. Native, perennial. Occasional in damp soil. Bell Co.: LH 6480

Juncus filipendulus Buckley, ring-seed rush. Native, perennial. Frequent in damp soil. Bell Co.: LH 6018

Juncus interior Wiegand var. *interior*, inland rush. Native, perennial. Occasional in damp soil. Bell Co.: LH 5173, Coryell Co.: **JW 286**

Juncus marginatus Rostk., grass-leaf rush. Native, perennial. Occasional in damp areas of grasslands. Coryell Co.: **LH 5957**

Juncus texanus (Engelm.) Coville, Texas rush. Native, perennial. Common along banks of creeks and ponds, and other damp areas. Bell Co.: LH 5937, Coryell Co.: LH 4956

Juncus torreyi Coville, Torrey's rush. Native, perennial. Occasional in damp soil. Coryell Co.: **LS 2459**

Lemnaceae

Lemna aequinoctialis Welw., lesser duckweed. Native, annual. Rare in still water, floating. Bell Co.: CLGY 54315 (TEX)

Lemna minuta Kunth, least duckweed. Native, annual. Rare in still water, floating. Bell Co.: **LH 6573**

Lemna obscura (Austin) Daubs, little duckweed. Native, annual. Rare in still water, floating. Bell Co.: **LH 6650**, Coryell Co.: **LH 5453**

Spirodela polyrrhiza (L.) Schleid., common duckmeat. Native, annual. Rare in still water, floating. Bell Co.: **CLGY 54316** (HABAYC), Coryell Co.: **LH 5454**

Wolffia brasiliensis Weddell, Brazilian watermeal. Native, annual. Rare in still water, floating. Bell Co.: **LH 6574**, Coryell Co.: **LH 5452**

Liliaceae

Allium ampeloprasum L., broadleaf wild leek. Introduced, perennial. Occasional at old homesites, cultivated, persisting. Bell Co.: Bell **LH 6052**, Coryell Co.: **LS 2571**

Allium canadense L. var. *canadense*, Canada garlic. Native, perennial. Common along banks of creeks and other damp areas. Bell Co.: LH 4828, Coryell Co.: **LH 4750**

Allium canadense L. var. *fraseri* Ownbey, Fraser meadow garlic. Native, perennial. Frequent in post oak woodlands and sandy alluvium. Bell Co.: **LH 6408**, Coryell Co.: **LS 1824**

Allium drummondii Regel, Drummond's wild onion. Native, perennial. Common in grasslands and open woodlands. Bell Co.: JS 4231, Coryell Co.: LS 2246

Allium porrum L., garden leek. Introduced, perennial. Rare at old homesites, cultivated, persisting. Coryell Co.: **LH 5970**

Allium sativum L., cultivated garlic. Introduced, perennial. Rare at old homesites, cultivated, persisting. Bell Co.: **LH 6649**

Allium stellatum Fraser ex Ker Gawl., prairie onion. Native, perennial. Occasional in grasslands and open woodlands. Bell Co.: **LS 2507**

Androstephium caeruleum (Scheele) Greene, blue funnel-lily. Native, perennial. Rare in grasslands. Bell Co.: LH 6695, Coryell Co.: **KSNH 793**

Camassia scilloides (Raf.) Cory, wild-hyacinth. Native, perennial. Occasional on limestone mesatops and slopes. Bell Co.: WRC 17305, Coryell Co.: **LS 2195**

Cooperia drummondii Herbert, cebolleta. Native, perennial. Common in grasslands. Bell Co.: **LH 5058**, Coryell Co.: **LS 2881**

Cooperia pedunculata Herbert, giant rain-lily. Native, perennial. Common in grasslands. Bell Co.: GG 343, Coryell Co.: **LH 5677**

Erythronium albidum Nutt., white dog-tooth-violet. Native, perennial. Common in mesic wooded canyons. Bell Co.: LS 4598, Coryell Co.: **LS 4613**

Erythronium mesochoreum Knerr, dog-tooth-violet. Native, perennial. Common on mesa tops, growing in shade of shrubs. Bell Co.: **LS 2259**, Coryell Co.: **LS 2647**

Muscari neglectum Guss. ex Ten., starch grape-hyacinth. Introduced, perennial. Occasional in disturbed areas, naturalized. Bell Co.: **LH 6681**, Coryell Co.: **LH 5603**

Nothoscordum bivalve (L.) Britton, crow-poison. Native, perennial. Common grasslands and open woodlands. Bell Co.: LS 4631, Coryell Co.: LS 3435

Zigadenus nuttallii (A. Gray) S. Watson, Nuttall's death-camas. Native, perennial. Frequent on limestone mesatops and along riparian corridors. Bell Co.: LH 6413, Coryell Co.: **LH 5602**

Najadaceae

Najas guadalupensis (Spreng.) Magnus ssp. *guadalupensis*, common water-nymph. Native, annual. Frequent in ponds and lakes, submersed. Bell Co.: LH 4995, Coryell Co.: **LH 4949**

Orchidaceae

Corallorhiza wisteriana Conrad, spring coralroot. Native, perennial. Occasional in leaf litter in mesic woodlands. Bell Co.: **LH 5584**, Coryell Co.: LH 5601

Hexalectris nitida L.O. Williams, shining hexalectris. Native, perennial. Frequent in juniper leaf litter on limestone slopes and mesatops. Bell Co.: LH 5115, Coryell Co.: LH 5111

Hexalectris spicata (Walter) Barnh. var. *arizonica* (S. Watson) Catling & Engel, spiked crested-coralroot. Native, perennial. Frequent in juniper leaf litter on limestone slopes and mesatops. Bell Co.: LS 769, Coryell Co.: LS 3886

Spiranthes cernua (L.) Rich., nodding ladies' tresses. Native, perennial. Occasional along banks of creeks and other damp areas. Bell Co.: LH 5537, Coryell Co.: **LH 5486**

Spiranthes magnicamporum Sheviak, Great Plains ladies' tresses. Native, perennial. Occasional along banks of creeks and other damp areas. Bell Co.: **LH 5541**, Coryell Co.: **LH 5487**

Poaceae

Aegilops cylindrica Host, jointed goat grass. Introduced, annual. Occasional in disturbed grasslands. Bell Co.: LS 2772, Coryell Co.: LS 2828

Andropogon gerardii Vitman, big bluestem. Native, perennial. Frequent in woodlands, where protected from grazing. Bell Co.: **LS 1428**, Coryell Co.: **LH 5276**

Andropogon glomeratus (Walter) Britton, Sterns, & Poggenb., bushy bluestem. Native, perennial. Common along banks of creeks and other damp areas. Bell Co.: LS 2999, Coryell Co.: **LH 5558**

Andropogon virginicus L., broomsedge bluestem. Native, perennial. Frequent near banks of creeks and other damp areas. Bell Co.: **LH 5552**, Coryell Co.: **SKJ s.n.**

Aristida longespica Poir. var. *geniculata* (Raf.) Fernald, slim-spike three-awn. Native, annual. Occasional on sandy soils and post oak woodlands. Coryell Co.: **LH 6244**

Aristida oligantha Michx., oldfield three-awn. Native, annual. Common in disturbed grasslands. Bell Co.: LS 4591, Coryell Co.: LS 2085

Aristida purpurea Nutt. var. *longiseta* (Steud.) Vasey, red three-awn. Native, perennial. Common in disturbed grasslands. Bell Co.: LS 3578, Coryell Co.: LS 2821

Aristida purpurea Nutt. var. *nealleyi* (Vasey) Allred, blue three-awn. Native, perennial. Common in disturbed grasslands on dry rocky limestone. Bell Co.: LH 5042, Coryell Co.: LH 5017

Aristida purpurea Nutt. var. *purpurea*, purple three-awn. Native, perennial. Common in disturbed grasslands. Bell Co.: LS 2474, Coryell Co.: LH 5012

Aristida purpurea Nutt. var. *wrightii* (Nash) Allred, Wright's three-awn. Native, perennial. Common in disturbed grasslands. Bell Co.: LS 3296, Coryell Co.: LS 2822

Arundo donax L., giant reed. Introduced, perennial. Occasional along banks of creeks and disturbed roadsides. Bell Co.: LH 5529, Coryell Co.: **LH 5302**

Avena fatua L., wild oats. Introduced, annual. Common on roadside shoulders and seeded areas, cultivated, persisting. Bell Co.: **LH 4755**, Coryell Co.: LH 4900

Avena sativa L., oats. Introduced, annual. Frequent on roadside shoulders and seeded areas, cultivated, persisting. Bell Co.: **LH 5927**, Coryell Co.: LH 4752

Bothriochloa barbinodis (Lag.) Herter, pinhole bluestem. Native, perennial. Common in disturbed grasslands. Bell Co.: LH 4940, Coryell Co.: LS 3398

Bothriochloa bladhii (Retz.) S.T. Blake, Caucasian bluestem. Introduced, perennial. Occasional in disturbed grasslands and seeded areas, cultivated, persisting. Coryell Co.: **LH 5110**

Bothriochloa ischaemum (L.) Keng var. *songarica* (Rupr. ex Fisch. & C.A. Mey.) Celarier & Harlan, King Ranch bluestem. Introduced, perennial. Common in most habitats, cultivated, persisting. Bell Co.: LH 5170, Coryell Co.: LS 2080

Bothriochloa laguroides (DC.) Herter ssp. *torreyana* (Steud.) Allred & Gould, silver bluestem. Native, perennial. Common in disturbed grasslands. Bell Co.: LS 3265, Coryell Co.: LS 3889

Bothriochloa longipaniculata (Gould) Allred & Gould, long-spike silver bluestem. Native, perennial. Frequent in grasslands. Bell Co.: **LH 4937**, Coryell Co.: **LS 3891**

Bothriochloa pertusa (L.) A. Camus, pitted bluestem. Introduced, perennial. Frequent in disturbed grasslands and seeded areas, cultivated, persisting. Bell Co.: **LH 5393**, Coryell Co.: **LH 5969**

Bouteloua curtipendula (Michx.) Torr. var. *caespitosa* Gould & Kapadia, side-oats grama. Native, perennial. Common in grasslands. Bell Co.: SMKL 218, Coryell Co.: LH 6243

Bouteloua curtipendula (Michx.) Torr. var. *curtipendula*, side-oats grama. Native, perennial. Common in grasslands. Bell Co.: LS 3257, Coryell Co.: LS 2866

Bouteloua dactyloides (Nutt.) J.T. Columbus, buffalo grass. Native, perennial. Common in disturbed grasslands. Bell Co.: LS 2692, Coryell Co.: LS 2552

Bouteloua hirsuta Lag. var. *hirsuta*, hairy grama. Native, perennial. Common in disturbed grasslands. Bell Co.: LS 2051, Coryell Co.: **LS 2897**

Bouteloua hirsuta Lag. var. *pectinata* (Featherly) Cory, tall grama. Native, perennial. Common in grasslands on rocky limestone. Bell Co.: LS 4483, Coryell Co.: LS 4428

Bouteloua rigidiseta (Steud.) Hitchc., Texas grama. Native, perennial. Common in disturbed grasslands. Bell Co.: LS 1853, Coryell Co.: LS 2454

Bouteloua trifida Thurb., red grama. Native, perennial. Common in disturbed grasslands. Bell Co.: LS 1680, Coryell Co.: **LS 2912**

Briza minor L., little quaking grass. Introduced, annual. Rare in sandy soil. Coryell Co.: **LH 5669**

Bromus arvensis L., field brome. Introduced, annual. Common in disturbed grasslands. Bell Co.: LS 2493, Coryell Co.: LS 2414

Bromus catharticus Vahl, rescue grass. Introduced, annual. Common in disturbed grasslands. Bell Co.: LS 1800, Coryell Co.: LS 2234

Bromus pubescens Muhl. ex Willd., downy brome grass. Native, perennial. Frequent in mesic wooded canyons and riparian corridors. Bell Co.: LS 4244, Coryell Co.: **LS 3393**

Bromus tectorum L., cheatgrass. Introduced, annual. Frequent

in disturbed grasslands. Bell Co.: **LS 2346**, Coryell Co.: **LH 6529**

Catapodium rigidum (L.) C.E. Hubbard ex Dony, catapodium. Introduced, annual. Occasional in disturbed areas. Bell Co.: **LH 6478**, Coryell Co.: **LS 3385**

Cenchrus spinifex Cav., common sandbur. Native, perennial. Frequent in sandy soils and disturbed areas. Bell Co.: **LS 3294**, Coryell Co.: **LS 4404**

Chasmanthium latifolium (Michx.) Yates, Indian woodoats. Native, perennial. Common in mesic wooded canyons and riparian corridors. Bell Co.: LS 1988, Coryell Co.: LS 3970

Chloris andropogonoides Fourn., slim-spike windmill grass. Native, perennial. Rare in disturbed grasslands. Bell Co.: **LS 3300**

Chloris ciliata Sw., fringed windmill grass. Native, annual or perennial. Rare in disturbed grasslands. Bell Co.: **LH 5449**, Coryell Co.: **LH 6634**

Chloris cucullata Bisch., hooded windmill grass. Native, perennial. Occasional on roadside shoulders and disturbed areas. Coryell Co.: **LS 3423**

Chloris subdolichostachya Muell., short-spike windmill grass. Native, perennial. Common in disturbed grasslands. Bell Co.: LS 4382, Coryell Co.: **LS 2096**

Chloris verticillata Nutt., tumble windmill grass. Native, perennial. Common in disturbed grasslands. Bell Co.: LS 2811, Coryell Co.: **LS 1903**

Chloris virgata Sw., feather finger grass. Native, annual. Occasional on roadside shoulders and disturbed areas. Bell Co.: **LH 6671**, Coryell Co.: **LS 4475**

Coelorachis cylindrica (Michx.) Nash, Carolina joint-tail. Native, perennial. Frequent on sandy soils and post oak woodlands. Bell Co.: LH 6604, Coryell Co.: **LH 5013**

Cynodon dactylon (L.) Pers., Bermuda grass. Introduced, perennial. Common in grasslands, seeded areas, and damp soil. Bell Co.: LS 4389, Coryell Co.: **LS 2542**

Dichanthelium aciculare (Desv. ex Poir.) Gould & C.A. Clark, needle-leaf rosette grass. Native, perennial. Rare on a wooded limestone slope. Coryell Co.: **CC 1441**

Dichanthelium acuminatum (Sw.) Gould & C.A. Clark var. *acuminatum*, tapered rosette grass. Native, perennial. Frequent along banks of creeks and other damp areas. Bell Co.: LH 5171, Coryell Co.: LS 3969

Dichanthelium acuminatum (Sw.) Gould & C.A. Clark var. *lindheimeri* (Nash) Gould & C.A. Clark, Lindheimer's rosette grass. Native, perennial. Frequent along banks of creeks and other damp areas. Bell Co.: LH 4927, Coryell Co.: LH 4915

Dichanthelium depauperatum (Muhl.) Gould, starved rosette grass. Native, perennial. Rare on a wooded limestone slope. Bell Co.: **RKGL 452**

Dichanthelium laxiflorum (Lam.) Gould, open-flower rosette grass. Native, perennial. Rare in post oak woodlands and sandy soil. Bell Co.: **LS s.n.**

Dichanthelium linearifolium (Scribn. ex Nash) Gould, slim-leaf panicgrass. Native, perennial. Rare in sandy soil and post oak woodlands. Coryell Co.: **LS 2608**

Dichanthelium malacophyllum (Nash) Gould, soft-leaf rosette grass. Native, perennial. Rare on sandy Pleistocene terrace deposits. Coryell Co.: **LS 3376**

Dichanthelium oligosanthes (Schult.) Gould var. *oligosanthes*, Heller's rosette grass. Native, perennial. Occasional in woodlands. Bell Co.: **LS 1799**

Dichanthelium oligosanthes (Schult.) Gould var. *scribnerianum* (Nash) Gould, Scribner's rosette grass. Native, perennial. Common in woodlands. Bell Co.: **LH 5770**, Coryell Co.: **LH 5880**

Dichanthelium pedicellatum (Vasey) Gould, cedar rosette grass. Native, perennial. Occasional on dry open limestone slopes and mesas. Bell Co.: LH 5901, Coryell Co.: LS s.n.

Dichanthelium sphaerocarpon (Elliot) Gould, round-seed rosette grass. Native, perennial. Rare in sandy soil and post oak woodlands. Coryell Co.: JW 261

Dichanthium annulatum (Forssk.) Stapf, Kleberg bluestem. Introduced, perennial. Frequent in disturbed grasslands and seeded areas, cultivated, persisting. Bell Co.: **LH 5896**, Coryell Co.: LH 6530

Dichanthium sericeum (R. Br.) A. Camus, silky bluestem. Introduced, perennial. Frequent in disturbed grasslands and seeded areas, cultivated, persisting. Bell Co.: **LH 6603**

Digitaria ciliaris (Retz.) Koel., southern crab grass. Introduced, annual. Frequent in alluvial floodplains and disturbed areas. Bell Co.: LH 6206, Coryell Co.: **LS 3412**

Digitaria cognata (Schult.) Pilger, western witch grass. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 2981, Coryell Co.: **LS 4405**

Digitaria pubiflora (Vasey) Wipff, Carolina crabgrass. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 2662, Coryell Co.: LS 2530

Echinochloa colona (L.) Link, jungle-rice. Introduced, annual. Common along banks of creeks and other damp areas. Bell Co.: LS 2945, Coryell Co.: **LS 4398**

Echinochloa crus-galli (L.) P. Beauv., common barnyard grass. Introduced, annual. Common along banks of creeks and other damp disturbed areas. Bell Co.: LH 5195, Coryell Co.: **LH 5388**

Echinochloa muricata (P. Beauv.) Fernald, rough barnyard grass. Native, annual. Frequent along banks of creeks and other damp areas. Coryell Co.: **LH 5391**

Echinochloa walteri (Pursh) A. Heller, coast cockspur grass. Native, annual. Occasional along banks of creeks and other damp areas. Bell Co.: LH 5194

Eleusine indica (L.) Gaertn., Indian goose grass. Introduced, annual. Occasional on roadside shoulders, lawns, and disturbed areas. Coryell Co.: **LS 4478**

Elymus canadensis L., Canada wild rye. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 2583, Coryell Co.: LS 2444

Elymus virginicus L., Virginia wild rye. Native, perennial. Common along banks of creeks and ponds. Bell Co.: LS 4388, Coryell Co.: LS 2550

Eragrostis barrelieri Daveau, Mediterranean love grass. Introduced, annual. Common along roadside shoulders and disturbed areas. Bell Co.: LS 3502, Coryell Co.: LS 2963

Eragrostis cilianensis (All.) Vign. ex Janchen, stink grass. Intro-

duced, annual. Frequent in disturbed areas. Bell Co.: LH 5176, Coryell Co.: **LH 5553**

Eragrostis curtipedicellata Buckley, gummy love grass. Native, perennial. Common in sandy soil, grasslands, and open woodlands. Bell Co.: LS 2771, Coryell Co.: LS 3399

Eragrostis curvula (Schrad.) Nees, weeping love grass. Introduced, perennial. Rare on roadside shoulder, seeded area, cultivated, persisting. Bell Co.: LH 5895

Eragrostis hirsuta (Michx.) Nees, big-top love grass. Native, perennial. Frequent in sandy soil, grasslands, and open woodlands. Bell Co.: **LH 5157**, Coryell Co.: **LS 2078**

Eragrostis intermedia Hitchc., plains love grass. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 2923, Coryell Co.: **LS 3421**

Eragrostis pectinacea (Michx.) Nees ex Steud. var. *pectinacea*, spreading love grass. Native, annual. Frequent in damp, disturbed areas. Bell Co.: LS 3501, Coryell Co.: **LH 5059**

Eragrostis secundiflora J. Presl ssp. *oxylepis* (Torr.) S.D. Koch, red love grass. Native, perennial. Frequent in sandy soil and post oak woodlands. Coryell Co.: LS 1953

Eragrostis sessilispica Buckley, tumble love grass. Native, perennial. Frequent in sandy soil and post oak woodlands. Coryell Co.: LH 6026

Eragrostis superba Peyr., Wilmann's love grass. Introduced, perennial. Common in disturbed grasslands. Bell Co.: **LS 2833**, Coryell Co.: **LS 2871**

Eragrostis trichodes (Nutt.) Alph. Wood, sand love grass. Native, perennial. Common on rocky limestone mesatops. Bell Co.: **LS 2924**, Coryell Co.: **LS 3400**

Eriochloa sericea (Scheele) Munro ex Vasey, Texas cup grass. Native, perennial. Frequent in grasslands. Bell Co.: LS 2725, Coryell Co.: **LS 2820**

Erioneuron pilosum (Buckley) Nash, hairy tridens. Native, perennial. Common in grasslands on dry rocky limestone. Bell Co.: LS 1802, Coryell Co.: LS 2294

Festuca versuta Beal, Texas fescue. Native, perennial. Rare in mesic woodlands along streams and in canyons. Bell Co.: WRC 17549

Glyceria striata (Lam.) Hitchc., fowl manna grass. Native, perennial. Frequent along damp banks of creeks and ponds. Bell Co.: LH 5198, Coryell Co.: **LH 6738**

Hilaria belangeri (Steud.) Nash, common curly-mesquite. Native, perennial. Frequent in grasslands on dry rocky limestone. Bell Co.: LS 2691, Coryell Co.: **LS 2878**

Hordeum pusillum Nutt., little barley. Native, annual. Common in grasslands and open woodlands. Bell Co.: LS 1877, Coryell Co.: LS 2227

Koeleria macrantha (Ledeb.) Schult., prairie Junegrass. Native, perennial. Rare in undisturbed grasslands. Bell Co.: **SEW H-412** (TEX)

Leersia oryzoides (L.) Sw., rice cut grass. Native, perennial. Frequent along damp banks of creeks and ponds. Coryell Co.: **LS 3440**

Leersia virginica Willd., white grass. Native, perennial. Frequent in mesic wooded canyons and along damp banks of creeks and ponds. Bell Co.: LH 6482, Coryell Co.: **LH 5483**

Leptochloa dubia (Kunth) Nees, green sprangletop. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LH 4968, Coryell Co.: **LS 2965**

Leptochloa fusca (L.) Kunth ssp. *fascicularis* (Lam.) N. Snow, bearded sprangletop. Native, annual. Common along banks of creeks and other damp areas. Bell Co.: **LS 3500**, Coryell Co.: **LH 5060**

Leptochloa panicea (Retz.) Ohwi ssp. *mucronata* (Michx.) Nowack, red sprangletop. Native, annual. Common along banks of creeks and other damp areas. Bell Co.: LS 2980, Coryell Co.: **LS 4488**

Limnodea arkansana (Nutt.) L.H. Dewey, Ozark grass. Native, annual. Common in grasslands and open woodlands. Bell Co.: LH 4910, Coryell Co.: LH 4913

Lolium perenne L. ssp. *multiflorum* (Lam.) Husnot, Italian rye grass. Introduced, annual or perennial. Frequent on disturbed roadside shoulders and disturbed areas. Bell Co.: LS 1867, Coryell Co.: LS 2265

Lolium temulentum L., rye grass. Introduced, annual. Occasional on disturbed roadside shoulders and disturbed areas. Bell Co.: LS 2492, Coryell Co.: LH 4944

Melica nitens (Scribn.) Nutt. ex Piper, three-flower melic grass. Native, perennial. Rare in mesic woodlands. Coryell Co.: **LH 6531**

***Muhlenbergia involuta* Swallen,** canyon muhly. Native, perennial. Rare in seasonally seeping limestone soil. Bell Co.: **LH 6238**

Muhlenbergia lindheimeri Hitchc., Lindheimer's muhly. Native, perennial. Rare in seasonally seeping limestone soil. Bell Co.: LH 6239

Muhlenbergia reverchonii Vasey & Scribn., seep muhly. Native, perennial. Common in seasonally seeping limestone soil and along unshaded creek banks. Bell Co.: LS 1430, Coryell Co.: LS 2091

Muhlenbergia schreberi J.F. Gmel., nimble-will. Native, perennial. Frequent along banks of creeks and other damp areas. Bell Co.: LS 1966, Coryell Co.: **LH 5122**

Muhlenbergia sobolifera (Muhl. ex Willd.) Trin., Rock muhly. Native, perennial. Rare on sandy Pleistocene terrace deposits. Coryell Co.: **LH 6195**

Muhlenbergia sylvatica Torr. ex A. Gray, forest muhly. Native, perennial. Rare along wooded riparian corridor. Bell Co.: **LS 2796**

Nassella leucotricha (Trin. & Rupr.) Pohl, Texas winter grass. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 1797, Coryell Co.: LS 2243

Neeragrostis reptans (Michx.) Nicora, creeping love grass. Native, annual. Occasional along banks of ponds and other damp areas. Bell Co.: LH 5475

Panicum bergii Arechav., Berg's panicgrass. Introduced, perennial. Rare in a disturbed grassland. Bell Co.: **LH 5150**

Panicum capillare L., witch grass. Native, annual. Common in grasslands on dry rocky limestone. Bell Co.: LH 5119, Coryell Co.: LH 5293

Panicum coloratum L., Klein grass. Introduced, perennial. Common in disturbed grasslands. Bell Co.: **LS 3256**, Coryell Co.: **LH 6030**

Panicum dichotomiflorum Michx. var. *dichotomiflorum*, fall

panicum grass. Native, annual. Frequent in damp, disturbed areas. Bell Co.: LH 5118, Coryell Co.: **LS 3451**

Panicum diffusum Sw., spreading panicum. Native, perennial. Rare in sandy soil. Coryell Co.: **LH 6538**

Panicum hallii Vasey var. *hallii*, Hall's panicum. Native, perennial. Common in grasslands on dry rocky limestone. Bell Co.: LH 5965, Coryell Co.: LS 2740

Panicum obtusum Kunth, vine-mesquite. Native, perennial. Common in grasslands. Bell Co.: LH 4963, Coryell Co.: LS 2879

Panicum virgatum L., switch grass. Native, perennial. Frequent along banks of creeks and other damp areas. Bell Co.: LS 2926, Coryell Co.: LH 5329

Paspalidium geminatum (Forssk.) Stapf, Egyptian paspalidium. Introduced, perennial. Occasional in shallow water near banks of ponds. Coryell Co.: LH 4948

Paspalum dilatatum Poir., Dallis grass. Introduced, perennial. Common along banks of creeks and in disturbed areas. Bell Co.: LS 3255, Coryell Co.: **LS 2815**

Paspalum distichum L., knot grass. Native, perennial. Common along banks of creeks and other damp areas. Bell Co.: LH 4924, Coryell Co.: **LH 5061**

Paspalum floridanum Michx., Florida paspalum. Native, perennial. Frequent along banks of creeks and ponds and other damp areas. Bell Co.: LS 4592, Coryell Co.: **LH 5325**

Paspalum notatum Fluegge var. *latiflorum* J. Doll, Bahia grass. Introduced, perennial. Rare in disturbed grasslands and roadside shoulders. Bell Co.: **LH 6672**

Paspalum pubiflorum Rupr. ex Fourn., hairy-seed paspalum. Native, perennial. Common along banks of creeks and other damp areas. Bell Co.: LH 5327, Coryell Co.: LH 4953

Paspalum setaceum Michx., thin paspalum. Native, perennial. Frequent on rocky limestone mesatops and in post oak woodlands. Bell Co.: LS 2976, Coryell Co.: LS 3380

Paspalum urvillei Steud., Vasey grass. Introduced, perennial. Frequent along banks of creeks and other damp areas. Bell Co.: **LS 2512**, Coryell Co.: LH 5387

Phalaris caroliniana Walter, Carolina Canary grass. Native, annual. Frequent in damp soil of creek banks and roadside ditches. Bell Co.: LH 4829, Coryell Co.: LS 2709

Poa annua L., annual bluegrass. Introduced, annual. Common in disturbed areas. Bell Co.: LH 6335, Coryell Co.: LS 2268

Poa arachnifera Torr., Texas blue grass. Native, perennial. Common along riparian corridors and in post oak woodlands. Bell Co.: LS 2384, Coryell Co.: LH 6315

Polypogon monspeliensis (L.) Desf., annual rabbit's foot grass. Introduced, annual. Frequent along banks of creeks and other damp areas. Bell Co.: LH 5686, Coryell Co.: **LS 2562**

Polypogon viridis (Gouan) Breistr., water bent grass. Introduced, perennial. Frequent along banks of creeks and ponds. Bell Co.: LS 2518, Coryell Co.: **LS 2557**

Schedonnardus paniculatus (Nutt.) Trel., tumble grass. Native, perennial. Common in disturbed grasslands. Bell Co.: LS 2584, Coryell Co.: LS 2671

Schedonorus phoenix (Scop.) Holub, tall fescue. Introduced, perennial. Rare along banks of creeks and rivers. Bell Co.: **LH 5940**, Coryell Co.: **LH 6072**

Schizachyrium scoparium (Michx.) Nash var. *scoparium*, little bluestem. Native, perennial. Common in grasslands and open woodlands. Bell Co.: **LS 1431**, Coryell Co.: LS 2089

Setaria parviflora (Poir.) Kerguelen, knot-root bristle grass. Native, perennial. Frequent along banks of creeks and other damp areas. Bell Co.: LH 5534, Coryell Co.: LS s.n.

Setaria pumila (Poir.) Roem. & Schult. ssp. *pumila*, yellow bristle grass. Introduced, annual. Frequent in disturbed areas. Bell Co.: LH 5070, Coryell Co.: LS s.n.

Setaria reverchonii (Vasey) Pilger ssp. *ramiseta* (Scribn.) W.E. Fox, Rio Grande bristle grass. Native, perennial. Occasional on sandy soils and post oak woodlands. Bell Co.: **LS 2471**, Coryell Co.: **LH 5843**

Setaria reverchonii (Vasey) Pilger ssp. *reverchonii*, Reverchon's bristle grass. Native, perennial. Common in grasslands on dry rocky limestone. Bell Co.: **LH 5160**, Coryell Co.: BRJ 59

Setaria scheelei (Steud.) Hitchc., southwestern bristle grass. Native, perennial. Common in open woodlands. Bell Co.: LS 2930, Coryell Co.: **LH 5286**

Setaria viridis (L.) P. Beauv. var. *viridis*, green bristle grass. Introduced, annual. Occasional in disturbed areas. Bell Co.: LS 2803, Coryell Co.: **LH 6566**

Sorghastrum nutans (L.) Nash, yellow Indian grass. Native, perennial. Common in grasslands and open woodlands. Bell Co.: LS 2062, Coryell Co.: **LS 2092**

Sorghum halepense (L.) Pers., Johnson grass. Introduced, perennial. Common in grasslands and disturbed areas. Bell Co.: LS 2589, Coryell Co.: LS 2409

Sphenopholis obtusata (Michx.) Scribn., prairie wedgescale. Native, annual. Common along banks of creeks and other damp areas. Bell Co.: LH 5882, Coryell Co.: **LH 5949**

Sporobolus clandestinus (Biehler) Hitchc., purple-flower dropseed. Native, perennial. Frequent in post oak woodlands. Bell Co.: LH 5375, Coryell Co.: LS 2095

Sporobolus compositus (Poir.) Merr. var. *compositus,* tall dropseed. Native, perennial. Common in disturbed grasslands. Bell Co.: LS 3429, Coryell Co.: LS 2865

Sporobolus compositus (Poir.) Merr. var. *drummondii* (Trin.) Kartesz & Gandhi, meadow dropseed. Native, perennial. Common in grasslands and open woodlands. Bell Co.: **LS 2979**, Coryell Co.: **LS 2090**

Sporobolus cryptandrus (Torr.) A. Gray, sand dropseed. Native, perennial. Frequent in grasslands and open woodlands. Bell Co.: RKGL 509, Coryell Co.: LS 2905

Sporobolus neglectus Nash, puff-sheath dropseed. Native, annual. Common in disturbed grasslands and along roadside shoulders. Bell Co.: **LH 6286**

Sporobolus vaginiflorus (Torr. ex A. Gray) Alph. Wood var. *ozarkanus* (Fernald) Shinners, Ozark dropseed. Native, annual. Common in disturbed grasslands and along roadside shoulders. Bell Co.: LH 5554, Coryell Co.: **LH 5551**

Sporobolus vaginiflorus (Torr. ex A. Gray) Alph. Wood var. *vaginiflorus,* poverty dropseed. Native, annual. Frequent in disturbed grasslands and along roadside shoulders. Bell Co.: CLY 53079 (TEX), Coryell Co.: LS 3433

Stenotaphrum secundatum (Walter) Kuntze, St. Augustine grass. Introduced, perennial. Rare along banks of a creek, possibly a waif, persisting. Bell Co.: **LH 5149**

Tridens albescens (Vasey) Woot. & Standl., white tridens. Native, perennial. Common in damp soil along banks of creeks and disturbed areas. Bell Co.: LS 1858, Coryell Co.: **LS 1948**

***Tridens congestus* (L.H. Dewey) Nash,** pink tridens. Native, perennial. Rare in damp soil along banks of a creek. Bell Co.: **LH 5932**

Tridens flavus (L.) Hitchc. var. *flavus*, purpletop. Native, perennial. Common in open woodlands. Bell Co.: LH 5197, Coryell Co.: **LS 3424**

Tridens muticus (Torr.) Nash var. *elongatus* (Buckley) Shinners, rough tridens. Native, perennial. Common on rocky limestone slopes and mesatops. Bell Co.: LS 3268, Coryell Co.: **LS 2874**

Tridens muticus (Torr.) Nash var. *muticus*, slim tridens. Native, perennial. Frequent on rocky limestone slopes and mesatops. Bell Co.: BRJ 58, Coryell Co.: **LS 3434**

Tripsacum dactyloides (L.) L., eastern gamma grass. Native, perennial. Occasional along banks of creeks and in damp soil. Bell Co.: LS 2519

Trisetum interruptum Buckley, prairie trisetum. Native, annual. Common in grasslands and open woodlands. Bell Co.: LH 5911, Coryell Co.: **LH 5844**

Triticum aestivum L., common wheat. Introduced, annual. Rare on roadside shoulders and seeded areas, cultivated, not persisting. Bell Co.: KSRS 1066 (CMML), Coryell Co.: LH 6741

Urochloa fusca (Sw.) B.F. Hansen & Wunderlin, browntop. Native, annual. Occasional in disturbed areas. Bell Co.: LH 5105, Coryell Co.: SMKL 160

Vulpia octoflora (Walter) Rydb. var. *glauca* (Nutt.) Fernald, six-weeks fescue. Native, annual. Common in grasslands and disturbed areas. Bell Co.: LS 1786, Coryell Co.: **LS 1826**

Pontederiaceae

Heteranthera limosa (Sw.) Willd., blue mud-plantain. Native, perennial. Rare in damp mud. Coryell Co.: **LH 6568**

Potamogetonaceae

Potamogeton nodosus Poir., long-leaf pondweed. Native, perennial. Frequent in ponds and lakes, submersed. Bell Co.: LH 5478, Coryell Co.: **LH 5294**

Smilacaceae

Smilax bona-nox L., saw greenbrier. Native, perennial. Common in most habitats, climbing onto shrubs and trees. Bell Co.: LS 1872, Coryell Co.: LH 4748

Smilax tamnoides L., bristle greenbrier. Native, perennial. Common along riparian corridors, climbing onto shrubs and trees. Bell Co.: LH 5290, Coryell Co.: LH 5121

Typhaceae

Typha domingensis Pers., narrow-leaf cat-tail. Native, perennial. Common in shallow water or mud near banks of creeks, ponds, and other damp areas. Bell Co.: LS 3303, Coryell Co.: **LS 3284**

Typha latifolia L., broad-leaf cat-tail. Native, perennial. Frequent in shallow water or mud near banks of creeks, ponds, and other damp areas. Bell Co.: LH 6019, Coryell Co.: **LH 5928**

ACKNOWLEDGMENTS

I am grateful to John Cornelius, Chief of Natural Resources, retired, for providing me the opportunity to work on this project. Bill Carr enthusiastically identified numerous specimens over the years. Walter Holmes, David Rosen, Stanley Jones, Billie Turner, and Tom Wendt assisted with determinations. Curators of the following herbaria provided access to or loans of their collections: BAYLU, CMML, HABAYC, HPC, LL, and TEX. Special thanks to Jack Stanford. The manuscript was improved by comments from Walter Holmes, Michael Palmer, and Bonnie Amos. The content of this manuscript does not necessarily reflect the position or policy of the US government and no official endorsement should be inferred.

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Appendix D. Agency and Public Correspondence

Reserved for correspondence between Fort Hood and participating reviewing parties during review of this INRMP/EA.

Distribution List

U.S. Fish and Wildlife Service
Arlington, Texas Ecological Services Field Office
Sean Edwards, Fish and Wildlife Biologist
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U.S. Fish and Wildlife Service
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10711 Burnet Road, Suite 200
Austin, TX 78758
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Texas Parks and Wildlife Department
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Laura Zebehazy, Program Leader
4200 Smith School Road
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Texas Parks and Wildlife Department
Wildlife Division: Wildlife Habitat Assessment Program
Richard Hanson, Habitat Assessment Biologist
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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
2005 NE Green Oaks Blvd., Suite 140
Arlington, Texas 76006

In Reply Refer To:
02ETAR00-2018-I-1465

August 16, 2018

Ms. Timi M. Dutchuk, P.E.
Chief, Environmental Programs
Building 4622 Engineer Drive
Fort Hood, TX 76544

Dear Ms. Dutchuk:

Thank you for your June 26, 2018, e-mail requesting review and comment on the draft 2019-2023 Integrated Natural Resources Management Plan (INRMP) for Fort Hood Military Installation in Bell and Coryell Counties, Texas. Our review was requested pursuant to the Sikes Act Improvement Act of 1997 (16 USC 670a et seq.), as amended. The purpose of the INRMP is to provide land management and improvement guidance to ensure maximum military use while maintaining and protecting natural resources, sustaining productivity of ecosystems to benefit fish and wildlife, and promoting recreational opportunities. After our comments on this preliminary draft have been considered, the forthcoming Final INRMP is due for its 5-year review and signature from the U.S. Fish & Wildlife Service's (Service) Region 2 Regional Director.

General Comments:

Fort Hood's ability to rehabilitate natural areas, implement an effective firebreak construction plan, and manage vegetative structure and composition has been especially beneficial to the black-capped vireo and endangered golden-cheeked warbler. In fact, in part because of your commitment to environmental stewardship, the Service determined that the black-capped vireo is recovered and no longer requires the protections under the Endangered Species Act, effective May 16, 2018. To ensure black-capped vireo populations remain healthy and stable into the future, the Service has developed a post-delisting monitoring plan which describes the methods we will use to monitor the status of the vireo and its habitat, in cooperation with our partners for a 12-year period and provides a strategy for identifying and responding to any future population declines or habitat loss. We greatly appreciate Fort Hood's pledge to continue efforts to benefit and monitor the status of the black-capped vireo while participating in the post-delisting monitoring plan.

Specific Comments:

p. 4-29 The current scientific name for smooth pimpleback is *Cyclonaias houstonensis*.

p. 4-34 Table 4-10. Recommend adding Texas fawnsfoot (*Truncilla macrodon*), a candidate species, as not known to occur on Fort Hood. Also recommend adding Salado Springs salamander (*Eurycea chisolmensis*), a federally-threatened species occurring in Bell County.

p. 4-75 Consider revising "Over the past nine years…Conservancy staff members… (have assisted in prescribed burns)" It is our understanding that Nature Conservancy has not been a participant in these efforts since approximately 2010 (pers. comm. Chris Harper, Austin USFWS).

p. 4-85 Table 4-27 indicates 29,182 grazeable acres in Eastern Training Area South; however, Table 4-28 (p. 4-47) indicates an acreage of 22,614 grazeable acres for the same area.

The natural resource management goals and objectives described in the INRMP do not appear to pose any substantial and/or permanent adverse impacts to natural resources found at Fort Hood. We believe that the planned projects as proposed will assist in accomplishing the desired and reasonable land management goals and objectives as outlined within the INRMP.

Thank you for the opportunity to review and comment on the draft INRMP. We look forward to assisting your staff in review of the final INRMP and on-the-ground habitat conservation activities. If you have any questions, please contact Sean Edwards of my staff at (817) 277-1100 ext. 2127.

Sincerely,

Debra T. Bills

Debra Bills
Field Supervisor

cc: Allison Arnold, USFWS Regional Sikes Act Coordinator, Southwest Region

S:\Correspondence\FY 2018\Project Files\2018-I-1465 Ft. Hood INRMP 5-yr Review\2018-I-1465 Ft Hood draft INRMP response.doc

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Carter P. Smith
Executive Director

August 14, 2018

Ms. Tonya Smith
Whitetail Environmental, LLC
P.O. Box 68
Jay, OK 74346

RE: Fort Hood 2019-2023 Integrated Natural Resources Management Plan (IMRMP) Review

Dear Ms. Smith:

Texas Parks and Wildlife Department (TPWD) has received the draft INRMP for Fort Hood. TPWD staff has reviewed the document and offers the following comments for consideration for incorporation into the INRMP.

Facility Description

Fort Hood Military Reservation is located in central Texas within Bell and Coryell Counties adjacent to the City of Killeen. Fort Hood encompasses just over 218,823 acres of land, consisting of 132,525 acres of maneuver training area and 64,272 acres of Live-Fire Area.

Rare and Protected Species

Table 3.2 of the draft INRMP references the Texas Wildlife Action (2005-2010) as the document/agreement between TPWD and Fort Hood.

Recommendation: The Texas Wildlife Action Plan is obsolete and has been replaced by the Texas Conservation Action Plan (TCAP). Please reference the TCAP in Table 3.

The TCAP Overview Handbook, as well as the TCAP Ecoregion Handbooks can be found on the TPWD Wildlife Diversity Program website.

Recommendation: TPWD recommends Fort Hood review the TCAP Overview Handbook and the TCAP Cross Timbers Ecoregion Handbook.

4200 SMITH SCHOOL ROAD
AUSTIN, TEXAS 78744-3291
512.389.4800
www.tpwd.texas.gov

Table 4-8 of the draft INRMP lists the Federally-listed threatened and endangered species that occur or may occur on Fort Hood.

> **Recommendation:** TPWD recommends Fort Hood review the TPWD county lists for Bell and Coryell Counties and include State-listed threatened and endangered species that occur or may occur on Fort Hood in Table 4-8. These lists are available on the Rare, Threatened, and Endangered Species of Texas website.

TPWD appreciates the opportunity to provide comments on the draft INRMP. Please contact me at (806) 761-4936 or Richard.Hanson@tpwd.texas.gov if you have any questions or need additional assistance.

Sincerely,

Rick Hanson

Rick Hanson
Wildlife Habitat Assessment Program
Wildlife Division

RH: 40235

Appendix E. Finding of No Significant Impact

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FINDING OF NO SIGNIFICANT IMPACT (FNSI)

Implementation of the
FY 2019-2023 Fort Hood
Integrated Natural Resources Management Plan

FORT HOOD, TEXAS

DIRECTORATE OF PUBLIC WORKS

Febuary 2019

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FINDING OF NO SIGNIFICANT IMPACT

(FNSI) IMPLEMENTATION OF THE

FY 2019-2023 FORT HOOD INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

FORT HOOD, TEXAS

The National Environmental Policy Act (NEPA) of 1969 requires federal agencies to consider potential environmental impacts prior to undertaking a course of action. NEPA is implemented through regulations promulgated by the Council on Environmental Quality (CEQ) (40 Code of Federal Regulations [CFR] 1500–1508) and within the United States (U.S.) Department of the Army (Army) by 32 CFR 651, *Environmental Analysis of Army Actions*. In accordance with these requirements, Fort Hood prepared an Environmental Assessment (EA), which is incorporated by reference, to consider environmental effects that could result from the implementation of the *FY 2019-2023 Fort Hood Integrated Natural Resources Management Plan* (INRMP) at Fort Hood, Texas (hereby referred to as the Proposed Action).

1.0 TITLE OF ACTION

Implementation of the FY 2019-2023 Integrated Natural Resources Management Plan, Fort Hood, Texas dated September 2018.

2.0 BACKGROUND INFORMATION

Whitetail Environmental, LLC, Jay, Oklahoma and the Environmental Division, Directorate of Public Works (DPW) at Fort Hood, Texas have prepared an EA to analyze potential environmental impacts resulting from the Proposed Action and alternatives from the implementation of the INRMP. The EA (included as Chapter 7 of the INRMP), which is hereby incorporated by reference, was prepared in accordance with NEPA, CEQ, and Army regulations.

The U.S. Army Garrison Fort Hood, Texas (Fort Hood) has an estimated on-installation population of 68,448 and is located in Central Texas, approximately 60 miles from both the cities of Austin and Waco, and adjoining the cities of Belton, Killeen, Copperas Cove, and Gatesville. Fort Hood is located in Bell and Coryell counties, with the majority of its training lands in Coryell County.

Fort Hood occupies approximately 342 square miles or 218,823 total acres. It is one of the largest installations in the U.S. and is home for approximately 20 percent of the active Army. Approximately 196,797 acres of this land is range and training land. Approximately 132,525 acres is used for maneuver training area and 64,272 acres is used for range live fire area (LFA).

3.0 DESCRIPTION OF THE PROPOSED ACTION

The Proposed Action includes the implementation of the FY 2019-2023 updated INRMP, which supports the management of natural resources. The purpose of the Proposed Action is to continue several management programs currently in place and to carry out the set of resource-specific management measures developed in the INRMP. This enables Fort Hood personnel to effectively manage the use and condition of natural resources on the installation. Implementation of the Proposed Action supports the U.S. Army's continuing need to ensure the safety and efficiency of its mission while practicing sound resources stewardship and compliance with environmental policies and regulations.

The Proposed Action supports an ecosystem approach and includes natural resources management measures to be undertaken on Fort Hood. The Proposed Action focuses on a 5-year planning period, which is consistent with the timeframe for the management measures described in the INRMP. This planning period will become effective upon the date of the last signatory and shall continue in full force for a period of 5 years. Additional environmental analysis might be required as new management measures are developed during annual reviews of the INRMP, or over the long term (i.e., beyond 5 years). The INRMP will be revised and updated at the end of the 5-year period.

4.1 ALTERNATIVES

4.2 Preferred Action Alternative

The Preferred Action Alternative or Proposed Action is to implement the FY 2019-2023 updated INRMP on Fort Hood, Texas.

4.3 No Action Alternative

The CEQ regulations and Title 32 CFR 651 Chapter V (*Environmental Analysis of Army Actions*) require that a No Action Alternative be evaluated. Analysis of the No Action Alternative assists in understanding the anticipated impacts of the proposal and the severity of those impacts. It allows for a comparison to be made of future environmental, social, and economic conditions, both with and without completion of the proposed plan. The No Action Alternative must be considered for comparison purposes, while other alternatives to the proposal may be eliminated from consideration. The No Action Alternative includes any actions or changes that would occur, regardless of any alternative.

Under the No Action Alternative, the proposed management measures set forth in the FY 2019-2023 updated INRMP would not be implemented. This would limit the implementation of an effective ACUB, which would limit urban sprawl and reduce potential encroachments on the military mission. The No Action Alternative would not immediately change management direction or the level of management intensity. Under the No Action Alternative, Fort Hood would continue to operate using existing programs and management practices in accordance with the 2014-2018 INRMP. Current management measures for natural resources would remain in effect, and existing conditions would continue as the status quo. The No Action Alternative

includes the existing INRMP that has not been updated and would fail to meet the described purpose and need.

Impacts under the No Action Alternative are the same as the Proposed Action except for land use. Long-term, less than significant impacts could occur without the implementation of the ACUB program. Without pursuit of the ACUB program as proposed in the updated INRMP, urban sprawl could be expected to continue along Fort Hood's borders resulting in further encroachments on the military mission. Additional care in following standard procedures or applying precautionary measures to minimize adverse impacts to encroaching communities may be required for training lands.

5.0 SUMMARY OF ENVIRONMENTAL EFFECTS

The analysis of the potential environmental impacts is documented in the EA (Chapter 7 of the INRMP). Table FNSI-1 provides a summary of the potential impacts to environmental, social, and economic resources that would result from implementing the Preferred Action Alternative or Proposed Action.

Cumulative impacts were also analyzed for past, present, and reasonably foreseeable future projects. The analysis considered activities within the Areas of Interest (AOI), which is defined as Bell and Coryell counties. The Proposed Action is located on military lands; therefore, Fort Hood projects were included in the cumulative impacts for this AOI. For each potential environmental impact detailed below, the cumulative impact is also addressed.

In terms of cumulative impacts, the Proposed Action and No Action Alternative were analyzed for air quality, noise, socioeconomics and environmental justice, facilities, hazardous and toxic materials, land use, soils, water resources, biological resources, and cultural resources. Following review of the alternative actions in combination with other past, present, and reasonably foreseeable future actions within the lands of Fort Hood, the Army determined that no significant cumulative impacts would occur. Implementation of the Proposed Action would be considered beneficial by enabling Fort Hood to achieve its goals of maintaining ecosystem viability and ensuring the sustainability of natural resources and land conditions.

Table FNSI-1. Summary of Environmental, Social, and Economic Impacts

Valued Environmental Component	Potential Environmental Impacts Resulting from the Proposed Action	Mitigation Measures to Minimize Impacts Resulting from the Proposed Action
Air Quality	No effects would occur because the Proposed Action does not involve any activities that would contribute to changes in existing air quality.	None required.
Noise	No effects would occur because the Proposed Action does not involve any activities that would affect noise conditions.	None required.
Socioeconomic Resources	No effects would occur because the Proposed Action would not involve any activities that would contribute to changes in population, housing, industry earnings and employment, or personal income.	None required.

Valued Environmental Component	Potential Environmental Impacts Resulting from the Proposed Action	Mitigation Measures to Minimize Impacts Resulting from the Proposed Action
Environmental Justice	No effects would occur because the Proposed Action would not create any advantage or disadvantage for any group or individual and would not create disproportionately high or adverse human health or environmental effects on children or minority or low-income populations at, or surrounding Fort Hood.	None required.
Facilities	No effects would occur as all facilities would continue to be maintained and operated in accordance with required permits and capabilities of the systems. Under the Proposed Action, the demand for utilities and roads would not increase and therefore would not adversely affect existing facilities.	None required.
Hazardous and Toxic Materials	No effects would occur as all hazardous and toxic materials would continue to be handled in accordance with Federal laws and Army regulations.	None required.
Land Use	Long-term, beneficial effects would occur as Fort Hood would continue to pursue and implement an effective ACUB, which would limit urban sprawl and reduce potential encroachments on the military mission.	None required.
Soils	Long-term, beneficial effects would occur through the implementation of a comprehensive soil resource management program that would ensure the effectiveness of soil conservation and erosion control measures.	None required.
Water Resources	Water Quality, Surface/Groundwater, and Wetlands: Long-term, beneficial effects would occur through the implementation of a comprehensive water monitoring program which includes routine water and sediment sampling across the installation and assessments and monitoring of wetlands, stream habitat, and aquatic communities. Floodplains: No effects would occur because the Proposed Action does not involve any activities that would involve construction within the floodplains of Fort Hood. Coastal Zone Contingency: No effect because Fort Hood is not located in the Texas Coastal Zone.	
Biological Resources	Sensitive Species (including Federal and State Listed Species): Long-term, beneficial effects would occur as the Proposed Action would provide additional and expanded protection and management for these species. Fish and Wildlife: Long-term, beneficial effects would occur as the Proposed Action was designed to mimic or enhance natural processes and would be expected to enhance fish and wildlife resources in general. Vegetation: Short-term, less than significant impacts to vegetation would be anticipated as the result of Woody Species Management implemented by ITAM. Loss of vegetation would be temporary, as vegetation re-growth would occur.	The Proposed Action limits construction that includes, but is not limited to, land maintenance, repairs, restoration, and reconfiguration, during the endangered species and migratory bird nesting seasons when feasible. These measures would minimize adverse effects to these species as a result of vegetation thinning and clearing projects.

Valued Environmental Component	Potential Environmental Impacts Resulting from the Proposed Action	Mitigation Measures to Minimize Impacts Resulting from the Proposed Action
Cultural Resources	Long-term, beneficial effects would occur because the Proposed Action provides for consultation and coordination with the Cultural Resources Manager prior to the initiation of any activity that might affect historic or cultural resources. As a result of this required consultation, the probability of disturbing potential cultural resources would be greatly reduced.	None required.

6.0 PUBLIC COMMENTS

A Notice of Availability (NOA) of the *Implementation of the FY 2019-2023 Integrated Natural Resources Management Plan, Fort Hood, Texas* (INRMP) was published in the Killeen Daily Herald newspaper on Saturday, September 15, 2018. During the 30-day public review and comment period, copies of the EA and Draft FNSI were made available at the Killeen Public Library located at 205 East Church Avenue, Killeen, Texas 78544. All documents were also posted on the Fort Hood website location under the public notices section, http://www.hood.army.mil/DPW. Requests for further information on the EA/draft FNSI and comment submissions were directed to the NEPA Program - Environmental Division, Directorate of Public Works, Building 4622, Engineer Dr., Fort Hood,Texas or email to: charlotte.f.baldwin.civ@mail.mil or timothy.w.buchanan.civ@mail.mil.

The Army received comments from the following coordinating agencies:

U.S. Fish and Wildlife Service (USFWS)

Texas Parks and Wildlife Department (TPWD)

FNSI Attachments contain the coordination and responses from the cooperating agencies. This correspondence is also located in the Final INRMP Appendix D. Recommendations and changes made by the agencies were incorporated into the Final INRMP.

During the 30-day public review period Fort Hood received no comments from the general public or any other agency.

7.0 CONCLUSIONS

Based on a careful review of the EA, which is incorporated by reference, I have concluded that no significant environmental impacts are anticipated to result from the implementation of the Proposed Action. Therefore, an Environmental Impact Statement EIS is not required.

The EA findings are consistent with the goals of the natural resources management program to ensure the long-term sustainability of desired military training area conditions; to maintain, protect, and improve ecological integrity; to protect and enhance biological communities, particularly sensitive, rare, threatened, and endangered species; to protect the ecosystems and their components from unacceptable damage or degradation; and to identify and restore degraded habitats. The management measures recommended by the INRMP, if implemented, would directly and positively affect the health and condition of natural resources at Fort Hood.

Fort Hood sincerely appreciates the participation of the public in the EA process. All public and agency comments are part of the Administrative Record and have been carefully considered by Fort Hood prior to making final decisions covered under this analysis.

APPROVED:

SANCHEZ.NANCY.1070741977

Digitally signed by SANCHEZ.NANCY.1070741977
Date: 2019.02.27 10:48:42 -06'00'

NANCY SANCHEZ, Attorney
Administrative and Civil Law
Office of the Staff Judge Advocate
III Corps and Fort Hood, Texas

DOSA.BRIAN.LAWRENCE.1045276682

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Date: 2019.02.27 18:00:57 -06'00'

BRIAN L. DOSA
Director of Public Works
Fort Hood, Texas

FNSI
ATTACHMENTS

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Chairman-Emeritus
Fort Worth

Carter P. Smith
Executive Director

August 14, 2018

Ms. Tonya Smith
Whitetail Environmental, LLC
P.O. Box 68
Jay, OK 74346

RE: Fort Hood 2019-2023 Integrated Natural Resources Management Plan (IMRMP) Review

Dear Ms. Smith:

Texas Parks and Wildlife Department (TPWD) has received the draft INRMP for Fort Hood. TPWD staff has reviewed the document and offers the following comments for consideration for incorporation into the INRMP.

Facility Description

Fort Hood Military Reservation is located in central Texas within Bell and Coryell Counties adjacent to the City of Killeen. Fort Hood encompasses just over 218,823 acres of land, consisting of 132,525 acres of maneuver training area and 64,272 acres of Live-Fire Area.

Rare and Protected Species

Table 3.2 of the draft INRMP references the Texas Wildlife Action (2005-2010) as the document/agreement between TPWD and Fort Hood.

Recommendation: The Texas Wildlife Action Plan is obsolete and has been replaced by the Texas Conservation Action Plan (TCAP). Please reference the TCAP in Table 3.

The TCAP Overview Handbook, as well as the TCAP Ecoregion Handbooks can be found on the TPWD Wildlife Diversity Program website.

Recommendation: TPWD recommends Fort Hood review the TCAP Overview Handbook and the TCAP Cross Timbers Ecoregion Handbook.

4200 SMITH SCHOOL ROAD
AUSTIN, TEXAS 78744-3291
512.389.4800
www.tpwd.texas.gov

Table 4-8 of the draft INRMP lists the Federally-listed threatened and endangered species that occur or may occur on Fort Hood.

> **Recommendation:** TPWD recommends Fort Hood review the TPWD county lists for Bell and Coryell Counties and include State-listed threatened and endangered species that occur or may occur on Fort Hood in Table 4-8. These lists are available on the Rare, Threatened, and Endangered Species of Texas website.

TPWD appreciates the opportunity to provide comments on the draft INRMP. Please contact me at (806) 761-4936 or Richard.Hanson@tpwd.texas.gov if you have any questions or need additional assistance.

Sincerely,

Rick Hanson

Rick Hanson
Wildlife Habitat Assessment Program
Wildlife Division

RH: 40235

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
2005 NE Green Oaks Blvd., Suite 140
Arlington, Texas 76006

In Reply Refer To:
02ETAR00-2018-I-1465

August 16, 2018

Ms. Timi M. Dutchuk, P.E.
Chief, Environmental Programs
Building 4622 Engineer Drive
Fort Hood, TX 76544

Dear Ms. Dutchuk:

Thank you for your June 26, 2018, e-mail requesting review and comment on the draft 2019-2023 Integrated Natural Resources Management Plan (INRMP) for Fort Hood Military Installation in Bell and Coryell Counties, Texas. Our review was requested pursuant to the Sikes Act Improvement Act of 1997 (16 USC 670a et seq.), as amended. The purpose of the INRMP is to provide land management and improvement guidance to ensure maximum military use while maintaining and protecting natural resources, sustaining productivity of ecosystems to benefit fish and wildlife, and promoting recreational opportunities. After our comments on this preliminary draft have been considered, the forthcoming Final INRMP is due for its 5-year review and signature from the U.S. Fish & Wildlife Service's (Service) Region 2 Regional Director.

General Comments:

Fort Hood's ability to rehabilitate natural areas, implement an effective firebreak construction plan, and manage vegetative structure and composition has been especially beneficial to the black-capped vireo and endangered golden-cheeked warbler. In fact, in part because of your commitment to environmental stewardship, the Service determined that the black-capped vireo is recovered and no longer requires the protections under the Endangered Species Act, effective May 16, 2018. To ensure black-capped vireo populations remain healthy and stable into the future, the Service has developed a post-delisting monitoring plan which describes the methods we will use to monitor the status of the vireo and its habitat, in cooperation with our partners for a 12-year period and provides a strategy for identifying and responding to any future population declines or habitat loss. We greatly appreciate Fort Hood's pledge to continue efforts to benefit and monitor the status of the black-capped vireo while participating in the post-delisting monitoring plan.

Specific Comments:

p. 4-29 The current scientific name for smooth pimpleback is *Cyclonaias houstonensis*.

p. 4-34 Table 4-10. Recommend adding Texas fawnsfoot (*Truncilla macrodon*), a candidate species, as not known to occur on Fort Hood. Also recommend adding Salado Springs salamander (*Eurycea chisolmensis*), a federally-threatened species occurring in Bell County.

p. 4-75 Consider revising "Over the past nine years…Conservancy staff members… (have assisted in prescribed burns)" It is our understanding that Nature Conservancy has not been a participant in these efforts since approximately 2010 (pers. comm. Chris Harper, Austin USFWS).

p. 4-85 Table 4-27 indicates 29,182 grazeable acres in Eastern Training Area South; however, Table 4-28 (p. 4-47) indicates an acreage of 22,614 grazeable acres for the same area.

The natural resource management goals and objectives described in the INRMP do not appear to pose any substantial and/or permanent adverse impacts to natural resources found at Fort Hood. We believe that the planned projects as proposed will assist in accomplishing the desired and reasonable land management goals and objectives as outlined within the INRMP.

Thank you for the opportunity to review and comment on the draft INRMP. We look forward to assisting your staff in review of the final INRMP and on-the-ground habitat conservation activities. If you have any questions, please contact Sean Edwards of my staff at (817) 277-1100 ext. 2127.

Sincerely,

Debra T. Bills

Debra Bills
Field Supervisor

cc: Allison Arnold, USFWS Regional Sikes Act Coordinator, Southwest Region

S:\Correspondence\FY 2018\Project Files\2018-I-1465 Ft. Hood INRMP 5-yr Review\2018-I-1465 Ft Hood draft INRMP response.doc